



**FINAL ASSESSMENT REPORT
September 2021
Bachelor of Engineering, Nuclear Engineering
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. Program reviews involve several stages, including:

1. A comprehensive and analytical self-study brief developed by members of the program under review.
2. A site visit by academic experts who are external to and arm's length from the program who prepare a report and recommendations on ways that it may be improved based on a review of the program's self-study and supporting material, and a two-day site visit involving discussions with faculty, staff and students and a tour of the facilities.
3. Development of a plan for improvement by the program and proposed timelines for implementation.

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 Resource committee, the appropriate standing committee of Academic Council (USC/GSC), and are subsequently reported to Academic Council, the Board of Governors and the Quality Council.

In academic years 2019-2021 a program review was scheduled for the Bachelor of Engineering in Nuclear Engineering.

This is the second 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. Mark Daymond, Queen's University
- Dr. Jungsook Wren, University of Western Ontario

Site Visit: May 25th -28th, 2021

Program Overview

The four-year honours Bachelor of Engineering in Nuclear Engineering program was designed to meet a worldwide need for graduates in the field of nuclear engineering. Although the primary focus of the program is nuclear power plant engineering, the curriculum is sufficiently broad-based that graduates are well qualified for careers in many applications of nuclear technology and energy related fields, including but limited to reactor physics, radiation protection, and thermalhydraulics.

Nuclear Engineering students gain a solid foundation in the fundamentals of mathematics and sciences within their first two years of the program. In the upper years, there is a concentration on engineering sciences and specific nuclear engineering courses, as well as courses in economics, ethics and law, and strategic management. Students develop management, interpersonal, problem-solving, and holistic thinking skills while gaining a comprehensive knowledge of nuclear engineering science and design, as well as the latest developments in the field. Learning takes place in a variety of setting including lectures, tutorials, field visits, laboratories, and via computer simulation – the most extensive computer simulation of nuclear power plants of any engineering program in Ontario.

The Bachelor of Engineering in Nuclear Engineering is the only undergraduate degree program in Nuclear Engineering to be accredited by The Canadian Engineering Accreditation Board (CEAB). Graduates are eligible to apply for licensing as a professional engineer (P.Eng) in any province or territory in Canada.

Significant Strengths of the Program

- A well-qualified engineering program with strong links to industry.
- State-of-the-art laboratory facilities and innovative and hands-on experiences that are provided at the undergraduate level, including a suite of laboratory equipment that is unique in Canada and prepares students well for employment in the industry.
- Innovations such as the Control Room simulator allow for an impressive and unique insight into actual plant operation, while the use of VR/AR technologies within teaching point to innovation in program delivery.
- Program has a strong design stream, with an effective build in skills and techniques over the program culminating in a strong capstone project course.
- Capstone projects which incorporate both team and individual components, and provides integrated, industry-focused learning in the final year of the program.
- High employment rate for graduates of the program.

Opportunities for Program Improvement and Enhancement

- Improve recruitment efforts in order to maintain and/or improve program enrollment. This includes the recruitment, conversion, and retention of more female students into the program.
- Strengthening support and opportunities between the program and other universities/associated researchers to benefit from an ongoing pool of specialized engineering graduates (e.g. student exchanges, simpler transfer requirements to the program from other engineering schools, etc.)
- Enhance links between nuclear power and climate change within the program curriculum.
- Formalized incorporation of SMR-related topics, and decontamination & decommissioning, into the program curriculum.
- More hands-on use of CAD by a larger group of students, perhaps by having individual CAD based assignments within 2nd and/or 3rd year courses.
- Change to the programming language taught, to one more directly applicable to the program, courses, and to industry (e.g. Python).
- Better alignment of Internship reports with PEO submission requirements.
- Development and implementation of exit surveying for graduation class to assist in overall continuing improvement of the program and student experience.

The External Review

The site visit took place on May 25th -28th, 2021. Drs. Daymond and Wren met with members of the Faculty as well as key stakeholders at the University, including Dr. Lori Livingston – Provost, Dr. Akira Tokuhiro – Dean, Dr. Daniel Hoornweg – Associate Dean, Dr. Matthew Kaye - Program Director 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 eighteen recommendations, several of which suggest ways which the program can better adapt to changes in the industry. The Faculty values the recommendations and have been very thoughtful in their responses.

Summary of Reviewer Recommendations and Faculty Responses

Recommendation 1

Formal incorporation of SMR topics within existing courses, including changing of course descriptions where necessary. This could be done via a review of appropriate courses by the Nuclear Engineering Curriculum Committee and discussion with instructors.

IAT's Response to recommendation 1

The Program agrees with the reviewers' recommendation. Efforts are already being made towards this. Summary applications are available in Capstone.

Dean's Response to recommendation 1

Agree – The recommendation is a good one and will require a two-prong faculty response. In the short term an additional lecture or guest speaker in the fourth year Capstone. There is also potential for SMR material to be inserted in courses already offered in the core of the program. The Program Curriculum Committee and/or the stream leads review could be tasked to examine this recommendation and provide a more detailed course of action. A longer-term response is to develop an elective course, perhaps in conjunction with the graduate program that covers SMR topics.

Recommendation 2

Consideration be given to offering an additional Elective(s) on Decommissioning, to address the potential needs associated with Pickering. This should probably be done in discussion with the OPG decommissioning team.

IAT's Response to recommendation 2

The Program agrees with the reviewers' recommendation. Students within the program with sufficient GPA may be able to take the masters course that is currently being developed. The topics is already covered in one lecture in NUCL 4700U, but we also plan to add a lecture on the subject in the Capstone course.

Dean's Response to recommendation 2

Agree - Plans and discussions are underway.

Recommendation 3

Ensure that Nuclear is clearly placed within the context of the low-carbon electricity mix in terms of addressing climate change; perhaps best done as exercises/examples in COMM 1050U, SSCI 1470U and/or ENGR 3360U.

IAT's Response to recommendation 3

The Program agrees with the reviewers' recommendation. FESNS will formally notify the Dean's Council and suggest incorporation into new Bachelors of Arts and Science in sustainability.

Dean's Response to recommendation 3

Agree –The Dean will bring this recommendation to the Dean's Council. As a secondary plan, the Program Curriculum Committee will be tasked with creating appropriate material and liaising with the course instructors of COMM 1050U, SSCI 1470U, and/or ENGR 3360U.

Recommendation 4

Evaluate the potential for alternative delivery modes such as flipped classrooms and blending learning for courses, where such approaches are appropriate.

IAT's Response to recommendation 4

The Program agrees with the reviewers' recommendation, and feel this is especially important in fourth-year courses and courses that do not have labs. This will need to be implemented in consultation with the faculty.

Dean's Response to recommendation 4

Agree – Alternative modes of delivery is one method to keep the program more engaging and also staying current with the best practices in education. The Dean will discuss this recommendation with the faculty as a whole (perhaps as part of a faculty workshop or retreat) and with individual professors to explore where this recommendation can be implemented.

Recommendation 5

Teach students a programming language other than C++ in the first year, one that is applicable to the rest of the course and to industry, *e.g.*, python.

IAT's Response to recommendation 5

The Program will take this under advisement, as this is an issue which will need to be included in the discussions around the common first year. In principle, FESNS is supportive of this recommendation.

Dean's Response to recommendation 5

Agree – The reservations expressed by the IAT certainly apply. The Dean of FESNS will consult with the Dean of FEAS and IT, as well as the Engineering Curriculum Committee (ECC) to see what can be done. One possibility is that ENGR 1200U could be diversified to offer different programming languages in different sections. There is a recognition that there will be logistical issues that would have to be worked out.

Recommendation 6

Develop approaches to ensure hands-on use of CAD by *all* students, perhaps by having individual CAD based assignments within 2nd and/or 3rd year courses.

IAT's Response to recommendation 6

The Program agrees with the reviewers' recommendation, and will put this recommendation to the faculty to encourage projects within the program to incorporate (and expect) CAD drawings.

Dean's Response to recommendation 6

Agree – In a manner similar to Recommendation 1, the Program Curriculum Committee and/or the stream leads review could be tasked to examine this recommendation and provide a more detailed course of action.

Recommendation 7

Several of the 1st year courses and 1st year labs could be more effectively targeted at the FESNS program if delivered by FESNS faculty / on FESNS topics rather than FEAS.

IAT's Response to recommendation 7

The Program agrees with the reviewers' recommendation, with the recognition that budgetary issues will likely limit the number. Consideration should be given as to which would be optimally transferred. In principle, FESNS is supportive of this recommendation, noting also that faculty availability is also a concern.

Dean's Response to recommendation 7

Agree – The IAT has encapsulated the pertinent points around this recommendation in its response.

Recommendation 8

The required FESNS internship report be divided into two sections, one which fulfills PEO requirements, a second which adds such additional information/detail as is required from a pedagogical assessment point of view.

IAT's Response to recommendation 8

The Program agrees with and thanks the reviewers for this recommendation. It is important to note that with co-op reporting some of these items are already in place.

Dean's Response to recommendation 8

Agree – In the past the Undergraduate Program Director (UPD) has monitored these reports. Perhaps the program curriculum committee (which includes the UPD) could be tasked to examine this recommendation and provide a more detailed course of action if one is necessary.

Recommendation 9

FESNS work with the University to increase representation and outreach to improve recruitment, especially during high-school outreach.

IAT's Response to recommendation 9

The Program agrees with the reviewers' recommendation. FESNS has already notified Recruitment. Bruce Power has offered to support prospective female students.

Dean's Response to recommendation 9

Agree – As noted by the IAT, efforts within the faculty have begun to address this recommendation. The Dean's Office will monitor our progress and provide regular reports to the faculty.

Recommendation 10

Introduction of a mandatory TA training session.

IAT's Response to recommendation 10

The Program agrees with the reviewers' recommendation. The Program Curriculum Committee (PCC), the FESNS safety committee, and Senior Lab Technician will be consulted to formalize a training package and organize appropriate TA training.

Dean's Response to recommendation 10

Agree – Again, the IAT's response is appropriate. In consultation with the UPD and Associate Dean, the Dean will designate either the UPD or the Associate Dean to administer this.

Recommendation 11

Ensure that course material is available to students *after* courses have finished, ideally through the learning management system. At present the lack of access to prior courses represents a barrier to learning.

IAT's Response to recommendation 11

The Program agrees with the reviewers' recommendation, but recognizes that this is a university wide issue. Potential in-house solutions will be sought in the meantime.

Dean's Response to recommendation 11

Agree – On the university side of this, the Dean will liaise with the departments responsible for CANVAS maintenance and upkeep. The Dean will also bring this issue to the Dean's Council. At the faculty level, it should be possible to setup a Google Drive Site dedicated to keep course lecture material stored in an electronic space, which can be made available to students. Our IT technical staff within the Faculty would be tasked with this. However, it will also be important get input from the faculty instructors, to ensure control of intellectual property is maintained.

Recommendation 12

Introduce one or more detailed examples of how CSA standards apply to a specific industry relevant issue.

IAT's Response to recommendation 12

The Program agrees with the reviewers' recommendation. This will be sent to the PCC for discussion and implementation once applicable courses have been identified. Currently, NUCL 4700U and NUCL 4525U discuss and apply CSA standards.

Dean's Response to recommendation 12

Agree – The IAT's response is sufficient.

Recommendation 13

FESNS should look for opportunities with the University to provide additional group study space for students.

IAT's Response to recommendation 13

The Program agrees with the reviewers' recommendation, and believes the issue might be improved with opening of the new campus building.

Dean's Response to recommendation 13

Agree – As students return to campus (from COVID-19 restrictions), the faculty and Dean's Office will monitor this situation. Since study- and work-spaces are perennial issue, creativity will be required. The Dean is prepared to work with all levels of the university to seek solutions.

Recommendation 14

FESNS should seek out new partnerships for internships, for example Candu Energy, and Hatch.

IAT's Response to recommendation 14

The Program agrees with the reviewers' recommendation. Efforts in this area need to be redoubled.

Dean's Response to recommendation 14

Agree – Corporate outreach and partnerships are broadly within the responsibility of the Dean. FESNS also works with FEAS with respect to an on-campus staff member responsible for co-ops/internships. FESNS also has a Faculty Advisory Board consisting of industry partners. The Faculty will seek new opportunities through our Board and industry contacts. The Dean is also supportive of faculty members seeking new partnerships within the framework of their research interests and goals.

Recommendation 15

Develop a clearer summer program that defines courses to be offered well in advance so that students can plan to take advantage of summer offerings.

IAT's Response to recommendation 15

The Program agrees with the reviewers' recommendation, but understands that there are budgetary and faculty considerations.

Dean's Response to recommendation 15

Agree – Once again the IAT has summarized the issues from FESNS's perspective. Perhaps as part of a larger discussion on teaching (see Recommendation 4) the faculty can propose a suite of courses that can be offered during the summer.

Recommendation 16

Set a goal and plans to improve participation in end-of-course student surveys.

IAT's Response to recommendation 16

The Program agrees with the reviewers' recommendation, and will look at options to make time available in class. Perhaps include question on final exams.

Dean's Response to recommendation 16

Agree – The Dean will task the Associate Dean, with the support of academic advising, to make this an annual activity. The results will be circulated to the faculty at large and the Program Curriculum Committee for appropriate action.

Recommendation 17

An exit survey be administered to the graduating class every year to assist in overall continuing improvement.

IAT's Response to recommendation 17

The Program agrees with the reviewers' recommendation. Furthermore, perhaps expand to recipient employers as well.

Dean's Response to recommendation 17

Agree – The Dean will task the Associate Dean, with the support of academic advising, to make this an annual activity. The inclusion of recipient employers is an excellent idea (Thank you IAT). The results will be circulated to the faculty at large and the Program Curriculum Committee for appropriate action.

Recommendation 18

Set a target for increased representation of women in the undergraduate population that is commensurate with the 30 by 30 goal, and put a sequence of activities in place to achieve it. This could start with a survey of existing members of FESNS.

IAT's Response to recommendation 18

The Program agrees with the reviewers' recommendation. It is currently under discussion.

Dean's Response to recommendation 18

Agree – As part of recruitment (see Recommendation 9) this is being implemented. The Dean is currently on the Board of Women in Nuclear, Durham Chapter and contributing to WiN and related initiatives regarding "30 by 30". The Dean recognizes that this is an industry and University effort.

Plan of Action

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

	Recommendation	Proposed Follow-Up	Responsibility for Leading Follow Up*	Timeline	Resources/ Support Needed
1)	Formal incorporation of SMR topics within existing courses, including changing of course descriptions where necessary. This could be done via a review of appropriate courses by the Nuclear Engineering Curriculum Committee and discussion with instructors.	Additional lecture or guest speaker in the 4th year Capstone.	Associate Dean	2021-2022 academic year	None
		There is also potential for SMR material to be inserted in courses already offered in the core of the program.	Undergraduate Program Director	Dec. 2021	Program Curriculum Committee & Stream Leads
		A longer-term response is to develop an elective course, perhaps in conjunction with the graduate program that covers SMR topics.	Graduate Program Director	April 30, 2022	None
2)	Consideration be given to offering an additional Elective(s) on Decommissioning, to address the potential needs associated with Pickering. This should probably be done in discussion with the OPG decommissioning team.	Develop course material for an elective for decommissioning; the rationale is that there is an identifiable industry need.	Undergraduate Program Director	Dec. 2021	None
		Add a lecture on decommissioning to capstone lecture series	Associate Dean	2021-2022 academic year	None

3)	Ensure that Nuclear is clearly placed within the context of the low-carbon electricity mix in terms of addressing climate change; perhaps best done as exercises/examples in COMM 1050U, SSCI 1470U and/or ENGR 3360U.	Recommend to the Dean's Council that Nuclear is clearly placed within the context of the low-carbon electricity mix in terms of addressing climate change in the Bachelors of Arts and Science Sustainability program and in courses like COMM 1050U, SSCI 1470U, and/or ENGR 3360U; the rationale for this is that this spreads the appropriate message about nuclear early in program.	Dean FESNS	Fall 2021	None
		Task the Program Curriculum Committee with creating appropriate material and liaising with course instructors directly.	Undergraduate Program Director	Develop material by Dec. 2021; deliver to instructors by May 2022	Program Curriculum Committee and interested faculty
4)	Evaluate the potential for alternative delivery modes such as flipped classrooms and blending learning for courses, where such approaches are appropriate.	Discuss this issue with the FESNS faculty as part of a faculty retreat. This is important to keep the program more engaging and also staying current with the best practices in education.	Dean FESNS	May 2022	FESNS Faculty
		After a faculty retreat the next steps will be to generate a report outlining a detailed plan of action on this issue.	Dean FESNS	August 2022	UPD, Program Curriculum Committee, and Stream Leads

5)	Teach students a programming language other than C++ in the first year, one that is applicable to the rest of the course and to industry, <i>e.g.</i> , python.	Discuss this with Dean of FEAS and with IT. Since this has broad implication across all engineering disciplines a collegial discussion is appropriate.	Dean FESNS	Fall 2021	To be determined in consultation with IT.
6)	Develop approaches to ensure hands-on use of CAD by <i>all</i> students, perhaps by having individual CAD based assignments within 2nd and/or 3rd year courses.	This recommendation will be forwarded to the Program Curriculum Committee for discussion with the objective being a plan for implementation. This will then be presented to the whole faculty for approval in accordance with our good governance model.	Undergraduate Program Director	May 2022	Program Curriculum Committee, and Stream Leads
7)	Several of the 1st year courses and 1st year labs could be more effectively targeted at the FESNS program if delivered by FESNS faculty / on FESNS topics rather than FEAS.	Discuss this with Dean of FEAS and the Dean of Science. Since this has broad implication across all engineering disciplines a collegial discussion is appropriate.	Dean FESNS	Fall 2021	To be determined
8)	The required FESNS internship report be divided into two sections, one which	Review the current requirements for internship reports. Once these have been determined, this recommendation will be forwarded	Undergraduate Program Director	May 2022	Program Curriculum Committee

	fulfills PEO requirements, a second which adds such additional information/detail as is required from a pedagogical assessment point of view.	to the Program Curriculum Committee for discussion with the objective being a plan for implementation. This will then be presented to the whole faculty for approval in accordance with our good governance model.			
9)	FESNS work with the University to increase representation and outreach to improve recruitment, especially during high-school outreach.	Create a recruitment committee within FESNS to propose strategies for increasing the outreach for FESNS. Increasing the enrollment will make the program more financially viable and enrich the learning experience for all students. Further, this will support our core industry partners.	Dean FESNS	Fall 2021	FESNS Faculty
10)	Introduction of a mandatory TA training session.	Create material to be distributed to all Teaching Assistants (TAs) to ensure that quality support from the TAs remains in place. It is necessary to clarify roles and goals at all levels of the faculty.	Undergraduate Program Director or Associate Dean	Fall 2021	Program Curriculum Committee, the FESNS safety committee, and Senior Lab Technician
11)	Ensure that course material is available to students <i>after</i> courses have finished, ideally through the learning management system. At present the lack of access to prior courses represents a barrier to learning.	Liaise with the departments responsible for CANVAS maintenance and upkeep. Further this is an issue for the Dean's Council. Having paid for course material, and knowing that the program builds on material previously presented, having some means to access the material in upper years has been a desire	Dean FESNS	Fall 2021	As this is University wide issue, it is unclear what resources would be necessary to support this. FESNS is not willing to offer resources that it does not control.

		expressed by many students (and echoed by the reviewers).			
		Independent of the University at large, FESNS may be able to solve this issue at the faculty level.	Dean FESNS	May 2022	FESNS Technical Staff
12)	Introduce one or more detailed examples of how CSA standards apply to a specific industry relevant issue.	Further introduce CSA standards into the program where appropriate. This is important as maintain standards are mission critical in nuclear engineering.	Undergraduate Program Director	May 2022	Program Curriculum Committee
13)	FESNS should look for opportunities with the University to provide additional group study space for students.	Monitor the use of designated study space under control by FESNS, to gain understanding of any trends or patterns of space usage. Creating space for undergraduate students to work in (especially as the return to campus) is in keeping with the "sticky campus" initiative.	Dean FESNS	Ongoing Activity; Yearly reports commencing June 2021	As this is University wide issue, it is unclear what resources would be necessary to support this. FESNS is not willing to offer resources that it does not control.
14)	FESNS should seek out new partnerships for internships, for example Candu Energy, and Hatch.	Create a list of companies with whom FESNS has a partnership and seek new partners. This is important to maintain the strong ties that FESNS has with industry and to make sure that we continue to show	Dean FESNS	Ongoing Activity; Yearly reports commencing June 2021	FESNS Faculty Consult with the FESNS Advisory Board

		that we are willing to engage with new companies as well.			
15)	Develop a clearer summer program that defines courses to be offered well in advance so that students can plan to take advantage of summer offerings.	Develop a list of courses that FESNS will offer in the summer on a regular basis.	Dean FESNS	Dec. 2021	FESNS Faculty; Budget restrictions apply
16)	Set a goal and plans to improve participation in end-of-course student surveys.	Prepare a survey for each yearly cohort	Associate Dean	May 2022	Assistance from Academic Advising
17)	An exit survey be administered to the graduating class every year to assist in overall continuing improvement.	Prepare a survey for employers	Associate Dean	May 2022	Assistance from Academic Advising
18)	Set a target for increased representation of women in the undergraduate population that is commensurate with the 30 by 30 goal, and put a sequence of activities in place to achieve it. This could	Ongoing Activity. Monitoring the enrollment of gender breakdown of incoming class on yearly basis will allow tracking of numbers and ratios.	Dean FESNS	Ongoing Activity; Yearly reports commencing October 2021	Assistance from FESNS Faculty

	start with a survey of existing members of FESNS.				
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*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 the Academic Resource Committee, 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: March 2023

Date of Next Cyclical Review: 2024-2026