
**Faculty of Energy Systems and Nuclear Science**

**Health Physics and Radiation Science – Minor in Health Physics**

# Major Program Modification

**Date: May 3, 2017**

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**Motion to CPRC: That CPRC recommend to Academic Council the approval of the new Minor program in Health Physics.**

## Proposal Brief

### 1. INTRODUCTION

The current major in Health Physics and Radiation Science addresses a specific niche role. This results in low enrolment in certain courses. Some of those courses are useful for other degrees that need to interface with the Health Physics and Radiation Science disciplines.

This minor is designed for UOIT undergraduates who may want to increase their knowledge in radiation protection science to better position them in the Ontario nuclear industry job-market. Refurbishment and decommissioning of nuclear facilities and nuclear power plants scheduled for the coming decades will bring with it an increasing need for all employees in this industrial sector and associated regulators to have an enhanced appreciation and awareness of radiation protection and health physics practices and the underlying scientific basis of these practices.

The purpose of the minor is to provide the fundamentals of radiation protection science related to applied nuclear technology and the medical applications of ionizing radiation. Topics covered in this minor include" Interaction of radiation with matter, Radiation detection, dosimetry, biophysics, shielding, radioisotopes, medical applications of radiation, and environmental effects of radiation.

The Health Physics minor will significantly increase the enrolment in the minor subject courses all of which are currently offered as part of the Health Physics and Radiation Science B.Sc. There are no new courses developed to offer this minor. The program is the selection of a structured set of courses as identified in 2(c).

The minor has been reviewed for fit with the Nuclear Engineering program. Students enrolled in that program can easily complete the minor in Health Physics by using the space for their technical electives and the addition of one space.

The only course that has a prerequisite that would not be automatically obtained by a BEng student following their normal program map would be BIOL1011 currently required for RADI4220 (Radiation Biophysics and Dosimetry). This prerequisite could be waived by the provision of some elementary review material on cell division, genetics and human anatomy.

Students interested in the minor from the Faculty of Health Science would have the required Biology but would be missing Nuclear Physics (NUCL 2500) and the supporting maths. NUCL 2500 can be taken as an elective to meet this requirement.

Students interested in the minor from the Faculty of Science would have the required Biology and maths but would be missing Nuclear Physics (NUCL 2500). NUCL 2500 can be taken as an elective to meet this requirement.

### 2. DEGREE REQUIREMENTS

**a) Program learning outcomes**

Students that successfully complete the Minor in Health Physics will have demonstrated the following degree level expectations:

- The student shall develop knowledge and critical understanding of radiation interaction with matter, how radiation is detected, its applications and how we protect people and the environment from the effects of radiation exposure.
- The student will have the ability to gather, review, evaluate and interpret information related to radiation and health risk.
- The student will develop an understanding of the methods used for working with radiation hazards and interpretation of the data associated with radiation spectrum.

The program learning outcomes for the minor in Health Physics represent a subset of those in the Health Physics and Radiation Science program. The following program learning outcomes will be achieved by delivery of the program:

- Understanding of the basic principles of radioactive materials
- Estimating dose both computationally and experimentally.
- Understanding the ALARA principle.
- Understanding shielding, distance and time principles.
- Understanding dosimetry and risk from exposure.
- Understand the sources of natural radiation, and the wide range of variations observed in different locations;
- Be able to explain the relative contributions of the various sources of artificial radiation to the total dose received by a given population;
- Define the units of radiation, quantify its biological effects, and describe the methods used to measure radiation
- Understand the principles of the major imaging techniques (ultrasound, X-ray, CT, PET, SPECT, MRI)
- Understand the principles of the major radioisotopes and radiation machines and their applications.
- Describe and apply the appropriate mathematical techniques that would be used to interpret various detector readings.
- Demonstrate the procedures and practices used to ensure the safe handling of radiation sources in the laboratory.

**b) Admission Requirements**

Students can enter the Minor in Health Physics after second year as long as they have a cumulative GPA >= 2.7 and are in enrolled in a science, health science, or engineering major.

**c) Program Structure**

To obtain a minor in Health Physics a student must take six (6) courses from the list given below. Of the required six courses four are mandatory and no more than five can be taken as part of the students' major program of study.

**Mandatory Courses**

NUCL2950 Radiation Protection
NUCL4670 Shielding Design
RADI4220 Radiation Biophysics and Dosimetry
RADI4550 Radiation Detection and Measurement

**Elective Courses (Choose 2)**
RADI3200 Medical Imaging
RADI3570 Environmental Effects of Radiation
RADI4320 Therapeutic Applications of Radiation
RADI4430 Industrial Applications of Radiation Techniques
RADI4440 Radioisotopes and Radiation Machines

**d) Program Content**

All of the above-mentioned courses are already approved and in the Academic Calendar. There are no changes to the Calendar descriptions of the courses. The program Calendar copy is below.

## 3. RESOURCE REQUIREMENTS

**a) Faculty members**

The faculty associated with the minor in Health Physics already provide lectures in these courses as part of either the Nuclear Engineering Program or the Health Physics and Radiation Science Program. The following faculty will be resources for the minor:

- Dr. Rachid Machrafi, Associate Professor, FESNS, NUCL 2950, RADI 4430
- Dr. Eleodor Nichita, Associate Professor, FESNS, RADI 3200
- Sharman Perera, Senior Lecturer- teaching focus, FESNS, RADI 3570
- Dr. Anthony Waker, Full Professor, FESNS, RADI 4220
- Dr. Ed Waller, Full Professor, FESNS, NUCL 4750

Courses RADI 4320, RADI 4440, and RADI 4550 are currently taught by sessionals under the guidance of the core faculty only. There are no gaps not currently covered and no expectation to hire to support the minor in Health Physics.

**b) Additional academic and non-academic human resources**

The management of the program will be done through the Dean's office. The Dean's designate for managing the program would be the Undergraduate Program Director. The academic advisor for the undergraduate programs in FESNS would perform the advising duties for the Minor in Health Physics. The lab manager and supporting staff would provide support to maintaining the labs in a safe environment and maintaining the equipment to run the labs. As all of these courses are currently taught, the administrative team is already performing these duties and the only impact would be the increase in the number of students. The expected increase in students is within the current capacity of the administrative team as long as those numbers do not exceed 40 per class. At that point, the demand would be high enough that additional lab sessions and additional TAs may be required.

Note there is also a load on the Registrar's Office for issuance of the degree. We assume that this cost is not unreasonable for the potential 15-30 students that may opt for the minor.

**c) Physical resource requirements**

No new space is required. The library holdings with the current updating plans are sufficient to support the program. There is no need for additional equipment or software.

**4. BUSINESS PLAN**

**a) Statement of funding requirements**

The Health Physics minor requires no new courses and therefore should have almost no associated costs. Typically, the HPRS students are approximately 10 per course in those courses unique to the HPRS program. Those nuclear engineering students that elect to take one of these courses typically number another 10 students. With the addition of recognizing a minor in Health Physics, we expect there to be more interest in taking these courses that would increase the nuclear engineering students to between 15-20 students. Students from other Science or Health Science programs may also be interested. Assuming 10 students in total from outside the faculty, then class size could increase from 10 students (HPRS students only) to as high as 40 students.

As the courses in the minor are already operational, then there are no start-up costs and the only expected increase in costs may be for additional TAs to support the laboratory experiments and the increased class size.

**b) Statements of resource availability**

All faculty members and lecturers are currently within FESNS and the minor has the support of our Dean.

**5. TIMELINE/DATE OF IMPLEMENTATION**

The minor will be available in the Fall 2018 semester.

**APPROVAL DATES**

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| Curriculum Committee Approval | May 18, 2017 |
| Faculty Council Approval | May 25, 2017 |
| CPRC or GSC Approval | September 15, 2017 |
| Academic Council Approval | |

**CALENDAR COPY**

## General information and admission requirements

This minor is designed for UOIT undergraduates who may want to increase their knowledge in radiation protection science to better position them in the Ontario nuclear industry job-market. Refurbishment and decommissioning of nuclear facilities and nuclear power plants scheduled for the coming decades will bring with it an increasing need for all employees in this industrial

sector and associated regulators to have an enhanced appreciation and awareness of radiation protection and health physics practices and the underlying scientific basis of these practices. The purpose of the minor is to provide the fundamentals of radiation protection science related to applied nuclear technology and the medical applications of ionizing radiation. Topics covered in this minor include" Interaction of radiation with matter, Radiation detection, dosimetry, biophysics, shielding, radioisotopes, medical applications of radiation, and environmental effects of radiation.

Students can enter the Minor in Health Physics after second year as long as they have a cumulative GPA ≥ 2.7 and are in enrolled in a science, health science, or engineering major.

A cumulative GPA of at least 2.7 in the minor courses is required to successfully complete the Health Physics minor.

**Program details and degree requirements**
To obtain a minor in Health Physics a student must take six courses (18 credit hours) from the list given below. Four required core courses and two electives. A maximum of two courses may be taken as part of a students' major program of study.

**Health Physics Minor Required Courses**
RADI4550- Radiation Detection and Measurement
NUCL2950 -Radiation Protection
RADI4220 -Radiation Biophysics and Dosimetry
NUCL4670- Shielding Design

**Health Physics Minor Electives (choose 2)**
RADI4320 -Therapeutic Applications of Radiation*
RADI3200- Medical Imaging*
RADI3570- Environmental Effects of Radiation*
RADI4430 -Industrial Applications of Radiation Techniques*
RADI4440- Radioisotopes and Radiation Machines*
NUCL2500-Introduction to Nuclear Physics* (Elective for those who need this as a prerequisite)