FINAL ASSESSMENT REPORT
Institutional Quality Assurance Program (IQAP) Review

UNENE Master's of Nuclear Engineering

Date of Review: November 12 – 13, 2013

In accordance with McMaster's Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the University Network of Excellence in Nuclear Engineering (UNENE) Master's of Nuclear Engineering program. This report identifies the significant strengths of the program, together with opportunities for program improvement and enhancement, and it sets out and prioritizes the recommendations that have been selected for implementation.

This Final Assessment Report includes an Implementation Plan that identifies who will be responsible for leading the follow up for the proposed recommendations; any changes in organization, policy or governance that will be necessary to meet the recommendations; and timelines for acting on and monitoring the implementation of those recommendations.

Executive Summary of the UNENE Master's of Nuclear Engineering Cyclical Program Review

The UNENE Master's of Nuclear Engineering is a cooperative program among five degree-granting institutions, namely McMaster University, Queen's University, University of Ontario Institute of Technology, University of Waterloo and University of Western Ontario (now Western University). In accordance with the IQAP, the Master's of Nuclear Engineering program submitted a self-study to the School of Graduate Studies on November 4, 2013. The self-study presented the program descriptions and learning outcomes, an analytical assessment of the program, including data collected from students along with the standard data package prepared by the Office of Institutional Research and Analysis. Appended were the course outlines for all courses in the program and the CVs for each full-time faculty member in the Program.

Two arm's-length reviewers, one from Ontario and one from Texas, and one internal reviewer participated in a two-day site visit organized by the School of Graduate Studies. The visit consisted of meetings with the Provost and Vice-President (Academic), Associate Vice-President and Dean of Graduate Studies, UNENE President, UNENE Director. UNENE Administrator, UNENE Secretary/Treasurer, Dean of Engineering and Associate Dean (Engineering) in addition to separate meetings with students and faculty members. The Review Team highlighted their findings in a report submitted on December 2, 2013. The Review Team found that program goals align quite closely with the academic plan and mission of McMaster University, and all the universities that are part of the UNENE Master's of Nuclear Engineering. They reported that the program was well run and has been developed to meet the needs of industry. They were impressed by the quality of instructors who come from the five participating universities and are well recognized leaders in their respective fields. The students who participated in a conference call with the Review Team expressed a high degree of satisfaction with the program and felt that it considerably expanded their knowledge base and is valuable in their

professional development and career progression. The following program strengths and weakness were also noted:

- **Strengths**
    - Instructors are leaders in their fields and several hold UNENE/NSERC Industrial Research Chairs or are recipients of collaborative research grants
    - Courses are delivered over two days on alternate weekends in Whitby, Ontario to make it possible for full-time employees to attend
    - Lectures available to other more remote sites by distance delivery technology
    - UNENE has the capability to accommodate fluctuations in enrollments to sustain program
    - Courses are regularly updated with current events
    - High level of student satisfaction with program

- **Weaknesses**
    - ADMI courses could be enhanced to strengthen the participant's background in the organizational and human performance aspects relevant to the safe operation of the power reactors
    - New course could be added on the regulations, protection of the environment, security and safeguards
    - Expanding certain courses to cover types of reactors other than CANDU which could serve the initiative for UNENE to expand in the international arena
    - Clarifying learning outcomes that relate to the development of communication skills

The reviewers did not raise any serious concerns about the operation of the program, but did put forward several recommendations for improvements. The response from the UNENE Director indicates that some of these suggestions such as adding a new course on uses of energy in society and the associated environment and security safeguards may be relatively straightforward, while others will require negotiation with other parties (see below). This Final Assessment Report was prepared by the Quality Assurance Committee. The 18-month report will show progress against items addressed in this review. The program has been approved to continue and is scheduled for its next full review in eight years.

Summary of the Reviewers' Recommendations with the Program Director and Dean's Responses & Follow Up Process

Recommendation #1: Some of the ADMI courses could be realigned and new courses could be added to strengthen the participant's background in the organizational and human performance aspects relevant to the safe operation of the power reactors.

Response: The program responded by stating that they do not have control over ADMI courses. ADMI courses are designed for a broad engineering audience. The UNENE Programme Director has, however, written to ADMI to see if ADMI has any interest in covering human factors.

Responsibility for following up: Programme Director

Timeline: Update at 18-month report

Recommendation #2: A new course could be added on the regulations, protection of the environment, security and safeguards.
Response: The Programme Director will design and propose such a course. UNENE has also started to discuss with COG, OPG, CNSC and UOIT to make sure the new course does not duplicate existing academic or industry material.
Responsibility for following up: Programme Director
Timeline: Update at 18 month report

Recommendation #3: Expanding certain courses to cover types of reactors other than CANDU.
Response: UNENE states that the UNENE M.Eng. already covers non-CANDU reactors in some courses, and believes it is sufficient for the M.Eng for now.
Responsibility for following up: N/A
Timeline: N/A

Recommendation #4: Expanding certain courses to include issues with nuclear engineering applicable to the whole fuel cycle.
Response: UNENE states that this is already covered somewhat in the Fuel Management course. The Programme Director will also ask Prof. P. Chan to add sustainability to the Fuel Design course.
Responsibility for following up: Programme Director
Timeline: Update at 18-month report

Recommendation #5: UNENE should negotiate with COG to explore ways to facilitate access to the wealth of operational safety knowledge at COG without jeopardizing proprietary information
Response: UNENE agrees and has made an initial request to COG.
Responsibility for following up: Programme Director
Timeline: Update at 18-month report

Recommendation #6: Promote further cooperation/integration between UNENE and UOIT.
Response: UNENE agrees and the diploma is designed to be a cooperative venture with UOIT and may serve as a model for further cooperation.
Responsibility for following up: Programme Director
Timeline: Update at 18-month report

Recommendation #7: Industry-oriented engineering projects could be initiated earlier in the program and linked to the courses. The topic along with the academic and industry advisors would then be identified sooner, and students could begin working on the project at an earlier stage.
Response: UNENE responded by stating that they did not favour a more open-ended project as they felt students would be even more discouraged by the length than they are now. The program proposed that the Engineering Project could be designed to be more appealing to students and so the program will explore some other ideas.
Responsibility for following up: UNENE
Timeline: Update at 18-month report

Recommendation #8: Offer the UNENE courses as a vehicle for professional development for employees in the nuclear industry in Canada
Response: UNENE has outlined that they are already doing some professional development. The diploma will further such opportunities. The program has just finished a professional development module on Project Management with a UNENE utility.

Responsibility for following up: UNENE
Timeline: Update at 18-month report

Recommendation #9: The Review Team endorses the concept of the Diploma.
Response: UNENE is drafting the application this coming academic term.
Responsibility for following up: UNENE
Timeline: Update at 18-month report

Recommendation #10: The UNENE Master's of Nuclear Engineering is almost ideally suited to help meet international needs.
Response: The program stated that neither COG nor UNENE has this as their mandate. UNENE does not have the resources to offer courses at its own expense. However, UNENE will continue to pursue international opportunities on a case-by-case basis consistent with the overall CANDU strategy.
Responsibility for following up: N/A
Timeline: Update at 18-month report

Recommendation #11: The distance delivery technology would benefit from improvement.
Response: The program agrees so the next step will be to set up a system similar to what is used at COG.
Responsibility for following up: Programme Director
Timeline: Update at 18-month report

Quality Assurance Committee Recommendation

The program has been approved to continue and is scheduled for its next full review in eight years with a progress report due in 18 months.