

3.00 credits

Q2

Language :	English
Place of the course	Autre site
Prerequisites	The following BNEN courses are a prerequisite <ul style="list-style-type: none"> <li>• Nuclear Energy: Introduction</li> <li>• Nuclear Fuel Cycle</li> </ul>
Main themes	<p><b>MOX and Th fuel</b></p> <ul style="list-style-type: none"> <li>• Comparison of the physical properties of Pu and Th</li> <li>• Possible core designs with Th based fuel with high conversion factors</li> <li>• Pu-MOX fuel fabrication (MIMAS process) and fuel rod thermal-mechanical behaviour under irradiation</li> <li>• Pu-MOX impact on reactivity coefficients and safety issues</li> <li>• Th-MOX impact on reactivity coefficients and overview of the possible safety issues</li> <li>•</li> </ul> <p><b>Radiochemistry</b></p> <ul style="list-style-type: none"> <li>• Applied radiochemistry (complementary to the course under "Nuclear Fuel cycle"): chemical process technology: radiochemical separation techniques, radiochemical analysis, production of radionuclides</li> <li>• Radionuclide migration through a clay host rock ' geochemistry and underlying phenomena: impact on the Safety Case; geochemistry in Boom Clay; role of organic matter; radionuclide speciation, sorption and transport; modelling.</li> </ul> <p><b>Dismantling, decommissioning</b></p> <ul style="list-style-type: none"> <li>• Introduction: definitions, objectives, levels, regulatory aspects, radioprotection, ALARA</li> <li>• Radionuclide inventory, characterization and measurements</li> <li>• Strategy for decontamination of buildings, concrete pieces and structures, metals</li> <li>• Dismantling of a nuclear reactor (the BR3 case): the experience, materials management</li> <li>• Other types of installations to be decommissioned, REX from other projects</li> <li>• Strategies and planning of decommissioning</li> </ul>
Learning outcomes	<p><b>At the end of this learning unit, the student is able to :</b></p> <p><b>MOX and Th fuel</b></p> <p>To get a global understanding of the utilization of Pu and Th based fuel in light water reactors:</p> <ul style="list-style-type: none"> <li>• The challenges of the U-Pu-MOX fuel regarding the fuel fabrication, the core and fuel neutronic aspects and fuel behaviour</li> <li>• The Th-Pu-MOX used in LWR for its breeding capabilities, or more realistically as matrix for Pu utilization.</li> </ul> <p><sup>1</sup></p> <p><b>Radiochemistry and Dismantling</b></p> <ul style="list-style-type: none"> <li>• To get an understanding of radiochemistry, as it is a basic discipline to understand the various stages and activities in the nuclear fuel cycle, including the safe disposal of the radioactive waste.</li> <li>• To get acquainted with the principles and practice of dismantling and decommissioning of nuclear materials, as this is becoming an activity of increasing importance in nuclear engineering.</li> </ul>
Evaluation methods	Oral examination; written preparation
Inline resources	<a href="https://www.sckcen.be/fbnen">https://www.sckcen.be/fbnen</a>
Bibliography	<b>The PowerPoint presentations of the lectures are available on the BNEN website.</b>

Other infos	<p>This course is part of the Advanced Master programme in nuclear engineering organized by the Belgian Nuclear Higher Education Network (BNEN). BNEN is organised through a consortium of six Belgian universities and the Belgian Nuclear Research Centre, SCK-CEN and takes place at the SCK-CEN in Mol.</p> <p><b>Prof. Pierre Van Iseghem</b> ' Université de Liège <b>Prof. Hubert Druenne</b> ' Université de Liège</p>
Faculty or entity in charge	EPL

<b>Programmes containing this learning unit (UE)</b>				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Advanced Master in Nuclear Engineering	<a href="#">GNUC2MC</a>	3		