240NU022 - Management of Nuclear Power Plants

**Degree competences to which the subject contributes**

**Specific:**

1. Ability to assess the environmental impact of a nuclear facility, both in operation and in the rest of the life cycle.
2. Ability to easily integrate interdisciplinary and creative technical team of any company in the nuclear industry or research.
3. Ability to identify the different tasks of the technical and financial management of a nuclear facility and assess the problems associated with analyzing and proposing possible solutions.
4. Ability to select the most appropriate components and materials for the nuclear island systems of a plant as well as to analyze its degradation as a result of the conditions (thermal, chemical, mechanical and radiation) to which they are subjected.
5. Knowledge of techniques and procedures for the management of radioactive waste.
6. Knowledge of the diagnostic techniques used in the inspection and life management of nuclear plant components.
7. Have a clear and comprehensive life cycle of facilities, from design to decommissioning of a nuclear plant.

**Teaching methodology**

The course combines expositive sessions with sessions of exercises and field visits.

**Learning objectives of the subject**

At the end of the course, the student will be able to:

- Outline the essence of the problem of managing the design and construction of a nuclear power plant.
- Explain and describe the design criteria for new plants.
- Analyze feasibility parameters and pre-project of a plant.
- Distinguish the different types of engineering and supply contracts.
- Explain and describe the philosophy of scheduling and cost control.
- Correlate the design of a plant with the coordinating and monitoring activities.
- Use specifications and documents related to plant construction.
- Follow and reason the convenience commissioning schedule.
- Outline the essence of the problem of the management of nuclear power plant operation.
- Describe the problem of establishing the organizational function.
- Use the concept of integrated management policies.
- Analyze the parameters describing the principles of excellence for the operation of nuclear power plants.
- Outline the essence of the organization of plant operation.
- Analyze the results of operating experience.
- Study a real operational incident and write a report.
- Analyze the organizational problems of waste management of low and intermediate level.
- Analyze the problems of maintenance and reload.
- Describe the essence of the organization of radiation protection in a plant.
- Analyze the application of an ALARA program to a plant.
- Identify the contents of engineering support to the operation.
- Interpret the results of an evaluation plan.
- Analyze the corrective actions of a quality assurance program.
- Identify the impact of a purchasing policy.
- Interpret the spare parts policy.
- Use the concepts of human performance policies.
- Interpret a training policy.
- Analyze the basic parameters of the equipment qualification process and their involvement in life management.
- Justify the possibility of plant life extension following investment and technical considerations.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 212h 30m</th>
<th>Hours large group:</th>
<th>0h</th>
<th>0.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group:</td>
<td>51h</td>
<td>24.00%</td>
<td></td>
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<tr>
<td>Hours small group:</td>
<td>25h 30m</td>
<td>12.00%</td>
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</tr>
<tr>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
<td></td>
</tr>
<tr>
<td>Self study:</td>
<td>136h</td>
<td>64.00%</td>
<td></td>
</tr>
</tbody>
</table>
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## Content

<table>
<thead>
<tr>
<th>Block</th>
<th>Description</th>
<th>Related activities</th>
<th>Learning time</th>
<th>Related activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction &amp; Management System</td>
<td>The overview of the course is presented in this block starting with the basic considerations about the management of nuclear power plants. The concept of management system is developed and the most relevant features of the Management System for each of the project phases are described.</td>
<td>Independent learning, reading of related material</td>
<td>20h</td>
<td></td>
</tr>
</tbody>
</table>
| 2. Engineering Tasks (System Design) | This block is organized around Assignment 1 which consists in designing a system devoted to face a selected scenario. This will combine sessions for launching, following and concluding the assignment, along with 2 or 3 Technical Talks related to it. | | 52h | Assignment 1.  
The exercise is organized in 4 different assignments / deliveries:  
A11 is a justification report on the adequacy of Design Basis  
A12 is a draft report ready for follow-up session  
A13 is the main design report  
A14 is the individual part of the exercise focused on preparing equipment spec and/or system description |
| 3. Engineering Tasks (Design Modification) | This block is organized around Assignment 2. It will combine sessions for launching, following and concluding the assignment, along with 2 or 3 Technical Talks related to it. | | 47h | Assignment 2  
This Assignment is related with a design modification. The task will be defined in the classroom and the corresponding material will be posted in ATENEA. |
### 4. From Pre-project to Commissioning

**Description:**
The presentations of this block are focused on the description of the activities carried out in each phase of the project. The different stages included are the following: Pre-project stage, Site selection and evaluation, Bid invitation specifications, Plant construction, erection and installation, Pre-operational Tests and Nuclear Tests.

**Learning time:** 16h  
- Practical classes: 10h  
- Self study: 6h

### 5 Operation (Management Tools)

**Description:**
This block is rather complex and quite miscellaneous. It includes the description of management tools used by an actual operating plant dealing with: Quality Assurance and Continuous Reliability Improvement, Materials and Services and Human Performance. Additionally, it describes the organization of Engineering Tasks carried out in an actual power plant, and also how the management of such plant deals with subjects like Communication and Operating Experience.

**Related activities:**
Two in-classroom practical cases complete the block, this cases involve some additional homework.

**Learning time:** 28h  
- Practical classes: 10h  
- Laboratory classes: 4h  
- Self study: 14h

### 6 Operation (Procedures and Activities)

**Description:**
This block is again rather complex and quite miscellaneous. It includes Operation activities and procedures like Technical Specifications, Tests and Chemistry, Effluents, Maintenance and Radiation exposure control.

**Related activities:**
The contents of this block, mainly the Technical Specifications, are linked with a simulator session devoted to Operating Procedures.

**Learning time:** 22h  
- Practical classes: 8h  
- Self study: 14h
## 7. Plant decommissioning and Radwaste Management

**Learning time:** 10h
- Practical classes: 6h
- Self study: 4h

**Description:**
This block includes considerations for previous stages to facilitate decommissioning, Decommissioning Strategies and Radwaste Management strategies.

## 8. Other

**Learning time:** 18h
- Practical classes: 2h
- Laboratory classes: 6h
- Self study: 10h

**Description:**
This block consists of talks given by experts in topics of interest for the Management of Nuclear Plants.

**Related activities:**
This bloc includes a simple exercise on the economic and environmental effects of changes in the structure of the Electricity System.

### Qualification system

\[ FQ = 0.5 \, CQ + 0.5 \, EQ \]

- **FQ**: Final Qualification
- **CQ**: Course qualification. This qualification is obtained weighting the different activities performed using the proportion of hours of each topic related to the total amount of hours of the course.
- **EQ**: Exam qualification. At the end of the semester students will have to answer an exam to determine the level of understanding reached.

### Bibliography

**Others resources:**
The materials needed to follow the course will be available in Atenea.