

Specializing Master program

Nuclear Safeguards

A cross-divisional training path
for the global context



**Funded by
the European Union**

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The organizers

European high level institutions for Nuclear Safeguards

The Specializing Master is organized by the **Department of Energy – Politecnico di Milano** and the **European Nuclear Education Network (ENEN)**, in collaboration with the European Joint Research Centre (EU JRC), academic institutions participating in the European Nuclear Education Network, ESARDA partners and international organizations.



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POLITECNICO
MILANO 1863



The Specializing Master is part of the **Safeguards Training and Education (MC3.01/18) project** funded by the **European Union** in the frames of the Instrument for Nuclear Safety Cooperation.

Politecnico di Milano (POLIMI) is a core academic institution hosting Specializing Master.

POLIMI is one of the leading scientific and technological universities in Europe. It trains engineers, architects and industrial designers. The Department of Energy of Politecnico di Milano brings together the scientific expertise necessary to deal and scrutinise subjects and energy-related technologies as a whole.

The **European Nuclear Education Network (ENEN)** is a Coordinator of the Safeguards Training and Education project. ENEN is an international nonprofit organization (aisbl) gathering more than 80 members and partners. The mission of ENEN is the preservation and the further development of expertise in the nuclear fields by higher Education and Training in Europe.



The aim

The Specializing Master course on Nuclear Safeguards gives the opportunity to educate and develop the competences of employees in order to enhance the efficiency of their actions in the field of nuclear safeguards and support the continuous development of a professional, competent and motivated workforce.

This attitude contributes directly to both the national nuclear safety and the implementation of the countries’ safeguards obligations under relevant agreements.

The context

The nuclear safeguards system is a key element of the international regime of the non-proliferation of nuclear weapons. Over decades it has evolved into a multifaceted set of legal and technical measures aimed at verifying the compliance of States with their non-proliferation commitments in the nuclear sector.

The need for training

Due to high demands on technical competence especially in the nuclear field, the ongoing availability of new information, development of new reactor types, new safety mechanisms and new assessment methodologies, there is a huge need for general, in depth and/or specialized training for the staff of NRAs.

The outcome

The Specializing Master will be organized as a cross-divisional training path, involving political science-forensics-nuclear scientific and technological areas, aimed to form key figures ready to be involved in the nuclear safeguards sector.

AWARDED TITLE

**First level Specializing Master
on Nuclear Safeguards’
Degree**

VALUE
60 ECTS

Students have to suitably complete the program of study and the ongoing examinations to obtain the title and its formal certification.

Program & training format

The blended format

The Specializing Master has a duration of around 15 months, and it is organized in a **blended format** with:

- 9 months of **online modules**;
- 5 weeks of **in-presence labs**;
- 3 months of **project work**.



Online modules

composed by digital contents (videos, quiz, additional materials), webinars, group activities



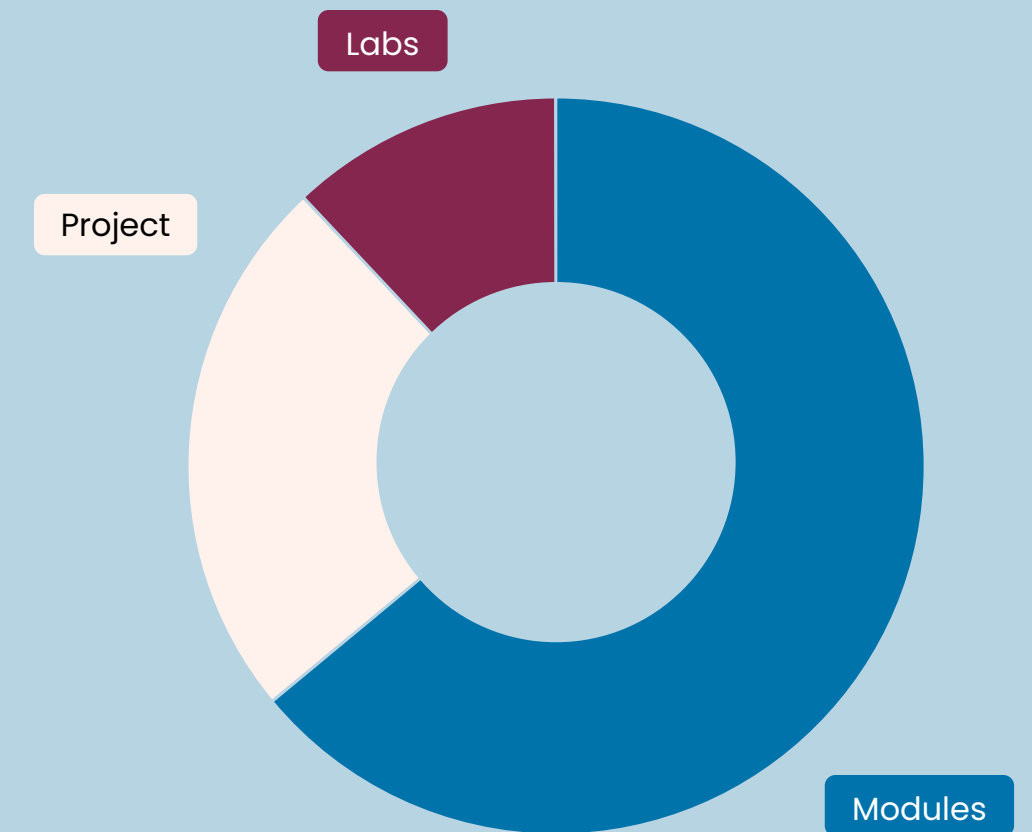
In-presence labs

held at Politecnico di Milano, JRC Labs in Italy and Europe and other European Labs which are part of the ENEN network



Project work

offers the opportunity to synthesise the knowledge acquired and critically apply it



Didactic modules 1/2

MODULE

01

Introduction and basics

Online

- Nuclear technologies
- Legal framework
- Soft Skills

MODULE

02

History of non-proliferation and safeguards

Online

- History and Policy of Nuclear dual-use
- EURATOM and IAEA Safeguards in the International Relations
- Historical making of Proliferation risks and Non-Proliferation policies

MODULE

03

National and International legal frameworks

Online

- Basics of Non Proliferation Treaty
- Comprehensive Safeguards Agreement
- State regulators, State's role, rights and responsibilities

MODULE

04

Fuel cycle and non-proliferation

Online

Elements of the fuel cycle: Mining, Conversion, Enrichment, Fuel fabrication, Reactors, Reprocessing, Waste Disposal, Aspects of Weaponisation, Physical Model/Pathway analysis

MODULE

05

Methodology for implementation of safeguards

Online

- Legal basis for nuclear material safeguards
- Tools to verify nuclear material accounts
- Political and legal options of inspectorates to apply sanctions in case of violations

LABs

1

Basic Labs

2 weeks of experimental tutoring activities and visits

Presence

MODULE

06

Nuclear material accountancy and mathematical methods for nuclear safeguards

Online

- Facility Attachments and Euratom safeguards regulation
- Nuclear material accountancy concepts
- Analytical methods and game theoretical concepts

Didactic modules 2/2

MODULE

07

Online

Destructive analysis

- Destructive Assay (DA) techniques
- Practical exercises with detectors currently approved for safeguards inspections

MODULE

08

Online

Non-destructive measurements

- Non-Destructive Assays (NDA) used for the measurement of nuclear material
- Introduction on the basic principles of NDA techniques

MODULE

09

Online

Verification and monitoring techniques incl. containment and surveillance

- Design Information Verification
- Process monitoring approaches
- Sealing technologies

MODULE

10

Online

Export control

- Main principles ruling nuclear trade control
- Analysis of international and regional legally and politically instruments
- General principles of international trade

MODULE

11

Online

Nuclear security

- Locations and use of nuclear and radiological materials
- Risks of misuse of nuclear and radiological materials
- Basics of physical protection, detection technologies and nuclear forensics analysis

LABs

2

Presence

Advanced Labs

3 weeks of training on the job and tutoring

MODULE

12

Online

Future challenges in safeguards

Novel technologies, approaches and methodologies

Online

Project work

Individual work or in pairs, resume and deepen the work done during the Advanced Labs

Calendar

2023
2024

20 NOV	● MODULE 01
6 DEC	Introduction and basics
11 DEC	● MODULE 02
22 DEC	History of non-proliferation and safeguards
8 JAN	● MODULE 03
26 JAN	National and International legal frameworks
5 FEB	● MODULE 04
23 FEB	Fuel cycle and non-proliferation
4 MAR	● MODULE 05
22 MAR	Methodology for implementation of safeguards

8 APR	▲ LABs 1
19 APR	Basic Labs
22 APR	● MODULE 06
10 MAY	Nuclear material accountancy and [...]
13 MAY	● MODULE 07
24 MAY	Destructive analysis
27 MAY	● MODULE 08
7 JUN	Non-destructive measurements
17 JUN	● MODULE 09
28 JUN	Verification and monitoring techniques incl. [...]

2024
2025

1 JUL	● MODULE 10
12 JUL	Export control
15 JUL	● MODULE 11
26 JUL	Nuclear security
OCT	● MODULE 12
	Future challenges in safeguards
OCT	▲ LABs 2
DEC	Advanced Labs
NOV	● Project work
JAN	
END JAN	● Graduation day

● Online ▲ Presence

Fees and scholarships

This is a financially supported Master for EXTRA EU students, with special regards to [INSC \(Instrument for Nuclear Safety Cooperation\) Countries](#) originated students.

FOR STUDENTS FROM INSC COUNTRIES

21 scholarships fully funded
by European Commission

FOR THE OTHER STUDENTS

5 partial scholarships
will be provided by POLIMI



Timing



Eligibility and admission

TITLE REQUIRED

Bachelor degree

in: Science, Technology, Engineering and Math, Law,
Economics or Political Science

CONSIDERED AS AN ASSET

Nuclear specialized Bachelor

or nuclear topics at the Bachelor level

CONSIDERED AS AN ASSET

Working in nuclear field

RECOMMENDED

English knowledge certification

or self-certification (B2 level)

Selection methods

All the candidates will be evaluated on:

- ✓ CV in European Format
- ✓ Bachelor or Master of Science Degree
- ✓ Motivation Letter
- ✓ Support Letter from Government, Institution, Foundation, Professor

WHERE TO APPLY

Application module available at <https://www.nuclearsafeguards.polimi.it>



Location

Nov 2023 – Oct 2024

ONLINE DIDACTIC MODULES

Online

Apr 2024

BASIC LABS

Italy – Politecnico di Milano

Oct – Dec 2024

ADVANCED LABS

Each Advanced Lab will be organized in accordance to topic requests and institution availability

Jan 2025

FINAL EXAM AND GRADUATION

Italy – Politecnico di Milano

Contacts

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WEBSITE

<https://www.nuclearsafeguards.polimi.it>



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Safeguards Training and Education project website (to be updated):
<http://nuclearsafeguards.eu>