COURSE DATA

DATA SUBJECT

Code: 47085
Name: Regulatory and Conceptual Framework of Environmental Pollution: Professional Skills
Cycle: Master's Degree
ECTS Credits: 3
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología	Facultat de Ciències Biològiques	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología	Procesos contaminantes y sus efectos	COMPULSORY

COORDINATION

ANDREU SANCHEZ OSCAR ENRIQUE

RAMO ROMERO JOSE JUAN DEL

SUMMARY

The course "Regulatory and conceptual framework of environmental pollution. Professional competencies" aims to show students the different regulations (European, national, and local) related to environmental pollution and ecotoxicology from all areas involved in the teaching of the Master's program. The complexity of studying environmental pollution requires a multidisciplinary approach that is regulated by standards that are mandatory for all social actors. In this regard, it is necessary to provide an initial overview of all the standards that graduates of the Master's program must master, as this will play a decisive role in the development of their professional skills as graduates.

The course is structured into different modules that will cover the regulations related to environmental pollution in this specific field and outline the professional skills required to comply with them:

· **Animal experimentation in ecotoxicology**

· **Experimentation on plants and plant organisms**

· **Assessment of pollution in:**

-Soil systems and chemical substances and waste

-Atmosphere

-Aquatic ecosystems

-Geological and related systems

Animal experimentation in ecotoxicology is justified by the need to assess complex environmental effects using model animals under strict regulations. Animal welfare and the application of the 3Rs are monitored by ethics committees. Some validated alternative methods are presented, such as fish embryo testing and in vitro models, along with new approaches such as omics and integrated strategies.

Waste policy should minimize negative impacts on health and the environment, aligning with the circular economy and promoting the efficient use of resources. Waste contributes to climate change and marine pollution, and its proper management reduces these emissions. Waste legislation seeks to implement the principles of the circular economy, combat climate change, and protect the marine environment, contributing to the Sustainable Development Goals. It also encourages job creation in sectors related to reuse and recycling.

The REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals) and BPR (Biocidal Products Regulation) directives are fundamental to environmental protection, as they seek to control the use and safety of chemicals in Europe. REACH promotes the identification of risks associated with chemical products and their replacement with safer alternatives, while BPR regulates biocides to prevent damage to ecosystems and biodiversity. Both regulations reduce environmental pollution and protect human health. They also encourage innovation in the development of more sustainable and less hazardous products. Their implementation contributes to a safer and more sustainable environment in the long term.

European directives on air pollution and noise control are essential for improving air quality and public health in Europe. These regulations set concentration limits for pollutants such as fine particles (PM10), nitrogen dioxide (NO2), and ozone, with the aim of reducing risks to human health and the environment. They also address noise control, which affects quality of life and can cause health problems such as stress and sleep disorders. The implementation of these directives promotes cleaner air, reduces pollutant emissions, and encourages urban sustainability. It also ensures that Member States cooperate to achieve a healthier and more livable environment for all.

With regard to the assessment of pollution in aquatic ecosystems, European water pollution control directives are crucial to ensuring the protection of water resources and environmental health. These regulations establish limits and standards for water quality, regulating both surface water and groundwater, and promote its proper treatment to prevent pollution by hazardous substances. In addition, they encourage the sustainable management of aquatic ecosystems and support the recovery of polluted water bodies. These directives also promote cooperation between Member States, aligning their policies to achieve a cleaner and healthier aquatic environment, thus protecting biodiversity and water resources for future generations.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

No restrictions on enrollment in other courses in the curriculum have been specified.

COMPETENCES / LEARNING OUTCOMES

2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología

Collaborate effectively in work teams, taking on responsibilities and leadership roles and contributing to collective improvement and development.

Demonstrate critical and self-critical reasoning in the field of the degree, considering aspects such as professional ethics, moral value and the social implications of the different activities carried out.

Develop and implement programmes and projects to prevent, control and mitigate environmental pollution.

Develop the ability to work in multidisciplinary teams and to cooperate effectively.

Develop the capacity for analysis, synthesis and critical thinking in applying the scientific method.

Diagnose environmental problems.

Evaluate and assess the impact of human activities on pollution in the atmosphere, inland waters, marine waters and soils.

Evaluate the behaviour of pollutants and their interactions in different environmental compartments.

Evaluate the quality of water and soil.

Know and understand, within the area of the degree, inequalities based on sex and gender in society; integrate different needs and preferences based on sex and gender into the design of solutions and problem-solving.

Know the animal models used for studying human diseases in relation to environmental pollution.

Know the standards and legislation relating to environmental pollution.

Use different bibliographic sources and biological databases.

Use indicators of environmental risks and health-related damage.

DESCRIPTION OF CONTENTS

The course is structured into thematic blocks

Block: Animal experimentation in ecotoxicology

This block will cover the following topics

- **Animal experimentation in ecotoxicology.** Use of animals in ecotoxicological studies. Introduction to ecotoxicology and ecotoxicological testing. Scientific justification for the use of animals. Model animals used in ecotoxicology.
- Current regulations in Spain and Europe. Directive 2010/63/EU on the protection of animals used for scientific purposes. Transposition into Spanish law: Royal Decree 53/2013. Role of the Animal Experimentation Ethics Committee (CEEA). Specific ecotoxicology regulations that cover the use of animals: REACH, CLP.
- **Animal welfare and application of the 3Rs in ecotoxicology.** Animal welfare in the ecotoxicological context. Principles of the 3Rs. Ethical evaluation of projects in ecotoxicology. Evaluation of the need to use animals. Project authorization procedure (Spain)
- **Alternative methods and new approaches in ecotoxicology**. Validated alternative methods. OECD guidelines. Fish Embryo Acute Toxicity Test (FET) as an alternative. In vitro models
- **New approaches and tools.** Omics, computational toxicology. Integrated testing and assessment strategies (IATA). Challenges and prospects: current limitations of alternative methods and the need for validation and regulatory acceptance.

Block: Experimentation on plants and plant organisms

- **Plant experimentation in ecotoxicology.** Use of plants in ecotoxicological studies. Scientific justification for the use of plants. Model plants used in ecotoxicology.
- **Current regulations in Spain and Europe.** Contaminant levels in plants.
- **Genetically Modified Organisms (GMOs).** Obtaining and techniques
- **Regulations on GMOs.** Directives, decrees, and labeling.
- **Invasive plant species**

Block on Pollution Assessment in:

Soil systems, chemicals, and waste

A review of European directives on contaminated soil and waste will be carried out, as well as the implications for the Sustainable Development Goals (SDGs). The directives regulating the marketing of chemicals and biocides and labeling regulations will also be reviewed.

- Proposal for a Directive of the European Parliament and of the Council on soil monitoring and

resilience (Soil Monitoring Act).
- European regulations on chemicals: REACH, BPR, and CLP
- Regulation (EU) No. 1357/2014
- Law 7/2022, of April 8, on waste and contaminated soil for a circular economy.
- RD 553/2020, regulating the transfer of waste within national territory
- RD 9/2005 on potentially contaminated soil

Atmosphere

This section reviews European, national, and regional regulations on air pollutants and environmental noise at different administrative levels:

- European Directives: 2008/50/EC, 2004/107/EC, 2015/1480)
- National regulations: RD102/2011 and RD34/2023
- Autonomous Community regulations: Decree 158/2015 on air quality and environmental noise.

Aquatic ecosystems

This section reviews both the European Directives of the national regulatory framework (main regulations) and some regional examples. The initial Directives, in order of importance, are as follows:

- Water Framework Directive
- Marine Strategy Directive
- Habitats Directive
- Groundwater Directive
- Waste Water Treatment Directive
- Nitrates Directive
- Other water-related directives

In geological and related systems

<u>General cartography</u>

- Law 14/2010, on geographic information infrastructure and services in Spain.
- Royal Decree 1545/2007, regulating the National Cartographic System.
- Royal Decree 1071/2007, regulating the official geodetic reference system in Spain.
- Royal Decree 556/2011, for the development of the Spanish Inventory of Natural Heritage and Biodiversity.
- Directive 2007/2/EC (INSPIRE Directive), establishing a spatial information infrastructure in the European Community.

<u>Cartography in specific areas:</u>

In Water (diffuse pollution and discharges):

- Royal Decree 47/2022 – nitrates – digital maps of affected waters and Directive 2000/60/EC (Water Framework Directive), establishing a Community framework for action in the field of water policy (inventories, emission and discharge maps).

In Air and atmospheric emissions:

- Law 34/2007, of November 15, on air quality and protection of the atmosphere.
- Royal Decree 102/2011, on improving air quality.
- Law 16/2002, on integrated pollution prevention and control (IPPC), which regulates Integrated Environmental Authorization.
- Directive 2010/75/EU (IED, on industrial emissions).
- Regulation (EC) No. 166/2006, establishing the European Pollutant Release and Transfer Register (E-PRTR).

On polluted soil :

- Royal Decree 9/2005, on activities that may contaminate soil and the criteria and standards for declaring soil contaminated.
- Directive on soil monitoring (provisional agreement between the Council and Parliament, 2025)
- soil mapping in the EU.

On Wastewater and Environmental Liability:

- Directive 2004/35/EC on environmental liability with regard to the prevention and remedying of environmental damage.
- Law 26/2007 on Environmental Liability, which incorporates the "polluter pays" principle.

Professional skills and entrepreneurship:

In addition to reviewing the aforementioned regulations and directives, an overview will be provided of the professional skills required for the application and supervision of these regulations, as well as the career opportunities they offer (public and private sector, authorized control laboratories, and consulting firms). Practical case studies related to the professional skills of each block will be evaluated, providing examples of real-life applications of each module.

In addition, talks and conferences will be held with graduates of the Master's program, assisted by ADEIT and Chamber of Commerce staff and with technicians from companies, technology centers, and the administration, who will give their views on the career opportunities that the application of all the

regulations covered offer to graduates.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Total hours	**30,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	5,00
Individual or group project	0,00
Independent study and work	10,00
Preparation of lessons	10,00
Preparation for assessment activities	10,00
Resolution of case studies	10,00
Total hours	**45,00**

TEACHING METHODOLOGY

- Participatory theory classes
- Master classes on theory to develop fundamental knowledge and methodology.
- Case studies and classroom exercises related to the content of the modules.

EVALUATION

The assessment will consist of:

- A written test (multiple choice) worth 70% of the final grade
- Continuous assessment based on case studies and procedures, class participation, and attendance at lectures/conferences. This part will account for 30% of the final grade

The average mark in each part to be averaged will be 4/10. To pass the course, a mark of 5/10 will be required.

REFERENCES

Block: Animal experimentation in ecotoxicology

• Balls M. Alternatives to Laboratory Animals: Trends in Replacement and the Three Rs. *Alternatives to Laboratory Animals*. 2022;50(1):10-26.

• Comisión de ética en investigación experimental de la Universitat de València. https://www.uv.es/comissio-etica-investigacio-experimental/ca/experimentacio-benestar-animal/normatives-aplicables.html. Ultima lectura: 9 Julio 2025

• Directiva 2010/63/UE del Parlamento Europeo y del Consejo, sobre la protección de los animales utilizados para fines científicos. Diario Oficial de la Unión Europea L 276/33.

• European Comission. Animals in science. EU actions for the protection of animals used for scientific purposes. https://environment.ec.europa.eu/topics/chemicals/animals-science_en. Ultima lectura: 9 Julio 2025

• OECD. Guidelines for the testing of chemicals. https://www.oecd.org/en/topics/sub-issues/testing-of-chemicals/test-guidelines.html. Ultima lectura: 9 Julio 2025

• Real Decreto 53/2013, por el que se establecen las normas básicas aplicables para la protección de los animales utilizados en experimentación y otros fines científicos. BOE 2013 (34) Pag 11370.

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Block: Experimentation on plants and plant organisms

• S. Ijaz, I. Ul Haq, H. Mohamed Ali (Eds.), Trends in Plant Biotechnology, Springer Nature, Singapore (2024), pp. 23-55, 10.1007/978-981-97-0814-7_2

• Hwang HH, Yu M, Lai EM. Agrobacterium-mediated plant transformation: biology and applications. Arabidopsis Book. 2017 Oct 20;15:e0186. doi: 10.1199/tab.0186. PMID: 31068763; PMCID: PMC6501860.

• Newell, C.A. (2000). Plant transformation technology: Developments and applications. Mol. Biotechnol. 16, 53-66

• Directiva 2001/18/CE del Parlamento Europeo y del Consejo, de 12 de marzo de 2001, sobre la liberación intencional en el medio ambiente de organismos modificados genéticamente y por la que se deroga la Directiva 90/220/CEE del Consejo. https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:32001L0018

• Directiva (UE) 2015/412 del Parlamento Europeo y del Consejo, de 11 de marzo de 2015 , por la que se modifica la Directiva 2001/18/CE en lo que respecta a la posibilidad de que los Estados miembros restrinjan o prohíban el cultivo de organismos modificados genéticamente (OMG) en su territorio Texto pertinente a efectos del EEE. https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:32015L0412

• Reglamento (CE) n° 1829/2003 del Parlamento Europeo y del Consejo, de 22 de septiembre de 2003, sobre alimentos y piensos modificados genéticamente (Texto pertinente a efectos del EEE). https://eur-lex.europa.eu/legal-content/ES/ALL/?uri=celex:32003R1829

• Reglamento (CE) n° 1830/2003 del Parlamento Europeo y del Consejo, de 22 de septiembre de 2003, relativo a la trazabilidad y al etiquetado de organismos modificados genéticamente y a la trazabilidad de los alimentos y piensos producidos a partir de éstos, y por el que se modifica la Directiva 2001/18/CE. https://eur-lex.europa.eu/legal-content/ES/ALL/?uri=CELEX%3A32003R1830

Pollution Assessment Block in:

Atmospheric Pollution Assessment

- Directivas 2008/50/CE
- Directiva 2004/107/CE
- Directiva 2015/1480
- Real Decreto 102/201

Real Decreto 34/2023

- Decreto 158/2015 de calidad del aire y el ruido ambiental (GVA)

Soil systems, chemicals, and residues

- Propuesta de Directiva del Parlamento Europeo y del Consejo relativa a la vigilancia y la resiliencia del suelo (Ley de vigilancia del suelo).
- Reglamentos europeos de sustancias químicas: REACH, BPR y CLP
- Reglamento (UE) nº1357/2014 de residuos
- Ley 7/2022, de 8 de abril, de residuos y suelos contaminados para una economía circular.
- RD 553/2020, que regula el traslado de residuos en territorio nacional
- RD 9/2005 sobre suelo potencialmente contaminados