

## Environmental Risk Assessment (1002606)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 5.0**

**Study time 150 h**

**Course offerings and teaching methods in academic year 2023-2024**

A (semester 1)

English

Gent

lecture

group work

seminar

practical

**Lecturers in academic year 2023-2024**

De Schampelaere, Karel

LA22

lecturer-in-charge

Asselman, Jana

LA22

co-lecturer

Janssen, Colin

LA22

co-lecturer

Verougstraete, Violaine

LA22

co-lecturer

**Offered in the following programmes in 2023-2024**

[Bachelor of Science in Environmental Technology](#)

crdts 5

offering A

[Master of Science in Electromechanical Engineering\(main subject Control Engineering and Automation\)](#)

5

A

[Master of Science in Electromechanical Engineering\(main subject Electrical Power Engineering\)](#)

5

A

[Master of Science in Electromechanical Engineering\(main subject Maritime Engineering\)](#)

5

A

[Master of Science in Electromechanical Engineering\(main subject Mechanical Construction\)](#)

5

A

[Master of Science in Electromechanical Engineering\(main subject Mechanical Energy Engineering\)](#)

5

A

[International Master of Science in Agro- and Environmental Nematology](#)

5

A

[Master of Science in Biology](#)

5

A

[Master of Science in Bioscience Engineering: Environmental Technology](#)

5

A

[Master of Science in Chemical Engineering](#)

5

A

[Master of Science in Chemical Engineering](#)

5

A

[Master of Science in Environmental Science and Technology](#)

5

A

[Master of Science in Materials Engineering](#)

5

A

[Master of Science in Sustainable Materials Engineering](#)

5

A

[Exchange Programme in Bioscience Engineering: Environmental Technology \(master's level\)](#)

5

A

**Teaching languages**

English

**Keywords**

risks and safety of chemicals, environmental toxicology, toxicology, ecotoxicology, toxicity, ecotoxicity tests, risk assessment of chemicals, dose-response evaluation, environmental pollution, human health, effects analysis, exposure analysis

**Position of the course**

The aim of this course is to introduce the students in the theoretical foundations of (eco) toxicology of chemicals and in the principles of exposure, effects and risk assessment of chemicals for ecosystems and humans. A strong focus is on understanding how different physical, chemical, biological and ecological processes contribute to chemicals exposure, effects and, ultimately, risk. Finally, the various aspects of the theory will be brought into

practice by means of hands-on training into exposure and effects testing in the laboratory ('practicum') and quantitative (real-life) chemicals risk assessment ('PC exercises', 'group work').

## Contents

### LECTURES

#### 1. General Introduction

- Chemicals are everywhere... concerns, examples, risks
- The bigger picture: planetary boundaries, sustainable development goals
- The dawn of (eco)toxicology: the case of DDT and effects on bird populations
- What is (Eco)toxicology?
- Human vs. ecological risk assessment
- General scheme of risk assessment: hazard, exposure, effects and risks
- Risk assessment vs. risk management
- Overview of worldwide legislative and regulatory frameworks for chemicals (e.g., REACH, water framework directive)
- Risk characterisation
- Marine pollution and risks

#### 2. Environmental Exposure Assessment

- Emission: sources, scenarios, estimation
- Equilibrium partitioning: principles, examples
- Intra- vs. inter-media transport
- Inter-media transport: sedimentation, leaching (PMT substances), volatilisation
- Transformation of chemicals: general introduction and modeling
- Abiotic degradation: hydrolysis, photolysis
- Biodegradation: persistence, measurement, examples, application (PBT substances)
- External Exposure assessment: predicting concentrations in water, air, soil & sediment
- Internal Exposure assessment: bioconcentration, bioaccumulation, biomagnification; the case of PFOS

#### 3. (Eco)toxicology at sub-organism level

- Hierarchical response scales to chemical stress
- Human toxicology and ecotoxicology integration
- Uptake, biotransformation, detoxification and elimination: metals and organic chemicals
- Molecular and cellular effects (oxidative stress, DNA damage, enzyme dysfunction, epigenetic effects)
- Adverse outcome pathways: framework, examples, development, regulatory significance

#### 4. Ecotoxicology at organism and supra-organism levels and effect assessment

- Ecotoxicity testing: design, exposure systems, acute and chronic toxicity, data analysis, animal alternatives
- Effect assessment: PNEC derivation, Assessment Factors, Species Sensitivity Distribution
- Contaminants of emerging concern: examples
- Increasing ecological realism: bioavailability and temperature effects, mixture toxicity
- Increasing ecological realism: population, community, and ecosystem-level effects

#### 5. Human toxicology and risk assessment

- Introduction, objectives, general framework
- Effects (hazard) assessment: toxicity testing (in vivo, in vitro), epidemiological & other data
- Exposure assessment: occupational, environmental & consumer exposure
- Risk characterisation: compares exposure with DNEL
- Risk management and communication

### PRACTICUM (WETLAB)

- Biodegradation test
- Ecotoxicity test

### PC EXERCISES (PCLAB)

- Biodegradation and dose-response data analysis
- Environmental exposure, effects and risk assessment
- Human exposure, effects and risk assessment

### GROUPWORK

Students need to search environmental fate, exposure and effects data on a certain chemical, critically review and interpret the dataset, perform a risk assessment, and present this to the entire group.

## Initial competences

Bachelor of science level knowledge of mathematics, chemistry, biology, and ecology

## Final competences

- 1 Understand physical, chemical, biological and ecological processes that determine exposure, effects and risks of chemical to man and the environment
- 2 Know how theoretical foundations of risk assessment are brought into practice in legislation
- 3 Apply quantitative techniques for dose-response, exposure, effect and risk evaluation
- 4 Interpret, critically analyze and report on scientific literature on (eco)toxicology and risk assessment

## Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

## Conditions for exam contract

This course unit cannot be taken via an exam contract

## Teaching methods

Group work, Seminar, Lecture, Practical

## Learning materials and price

- Selected chapters from the Van Leeuwen and Vermeire (2007) textbook: "Risk Assessment of Chemicals: An Introduction"
- Lecture notes: slides presented during the theory lectures, practicum and PC exercises
- Course notes for the practicum and PC exercises
- Video recordings of theory lectures
- Lecture and course notes are made available via Ufora, at no extra costs

## References

van Leeuwen C.J., Vermeire T.G. (2007) Risk Assessment of Chemicals: An Introduction. Springer, 2nd edition, 688p; ISBN 978-1-4020-6101-1.

## Course content-related study coaching

Lecturers and academic assistants can be consulted (after electronic appointment only) for additional guidance

## Assessment moments

end-of-term and continuous assessment

## Examination methods in case of periodic assessment during the first examination period

Skills test, Written assessment with multiple-choice questions, Written assessment with open-ended questions

## Examination methods in case of periodic assessment during the second examination period

Skills test, Written assessment with multiple-choice questions, Written assessment with open-ended questions

## Examination methods in case of permanent assessment

Participation, Peer and/or self assessment, Assignment

## Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

## Extra information on the examination methods

### Period-aligned evaluation:

- Theory: closed book exam with open questions and multiple choice questions focusing on a detailed and integrated understanding of the theoretical foundations of (eco)toxicology and risk assessment.
- Skills test: closed book exam; students will need to solve one or more 'integrated problems' for which integrated knowledge obtained during the lectures, practicals and PC exercises classes is required

### Permanent evaluation:

- Group Work: Groups of 3-6 students will have to gather environmental fate, exposure, and effects data on a certain chemical, critically review and analyse it and perform a risk assessment. They need to submit a report and present their findings to all other students and need to be able to discuss these with them as well as with the lecturers. in the case that a second chance exam is needed for this part, the work has to be improved, presented to the lecturer and defended individually.

- Participation during practicals, PC exercises, and group work (including peer assessment)

### Calculation of the examination mark

The calculation of the global examination mark will be as follows:

1. Period-aligned evaluation: 60% of the total mark (12 points of the 20)
  - 1.1 Theory: 40% of the total mark (8 points of the 20)
  - 1.2 Skills test: 20% of the total mark (4 points of the 20)

2. Permanent evaluation: 40% of the total mark (8 points of the 20)
  - 2.1 Group work: 40% of the total mark (8 points of the 20)

For group work: if there is a clear difference of input between the different group members, the examination mark for this part can be different by up to 5/20 between the different group members.

To pass, the students must score at least half of the points on periodic (6/12) and permanent evaluation (4/8). Students who score less than half of the maximum score for either periodic or permanent evaluation, will only be able to receive a maximum global examination mark of 9/20. Students who eschew period aligned (periodic) or non-period aligned (permanent) evaluations or who eschew participation in practicum, PC exercises, or groupwork for this course unit may only be able to receive a global examination mark of 6/20.