



## **CLIMATE CHANGE AND ENVIRONMENTAL POLLUTION**

Lecturer: Antonio Marcomini

e-mail: [marcom@unive.it](mailto:marcom@unive.it)

*PERIOD: 3<sup>rd</sup> TERM, Spring 2011*

tel.: +39-041-2348548

---

### **Course description**

The course seeks to impart a broad understanding of the thermodynamic and chemical aspects of climate change, and to the risks posed by the possible effects on environmental contamination.

In the first part of the course the main concepts of environmental chemistry and thermodynamics will be introduced. Hence, the main focus will shift towards introducing the climate system under a chemical and thermodynamic perspective, through the application of the concepts presented earlier.

In the second part of the course, the possible effects of climate change on environmental pollution will be discussed. The concepts of environmental chemistry introduced in the first part of the course will help in understanding how pollutants behave once emitted in the environment, and how a different climate may influence their fate and transport.

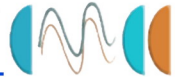
Furthermore, in order to provide the student a complete frame of contaminants' management, the last part of the course will consist on the introduction of a method to assess risks related to exposure to chemicals (Environmental Risk Assessment).

### **Prerequisites**

Basic knowledge of general and environmental chemistry.

### **Readings**

References underlined in the program of lectures below will be discussed at the lectures and thus students are required to read them in advance.



## Grading

- Participation* 20% Students are expected to play an active role in seminars and prepare the required readings in advance.
- Preparation of a short paper* 50% Each student will be required to present a paper (max 20.000 characters, spaces included) on a particular issue **approved in advance by the instructor**. The **oral presentation** of the chosen topic will be scheduled by the instructor. Each individual oral presentation shall last 15 minutes and will be followed by discussion with other students and the instructor.
- Final exam* 30% Each student will be required to present the above paper. The oral presentation of the student work will be scheduled at the end of the course. Each individual oral presentation shall last 15 minutes and will be followed by discussion with other students and the instructor.

## Policies and procedures

The course may be enriched by the participation of some external lecturers. Attendance is required. Daily preparation is also required. The assignments are set out above in the course syllabus. Academic honesty is an important part of university training. While students may discuss assignments with their classmates and others, they are expected to make sure any written material they submit is their own work. Students are expected to know how to cite the work of others and present a bibliography of the research texts that were used.

## Office location

Prof. Marcomini' s office is located at the Department of Environmental Sciences, Computing and Statistics, Calle Larga S. Marta 2137, Venezia.



<b>Climate Change and Environmental Contamination</b>		
<i>Lectures</i>		<i>Time</i>
<b>no. 1</b>	<b><i>Key concepts of environmental chemistry.</i></b> Basic concepts of chemistry. The periodic table. Electronegativity. Intermolecular forces. Properties of liquids and solids. Concept of chemical equilibrium. Kinetics and reactions.  Selected chapters from Schwarzenbach et al., 2003. Environmental Organic Chemistry, Wiley & Sons, Hoboken, New Jersey. Manahan SE, Environmental Chemistry, 1996. 7 <sup>th</sup> Edition, Lewis Ed.	5 h
<b>no. 2</b>	<b><i>The climate system</i></b> Introduction to the climate system. Concepts of weather and climate, climate variables. Components of the global climate systems, processes and interactions. Effect of change. Natural variability of climate. Climate observations.  Sources: TAR and AR4. Earth's climate - past and future. Ruddiman. ediz.:Freeman, 2 <sup>nd</sup> Edition.	2 h
<b>no. 3</b>	<b><i>The Earth' s greenhouse effect</i></b> Warming and cooling factors. Natural and anthropogenic greenhouse effect; natural and anthropogenic variability of climate. Concept of radiative forcing. Vibrational levels of greenhouse gases.  Sources: TAR and AR4. Earth's climate - past and future. Ruddiman. ediz.:Freeman, 2 <sup>nd</sup> Edition.	2 h
<b>no. 4</b>	<b><i>The water cycle.</i></b> Overview on the water cycle. Runoff, transpiration, evaporation, condensation and precipitation. Climate change impacts on the water cycle. Eutrophication.  Sources: Earth's climate - past and future. Ruddiman. ediz.:Freeman, 2 <sup>nd</sup> Edition.	2 h
<b>no. 5</b>	<b><i>Environmental pollution.</i></b> Atmospheric pollution. Water pollution. A global perspective on pollution.	3 h



Sources:

Rachel Carson, 1962. Silent Spring. Houghton Mifflin Company Boston.

Wania F, Mackay DE, 1996. Tracking the distribution of persistent organic pollutants. Environmental Science and Technology 1996, 30: 390A- 396A.

Selected chapters from Schwarzenbach et al., 2003. Environmental Organic Chemistry, Wiley & Sons, Hoboken, New Jersey.

no. 6

***Climate change impacts on pollution.***

2 h

Students are required to make a review on the climate-change effect on environmental pollution. These will be discussed during the lecture.

Sources:

Dalla Valle, M.; Marcomini, A.; Codato, E. Climate change influence on POPs distribution and fate: A case study. Chemosphere 2007, 67, 1287–1295.

L. Lamon, H. von Waldow, M. MacLeod, M. Scheringer, A. Marcomini, K. Hungerbühler, Modeling the global levels and distribution of polychlorinated biphenyls in air under a climate change scenario. Environmental Science & Technology Aug 2009, vol. 43, pp. 5818-5824.

Bytnerowicz, A., Omasa, K., Paoletti, E., 2007. Integrated effects of air pollution and climate change on forests: A northern hemisphere perspective. Environmental Pollution 147, 438-445.

Papers collected by the students.

no. 7

***Climate change influence on pollutants' environmental distribution and fate.***

2 h

Applications of environmental chemistry and thermodynamics' principles aimed at understanding how climate change influences chemicals' environmental behaviour. Case studies.

Sources: \_

Rosenfeld D., Lohman U., et a., 2008. Flood or Drought: How Do Aerosols Affect Precipitation? Science, 321, 1309-1313.



Dalla Valle, M.; Marcomini, A.; Codato, E. Climate change influence on POPs distribution and fate: A case study. *Chemosphere* 2007, 67, 1287–1295.

L. Lamon, H. von Waldow, M. MacLeod, M. Scheringer, A. Marcomini, K. Hungerbühler, Modeling the global levels and distribution of polychlorinated biphenyls in air under a climate change scenario. *Environmental Science & Technology* Aug 2009, vol. 43, pp. 5818-5824.

<b>no. 8</b>	<b><i>Climate change effect on risks posed by chemicals.</i></b>	<b>2 h</b>
	Introduction to environmental risk assessment (definitions). Application of risk assessment. Risk assessment in technical legislation. Human health risk assessment phases.	
	McKone, T.E.; Daniels, J.I.; Goldman, M. Uncertainties in the link between global climate change and predicted health risks from pollution: Hexachlorobenzene (HCB) case study using a fugacity model. <i>Risk Analysis</i> 1996, 16, 377– 393.	
<b>no. 9</b>	<b><i>Presentation of student work</i></b>	<b>4 h</b>
	Power Point presentations (15' ) plus discussion (10' ).	