



# NATIONAL UNIVERSITY OF ENGINEERING

## COLLEGE OF ENVIRONMENTAL ENGINEERING

### HYGIENE AND INDUSTRIAL SAFETY ENGINEERING PROGRAM

---

## HO210 – EVALUATION AND CONTROL OF CHEMICAL AGENTS

### I. GENERAL INFORMATION

<b>CODE</b>	: HO210 – Evaluation and Control of Chemical Agents
<b>SEMESTER</b>	: 6
<b>CREDITS</b>	: 04
<b>HOURS PER WEEK</b>	: 06 (Theory – Practice – Laboratory)
<b>PREREQUISITES</b>	: Industrial Hygiene
<b>CONDITION</b>	: Mandatory

### II. COURSE DESCRIPTION

The course prepares the student in the application of the concepts, methods and techniques for the evaluation and control of chemical agents. The chemical agents in the working environment. Classification of chemical agents. Industrial exhibition. Risk assessment. The permissible limits. Adjustment of permissible limits. Strategy of sampling and measurement of chemical agents. Environmental and occupational monitoring teams. Principle of operation, calibration of sampling systems and equipment. Methods of control of chemical agents. The control of the dispersion of pollutants. The personal protection.

### III. COURSE OUTCOMES

At the end of the course the student will:

- Recognize and evaluate chemical agents from different industrial areas or other areas of work.
- Define the strategy of sampling and measuring chemical agents.
- Measure and determine concentrations of chemical agents present in the workplace. Analyze and interpret the results according to their sample distribution.
- Train in instruments handling for gravimetric analysis of occupational samples and in the instruments handling to capture air samples containing chemical agents and in the handling of instruments of measurement in real time. It includes calibration, operation in progress and conservation of the instruments.
- Propose methods of control of chemical agents based on the hierarchy of controls in aspects of safety and industrial hygiene.
- Prepare clear technical reports detailing the process developed, interpreting results and formulating conclusions and recommendations.

#### **IV. LEARNING UNITS**

##### **1. IDENTIFICATION OF CHEMICAL AGENTS**

Basic concepts of chemical agents / Current standards / Maximum permissible limits / Limits adjustment.

##### **2. PARTICULATE MATERIAL**

Powder physics / Classification of dust / Exposure.

##### **3. GASES AND VAPORS**

Dynamics of gases and vapors. Evaluation of gases and vapors. Instrumentation. Measurement of the environmental concentration of chemical gaseous pollutants with colorimetric tubes, with portable sampling pump and passive monitors.

##### **4. SAMPLING AND MEASUREMENT STRATEGY**

Definitions. Definition of the GES (Group of Similar Exposure). Type of samples. Determination of the sampling time. Statistical studies on work environment sampling.

##### **5. MONITORING TECHNIQUES**

Review and study of the analytical manuals of the NIOSH. INSHT guides.

##### **6. STUDY OF CONTROL ALTERNATIVES FOR CHEMICAL AGENTS**

Definitions. Hierarchy of controls. STOP model. Study of cases. NTP897, NTP872 National Institute for Work Safety and Hygiene.

#### **V. LABORATORIES AND PRACTICAL EXPERIENCES**

- Laboratory 1: Recognition of industrial hygiene equipment.
- Laboratory 2: Calibration of sampling train to capture breathable dust and filter recognition and particle counting.
- Laboratory 3: Gravimetric analysis and particle counting.
- Laboratory 4: Statistical processing of results of the calibration of a sampling train.
- Laboratory 5: Detection of gases with active equipment in real time and passive reference instruments.
- Laboratory 6: Calibration of gas detectors type active pumps.
- Laboratory 7: Thermo-hygrometer and thermo-anemometer management.
- Laboratory 8: Determination of relative humidity using the results of wet bulb and dry bulb thermometer.
- Research Project in relation to evaluation and control of chemical agents.

#### **VI. METHODOLOGY**

The course is developed in theory sessions and laboratory practices. In the theory sessions, the teacher presents the concepts and in the practical-laboratory sessions, their integral understanding is sought with the use of the corresponding instrumentation. The use of the Log Norm 2 statistical software is included in the laboratory sessions for the processing of results.

At the end of the course the student must present and present a work or applied research project of some of the topics that have been addressed in the course. In all the sessions, the active participation of the student is promoted.

## VII. EVALUATION FORMULA

The learning will be evaluated through the "C" system.

- Partial Exam: Weight 1
- Final Exam: Weight 2
- Practices Average: Weight 1.

Calculation of the Final Average:

$$FA = \frac{PE + 2 * FE + PA}{4}$$

PE: Partial Exam; FE: Final Exam, PA: Practices Average

For the Practices Average, during the semester eight qualified practices and one project (PI) are graded, two practice with lowest grades are eliminated and the average is calculated with the remaining six practices and twice the grade of the project.

$$PA = \frac{P1 + P2 + P3 + P4 + P5 + P6 + 2 * PI}{8}$$

## VIII. BIBLIOGRAPHY

- Chilean Public Health Institute. Basic Manual about measurements and taking of environmental and biological samples in Occupational Health. Transcription of the text: Mr. Ana María Fuentealba S.II. (I.S.P.)
- General catalog of official publications: <http://publicacionesoficiales.boe.es> Catalog of INSHT publications: <http://www.insht.es/catalogpublicaciones>