COURSE DESCRIPTION CARD - SYLLABUS

Course name
Risk analysis in the chemical industry [S2TCh2E-KiN>ARwPC]

Course

Field of study
Chemical Technology

Year/Semester
1/2

Area of study (specialization)
Composites and Nanomaterials

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

1,00

Coordinators

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Lecturers

Prerequisites

Student knows: • basics of algebra and probability theory, • basic laws of heat, mass and momentum transfers, • basic chemical reaction engineering, • legal basis for process safety according to Polish and the European Union laws, • basic hazards that may arise from the use of chemical substances in industrial processes, • principles of conducting analyzes: HAZOP, FTA and ETA. Student possesses the following skills of: • reading and understanding of process flow diagrams (PFD) and simple piping and instrumentation diagrams (P&ID), • identification of the main steps of risk analysis of chemical processes, • basic risk management by identification of the main steps in the risk assessment of chemical processes.

Course objective

The main goal of the course is to broaden the student's knowledge of the safe use of apparatus and industrial fittings through the identification and analysis of industrial risk with assistance of qualitative, semi-quantitative and quantitative methods in determination of: • the quantitative threat of environmental contamination with chemical substances, • fire hazards, • explosion hazards. A particularly important aspect of the course is the description of the dispersion of chemicals released from an industrial installation. In addition, the student is acquainted with the analysis of the causes and effects of accidents encountered in the chemical, petrochemical and food industries.

Course-related learning outcomes

Knowledge:
1. Student knows the principles of semi-quantitative and quantitative interpretation in HAZOP, FTA and ETA analyzes. [K_W12]
2. Student knows the rules of CEI and F&EI analysis. [K_W12]
3. Student knows mathematical models describing the basic types of releases of chemical substances from industrial processes. [K_W12, K_W13]
4. Student knows the rules for determining explosion hazard zones. [K_W12]
5. Student knows the basic and specific aspects of occupational health and safety in the broadly understood chemical industry. [K_W12]

Skills:
1. Student knows how to identify hazards, analyse them in quantitative manner and is able to manage risks related to the chemical and other industries at a basic level. [K_U01]
2. Student is able to apply HAZOP, FTA and ETA analyzes for quantitative or semi-quantitative interpretation. [K_U15, K_U19]
3. Student is able to take into account the results of CEI and F&EI index analyses in order to arrange the plant. [K_U11, K_U15]
4. Student is able to make basic calculations related to the release of substances. [K_U15]

Social competences:
1. Student is aware and understand the social aspects of the practical application of acquired knowledge and skills in the field of process safety and related with it responsibility. [K_K07]
2. Student is aware of the advantages and limitations of individual and group work in solving interdisciplinary problems in industry. Student is aware of the responsibility of jointly implemented tasks as part of teamwork. [K_K05]
3. Student is aware of the professionalism and compliance with the principles of professional ethics in relation to the storage and processing of chemical substances and hazardous events. [K_K02]
4. Student knows the limitations of her/his own knowledge and understands the need for continuous education, with particular emphasis on ongoing analysis of industrial accidents. [K_K04]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge and skills acquired during the course are verified by the prepared report on the selected aspects of process safety analysis for the sample part of the process installation. The report is going to be made in a group of several people.

Programme content

Issues in the field of the safe use of apparatus and industrial fittings through the identification and analysis of industrial risk with assistance of qualitative, semi-quantitative and quantitative methods.

Course topics

During the course the following issues are discussed:
• the possibility of quantitative and semi-quantitative interpretation of risk assessment methods in industry such as: HAZOP, FTA and ETA.
• principles of analyzes with use of indicators proposed by Dow Chemicals: chemical exposure index (CEI) and fire and explosion index (F&EI).
• mathematical models describing the basic types of releases of chemical substances from industrial processes, e.g. liquid outflow through an opening, liquid outflow through an opening in a tank, liquid flow through a pipeline, gas outflow through an opening, gas flow through a pipeline, pool evaporation and boiling of the leaked liquid.
• basic models describing the dispersion of substances.
• analyzes of selected accidents and failures in the chemical and petrochemical industries.

Teaching methods

Multimedia presentation, materials shared in the university's e-Learning system.

Bibliography

Basic:
1. Markowski Adam S., Bezpieczeństwo procesów przemysłowych, 2017, Wydawnictwo Politechniki Łódzkiej, ISBN: 978-83-7283-805-6
2. Mitkowski P.T., Analiza ryzyka w przemyśle chemicznym, 2012, Wydawnictwo Politechniki Poznańskiej, ISBN: 978-83-7775-202-9.

Additional:
1. Crowl D. A., Louvar J. F., Chemical Process Safety. Fundamentals with Applications, Pearson Education INC, 2011.
2. Atherton J., Gil F., Hoboken, N.J,. Incidents that define process safety, Center for Chemical Process Safety, Wiley, 2008.
3. Guidelines for Process Safety Fundamentals in General Plant Operations, Center for Chemical Process Safety of the American Institute of Chemical Engineers, Nowy Jork, 1995 (dostęp elektroniczny przez www.library.put.poznan.pl).
4. Sanders R. E., Chemical Process Safety - Learning from Case Histories (3rd Edition), Elsevier, 2005 (dostęp elektroniczny przez www.library.put.poznan.pl).

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,00
Classes requiring direct contact with the teacher	15	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	10	0,50