

KE2351 Risk Analysis and Management for Chemical Engineers

7.5 credits

Course PM HT 2020

I. Course responsible and examiner

Klas Engvall, phone: 08-790 8995, e-mail: kengvall@kth.se

II. Introduction

The course deals with risk analysis and management in relation to handling chemicals as well as work situations in industrial processes. The following is included:

- Chemical hazards
 - Flammability
 - Stability/explosivity
 - Toxicity and health risk assessment
 - Environmental risks, persistence, bioaccumulation
 - Dangerous reactions
- Hazards in process industry
- Hazards in handling chemicals in laboratory environment
- Risk analysis and management theory
 - The process
 - Risk analysis (e.g. what-if analysis, HAZOP, Fault Tree Analysis, event analysis, etc)
 - Mitigations and follow up
 - Design of safe processes
- Legislation and standards in Sweden, EU and internationally

Training materials in the form of pdf files are available to all students registered for the course through the Form on the KTH student web.

III. Learning objectives

After the successful completion of the course students should:

- have a basic understanding of chemical hazards and of other relevant hazardous situations;
- have a sound understanding of the principles behind chemical risk assessment and management;
- have a basic knowledge and understanding of methodology and tools for risk assessment and management and how these are used (e.g. what-if analysis, HAZOP analysis, fault tree analysis);
- be able to describe how the risk assessment and mitigation process is adapted to specific situations (e.g. chemical laboratory, process industry, local and global environment);
- have a basic understanding of environmental and human health risk assessment;
- have an overview of major regulatory frameworks in Sweden and Europe;

- appreciate that risk assessment and management is not the end of the story but is followed and accompanied by risk mitigation and cost-benefit analyses.

IV. Course main content

In order to achieve the learning objectives, the course is divided into four blocks.

- Block A: Legislation and standards
- Block B: Chemical hazards and hazards in process industry
- Block C: Risk analysis and management theory
- Block D: Risk assessment project

V. Examination and requirements for final grade

PRO1 - Project assignment, 2 credits, grade scale: P, F

TEN1 - Written examination, 4.5 credits, grade scale: A, B, C, D, E, FX, F

***NOTE:** Exercises are not compulsory but if approved, extra points will be credited on the examination.*

INL1 – Assignment, 0.5 credits, grade credit: P, F

SEM1 - Assignment, 0.5 credits, grade credit: P, F

***NOTE** Mandatory registration for exams via My Pages on the Web 15 days before the exam. Exam registration is for us to be able to plan the need for facilities and invigilators. Therefore, do not forget to unsubscribe through My Account if you change your mind.*

VI. Course literature

- Handouts
- Notes from lectures and lessons
- Links to documents
- Chemical Risk Analysis: A Practical Handbook, Bernad Martel (Supplementary reading)

VII. Teachers

Course responsible, lecturer	Klas Engvall (KTH)	kengvall@kth.se	KE
Lecturer	Inger Odnevall Walinder (KTH)	ingero@kth.se	IOW
Lecturer	Charlotte Nilsson (RISE)	charlotte.nilsson@ri.se	CN
Lecturer	Christian Bernlind (RISE)	christian.bernlind@ri.se	CB
Lecturer	Erika Tönnerfors (RISE)	erika.tonnerfors@ri.se	ET
Lecturer	Efthymios Kantarelis (KTH)	ekan@kth.se	EK
Project assistant	Saiman Ding	saiman@kth.se	SD

Course schedule

L: Lecture

E: Exercise/Lesson

Week 44, 2020			Block	Place	Teacher	Comment
Mon	26 Oct	10:00-12:00	L	F2	KE	<ul style="list-style-type: none"> • Introduction to course • Accidents and failures: Introduction • Introduction projects
Wed	28 Oct	10:00-12:00	E	M2	KE	"Bhopal disaster"
Fri	30 Oct	15:00-17:00	L	Online	KE	Accidents and failures: Human and organizational behaviour!

Week 45, 2020			Block	Place	Teacher	Comment
Mon	02 Nov	10:00-12:00	L and E	Online	IOW	Regulations
Wed	04 Nov	10:00-12:00	L	Online	KE	Risk management – an overview
Thu	05 Nov	10:00-12:00	L	Online	KE	Risk analysis and assessment methodology – PHA - Preliminary Hazard Analysis, "What-If", FTA - Fault Tree Analysis, ETA - Event Tree Analysis and
Fri	06 Nov	15:00-17:00	L	Online	CB	Theoretical and practical assessment of stability, explosivity, and flammability for chemical processes

Week 46, 2020			Block	Place	Teacher	Comment
Mon	09 Nov	10:00-12:00	E	D1	CB	Theoretical and practical assessment of stability, explosivity, and flammability for chemical processes
Wed	11 Nov	10:00-12:00	L	Online	KE	Risk analysis and assessment methodology – Bow tie analysis, "HAZOP"
Fri	13 nov	15:00-17:00	E	D1	KE	Exercise – PHA, "What-If", Risk rating

Week 47, 2020			Block	Place	Teacher	Comment
Mon	16 Nov	10:00-12:00	L	Online	CB	Theoretical and practical assessment of stability, explosivity, and flammability for chemical processes
Wed	18 Nov	10:00-12:00	E	B2	CB	Theoretical and practical assessment of stability, explosivity, and flammability for chemical processes
Fri	20 Nov	15:00-17:00	L	Online	CN	Toxicology and health risk assessment

Week 48, 2020			Block	Place	Teacher	Comment
Mon	23 Nov	10:00-12:00	L	Online	CN	Toxicology and health risk assessment
Wed	25 Nov	10:00-12:00	E	B2	KE	Exercise – “HAZOP”
Fri	27 Nov	15:00-17:00	L	Online		Fall-back

Week 49, 2020			Block	Place	Teacher	Comment
Mon	30 Nov	10:00-12:00	L	Online	EF	Thermal safety in process design: Fires, explosions and their calculation
Wed	02 Dec	10:00-12:00	E	B2	EF	Thermal safety in process design: Fires, explosions and their calculation

Week 50, 2020			Block	Place	Teacher	Comment
Mon	07 Dec	10:00-12:00	L	D1	EF	Thermal safety in process design: Fires, explosions and their calculation
Wed	09 Dec	10:00-12:00	L	Online	KE	Summing up
Fri	11 Dec	13:00-17:00	L	K1	KE	Presentation projects

Week 3, 2021			Block	Place	Teacher	Comment
Mon	11 Jan	14:00-18:00	TEN	K51		Written examination