



Process safety



Geert Boogaerts
Senior Advisor Process Safety and
Occupational Health



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Initiatives by essencia

(1) Process Safety Engineering Chair

(2) Athens Course

(3) Delta Process Academy

(4) Advanced course in process safety



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Delta Process Academy

Advanced Course in Process Safety

Athens course

Master in Safety Engineering
(Process Safety Engineering Chair)



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Process Safety Engineering Chair

UNIVERSITY – INDUSTRY COLLABORATION: SAFETY ENGINEERING EDUCATION AT KU LEUVEN

J. Degreve¹, J. Berghmans¹, G. Boogaerts²

¹ KU Leuven (BELGIUM)

² essencia (BELGIUM)

jan.degreve@cit.kuleuven.be, jan.berghmans@mech.kuleuven.be, gboogaerts@essencia.be

Abstract

In collaboration with Essencia, a multi-sector umbrella organisation that represents the numerous sectors in the field of chemicals and the life sciences, KU Leuven (Katholieke Universiteit Leuven, Belgium) adapted and expanded its safety study program to train safety experts at the university level. This program leads to the degree of master in safety engineering.



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Process Safety Engineering Chair

The program is directed towards students who already have a master degree in engineering or in the exact sciences. It consists of two parts, Prevention and Process Safety, which have a number of courses in common. The common courses introduce safety as a science. They cover subjects such as safety of industrial installations, building safety and fire and explosion safety, safety aspects of chemical and biological products and processes, qualitative risk analysis and safety management. The option Prevention of the program trains students to become general safety experts to be active in industry, government or general safety services (consulting...).

The option Process Safety aims at the training of technical safety experts in the field of industrial processes. The whole program requires one year of full time study. The large majority of the courses are taught by professionals active in the field of safety. Visits to e.g. industrial plants or laboratories are part of the program. In addition a large number of seminars given by experts in the field are planned illustrating the application of the various course topics.

Keywords: Safety, education, industry.



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

KU LEUVEN

Common Compulsory courses in English

KU LEUVEN

Option Process Safety

Compulsory part in English
Electives in English

Option Prevention

Compulsory part in Dutch
Electives in English

Master Thesis



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Common Compulsory courses in English

- Introduction to Safety engineering: General Introduction to Safety Engineering
- Prevention Policy and Safety Management Systems
- Safety of Chemical and Biological Products and Chemical Processes
- Safety Aspects of Industrial Installations
- Qualitative Risk Analysis Techniques
- Fire Protection and Building Safety
- Explosion Safety



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Option Process Safety: Compulsory

- Quantitative Risk Analysis Techniques
- Statistics for Safety Engineers
- Process Control and Safety of Digital Systems
- Selected topics: Safety in Unit Operations
- Selected topics: Competence in Operations



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Option Prevention (Dutch): Compulsory

- Specific courses needed in Belgium defined by Law.
- Workers participation
- Health and Safety issues
- Medical implications



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Option Process Safety (English): Electives

- Materials Selection
- Degradation and Corrosion
- Reliability and Safety of Nuclear Power plants
- Advanced Process Control in the (bio) Chemical Industry



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Option Prevention (English/Dutch): Electives

- Quantitative Risk Analysis Techniques
- Statistics for Safety Engineers
- Process Control and Safety of Digital Systems
- Environmental Safety Management



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Athens Course

Athens is a programme of scientific and cultural exchanges proposed twice a year (in March and November) to students of the schools and Universities making up the network of the same name.

Set up in 1996, the ATHENS network (Advanced Technology Higher Education Network/Socrates) consists of ParisTech and 14 European Universities. Each year, 5000 students take part in the exchanges, and about 2100 of them go on a session in another country of the network.

This programme consists of a 1-week course module to be picked from all those offered by the partners, as well as a programme of cultural activities by the host University. The programme is coordinated by Paris Tech.

At the termination of an ATHENS Session, the Home Institution officially recognises the work carried out, according to the results obtained on an examination organised by the Host Institution and evaluated according to its proper system of grading. Each complete Session is generally worth 2 to 3 ECTS credits. The number of credits given depends on the home University.

Mission impossible: a cruise through safety engineering?



essenscia

where chemistry meets life sciences

Process safety and sustainability reporting

Athens Course

Objectives:

Safety - in its many different aspects - is very important for the successful operation of industrial processes. However, many engineering graduates are confronted for the first time with the importance of safety issues when they start to work as a professional, since in many educational engineering programmes the subject is either not presented at all, or taught only minimally.

This short course on safety engineering - a "cruise" through some of the important subfields - should give engineering students some insights into why things (can) go wrong and what can be done about it.



essenscia

where chemistry meets life sciences

Process safety and sustainability reporting

Athens Course

Programme to be followed:

The first 4 lecture days (Day 1-4) will be structured as follows: 3 hours morning session + 2 hours afternoon session.

1. **Day 1** - General introduction to safety engineering, incidents and major accidents in the process industries and their consequences (J. Van Peteghem, P. Smedts) - Prevention policy and safety management systems (J. Van Peteghem, P. Smedts)
2. **Day 2** - Chemical and biological product safety (K. Bernaerts, T. Cattoor) - Process safety engineering (G. Vercruysse, P. Smedts)
3. **Day 3** - Explosion prevention and protection (F. Verplaetsen, F. Van den Schoor)
4. **Day 4** - Overview of qualitative and quantitative risk analysis techniques (G. Boogaerts, F. Van den Schoor) The last Day 5 will be devoted to laboratory demonstration (afternoon session, 2.5 hours)
5. **Day 5** - Demonstration of explosion safety, and of product safety at the Laboratory for Industrial Safety (LIV). Flame propagation, light and heavy gases, liquid flash point, dust explosion. (Labo Industriële Veiligheid, F. Verplaetsen and F. Van den Schoor)





Process safety and sustainability reporting

essencia
where chemistry meets life sciences

Delta Process Academy



Delta
Process
Academy

SAMEN VOOR VEILIGHEID EN MILIEU

Our mission:

To help reinforce the Health, Safety and Environmental Performance of the DPA-companies and thereby improve the reliability and reputation of the Flemisch Process industry as viewed by our employees, the authorities, media and the public.

We shall achieve this by:

sharing, collecting and improving the Health, Safety and Environmental knowledge amongst our members organizing workshops focussing on specific elements of HSE developing a common platform to share our lessons learned.



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Delta Process Academy

Topics:

Process safety and operators

Electricity and process safety

Inspection of safety devices

Ageing and Corrosion

How we can learn from incidents?

Transport

Incidents



Delta
Process
Academy

SAMEN VOOR VEILIGHEID EN MILIEU



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Delta Process Academy



Delta
Process
Academy

SAMEN VOOR VEILIGHEID EN MILIEU

Organization and Management

Daily Coördination

essencia expert

Sound board group:

Two times a year

8 experts with a strong background in process safety

Board of Directors: Once a year

Strategy

Management review

Members

80 members

Target audience

Depends on topic

Lots of variation



Responsible
OUR COMMITMENT TO SUSTAINABILITY

Process safety and sustainability reporting



essencia
where chemistry meets life sciences

Delta Process Academy



Delta
Process
Academy

SAMEN VOOR VEILIGHEID EN MILIEU

Every Year Ends with an Academic Session

Academic Session Delta Process Academy: The Future of Process Safety?

Mr. Geert Boogaerts, Coordinator of Delta Process Academy

Prof. Dr. Ir. Jan Van Impe, Holder of essencia Chair, Safety Engineering KU Leuven, Leuven

The academic vision on process safety

Dr. Herman Van Roost, Business Development Manager for the Middle East and North Africa at Total Refining & Chemicals, Brussels

Process Safety and Human Factors: Is there a paradigm?

Prof. Dr. Ir. Hans Pasman, Mary Kay O' Connor Process Safety Center, Texas A&M University, USA, The Netherlands

Process Safety and the Research Agenda



Responsible Care®

Closing remarks by Mr. Frans Dieryck, Managing Director essencia Flanders, Brussels



essenscia

where chemistry meets life sciences

Process safety and sustainability reporting

Delta Process Academy

Integration with Process Safety Engineering Chair

Safety in Unit Operations (46h)

At the end of this course, the student is able to:

- (1) analyze and execute a process hazardous analysis of a basic unit operation such as a reactor, distillation column and storage tank;
- (2) demonstrate a Process Hazard Analysis (PHA) methodology for other, similar, units used in the process industry;
- (3) explain the protective systems used in a PHA.

As introduction the two most important process units within the chemical industry: chemical reactors and distillation columns, are presented. The course will further focus on the basic process and safety features that are generally installed within the process industry. Special attention will be spent on process intensification and handling of chemicals in storage tanks (loading, unloading and hold up in general). The different elements of a process safety review are being studied in detail.



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Delta Process Academy

Integration with Process Safety Engineering Chair

Competence in Unit Operations (40h)

At the end of this course, the student is able to:

- (1) implement protective systems and review the impact on normal operators;
- (2) set up training program for operators to explain origin and functionality of the protective systems;
- (3) to determine if specific tools such as alarm management or risk based inspection would be helpful
- (4) for the process safety concept of a manufacturing plant;
- (5) explain the norms and guidelines for installing protective systems.

This course is dealing with the norms and guidelines for designing, maintaining and implementing the process safety protective systems that were defined during the risk assessment of an industrial process. Special attention will be spent on training of process operators and maintenance workers. Additionally the handling of non-operational situations such as project & shutdown activities are explained during the lectures. Several industrial experts will cover actual themes with regard to process safety: alarm management, risk based inspection, contractor management, etc.



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Advanced Course in Process Safety

Programme

Process safety is a specific discipline within the organization of a company. The level and quality of process safety management determines the success of the organization. Delta Process Academy aims, with this 4-day programme 'Advanced Master Class on Process Safety', to provide professionals with a process safety course offering the essentials and pointing out the pitfalls of process safety. The courses are taught by academics and specialists in their discipline.

Advanced Master Class on Process Safety: 28th – 31st of January 2013: 8h00 - 17h00



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Advanced Course in Process Safety

Programme

Day 1: Introduction to process safety

Welcome speech: Ir. Patrick Van Acker, Plant Manager BP, Geel and President of essencia Flanders.
Still a need?

Introduction to process safety Incidents & Legislation that defines process safety: Mr. Geert Boogaerts, Senior Advisor Process Safety & Occupational Health, essencia, Brussels
Are things improving?

Process Safety Management Systems: Dr. Pol Hoorelbeke, Total Refining and Chemicals, Brussels, Visiting professor at the South China University of Technology
An integrated safety management system

The competent authority: Ir. Peter Vansina, Department for the supervision of chemical risks, Federal Public Service Employment, Labour and Social Dialogue, Brussels
The inspection of Belgian Seveso sites

Product Safety: Prof. Dr. Ir. Kristel Bernaerts, KU Leuven, Leuven
Do we understand the intrinsic hazards?



Responsible Care®
OUR COMMITMENT TO SUSTAINABILITY



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Advanced Course in Process Safety

Programme

Day 2: Qualitative and quantitative risk analysis

HAZOP: Ms. Grainne Kelly, Clwyd Associate, Leicestershire
Use and pitfalls of HAZOP

LOPA: Ir. Nico Hertoghe, ExxonMobil, Antwerp
Use and pitfalls of LOPA

QRA sub selection: Mr. Bob Gorrens, SGS Belgium, Antwerp
Towards a dynamic instrument in safety reporting?

QRA modelling: Mr. Peter Wittevrongel, Vinçotte, Brussel
What are we modelling?



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Advanced Course in Process Safety

Programme

Day 3: Explosion safety

(Gas) Explosion Characteristics: Dr. Ir. F. Van den Schoor, M-tech, Hasselt.

Essential elements in risk assessment

Dust Explosion Characteristics and Ignition Sources: Dr. Ir. F. Verplaetsen, Adinex, Herentals, visiting professor KU Leuven and Ghent University.

Essential for prevention

Vapour Cloud Explosion and Explosion Modelling: Dr. Ir. F. Van den Schoor, M-tech, Hasselt

The number one cause?

Explosion Prevention and Protection – ATEX directives: Dr. Ir. F. Verplaetsen, Adinex, Herentals, visiting professor KU Leuven and Ghent University.

What is emphasized by the legislation?



essenscia

where chemistry meets life sciences

Process safety and sustainability reporting

Advanced Course in Process Safety

Programme

Day 4: Competence in operation & safety in unit operations

Introduction to process safety engineering: Ir. Geert Vercruysse, BASF Antwerp
Safety engineering the corner stone of intrinsic safety

SIL: Ir. Eric Dom, Nero Engineering, Antwerp
A reliable device on a known risk.

Risk based inspection: ir. Rik De Bosscher, Llyods, Antwerp
How can efficient inspections be organized?



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Advanced Course in Process Safety

Programme

Academic Session Delta Process Academy: The Future of Process Safety?

18h00: Mr. Geert Boogaerts, Coordinator of Delta Process Academy

18h10: Prof. Dr. Ir. Jan Van Impe, Holder of essencia Chair, Safety Engineering KU Leuven, Leuven
The academic vision on process safety

18h30: Dr. Herman Van Roost, Business Development Manager for the Middle East and North Africa at Total Refining & Chemicals, Brussels
Process Safety and Human Factors: Is there a paradigm?

19h15: Prof. Dr. Ir. Hans Pasman, Mary Kay O' Connor Process Safety Center, Texas A&M University, USA, The Netherlands
Process Safety and the Research Agenda

20h00: Closing remarks by Mr. Frans Dieryck, Managing Director essencia Flanders, Brussels



essenscia

where chemistry meets life sciences

Process safety and sustainability reporting

Conclusions

(1) Hard to find good experts with good teaching skills

(2) Success (pragmatic « science based » approach)

(3) Developments for the future

- Specific training for operators
- Focus on integration management and operators into process safety management
- Continuing in widening the audience (not only for people directly involved in process safety)
- More modular integration of the Master with Delta Process Academy
- Invite & integrate stakeholders
- In house training
- Open for collaboration



essencia

where chemistry meets life sciences

Process safety and sustainability reporting

Geert Boogaerts

Senior Advisor Process Safety and Occupational Health

Diamont Building

Auguste Reyerslaan 80

B-1030 Brussel

gboogaerts@essencia.be

- Co-ordinator Chair Safety engineering essencia – K.U. Leuven
- Co-ordinator Delta Process Academy essencia