

■ **Course title:**

Thermodynamics and Phase Diagrams in Urea Plants

■ **Introduction:**

Understanding thermodynamics and phase diagrams are vital to understanding why a urea plant is designed and why it reacts to disturbances as it does. This course will support managers, engineers, (shift)supervisors and operators to optimize the operating conditions leading to higher safety and reliability and better performance figures of any urea plant.

■ **Course outline:**

Module 1: Thermodynamics (duration 1hr)

1. Main reactions in urea synthesis sections
2. Challenges in urea plants
3. Conversion parameters and its relations with time and temperature
4. Main ratios and parameters to assess the efficiency of urea synthesis sections, including a practical case
5. Influence of water and N/C ratio in conversion
6. Synthesis, inert and system pressure and its impact on conversion figures

Module 2: Phase Diagram (duration 1.5hrs)

1. Binary phase diagrams and azeotropic mixtures
2. Ternary phase diagrams and top ridgelines
3. Isotherms and isobars
4. Applying phase diagrams for the urea reactor
5. Applying phase diagrams for the various types of carbamate condensers
6. Applying phase diagrams for a CO₂ and NH₃ stripper
7. Applying phase diagrams in Falling film, Pool Condenser and ACES21 synthesis sections; what are the optimum process conditions
8. Applying phase diagrams in leak detection systems
9. Applying phase diagrams in evaporation sections

Author / Trainer:

Mark Brouwer



Process & Safety Engineer,
Urea Expert

Mark has over 25 years of licensing, revamping, engineering and consultancy experience in urea projects. He has been visiting more than 100 urea plants located in almost all continents.

Mark has experience in all project phases starting from Concept and Front End Engineering (FEED) through Commissioning and Operation. He is a Master of Chemical Engineering, Post Bachelor in Safety for Engineers, Marketing and Business Strategy Courses at the Rotterdam School of Management and a Member of American Institute of Chemical Engineers (AIChE).

Mark has extensive experience in revamp studies, engineering and process safety consultancy services to EPCM companies and urea plants including the preparation of Revamp and Plant Assessment and Safety Reports, hazard identification and analysis, troubleshooting, risk registers, corrosion inspections, procurement services, training services, etc.

Mark's expertise are Process technology, Corrosion, Licensing, Engineering, Revamping, Marketing, Sales, Contract negotiations, Troubleshooting, Project Management, International business, Safety, high pressure urea valves, high pressure urea equipment.

Mark has provided extensive training programs to more than 1000 urea engineers, managers, (shift)supervisors and operators from all over world.

Mark has published numerous technical papers in reputable industry magazines and presented at numerous CRU Nitrogen & Syngas and AIChE Ammonia Safety Conferences.

■ Learning Outcomes:

By the end of this course, you will understand:

- Convert lab analysis results into understandable process parameters
- Read and understand phase diagrams
- How to maximise the conversion figures in a urea reactor
- How to operate the urea synthesis section in the most optimum way
- The differences between CO₂ and ammonia stripping
- How licensors choose their design parameters and the reasons why

■ Who will benefit:

Anyone who is involved in the design, engineering, operation and optimisation of any kind of urea plant, including:

- Operations
- Shift supervisors
- Engineers
- Managers

■ Course materials:

- Hand Out Presentations in pdf format
- Technical Paper: Thermodynamics in Urea Plants in pdf format
- Technical Paper: Phase Diagrams in Urea Plants in pdf format

■ Price:

€ 350

■ Discounts:

- 2 places – 10% discount
- 3 places – 15% discount
- 4 or more places – 20% discount.

■ In-company training:

This course is also available as an in-company course (face-to-face or online) where content can be customised to meet your organisation's specific needs and delivered on a date/location that suits your requirements.

[Contact us](#) for more information.

■ **Training code:** UREA01