Advanced Fertilizer Production and Ammonia Plant Operations Training Course

02 - 06 Nov 2026

Cape town

4600 € (Per Person)

Ref: #ACE7293_296290

Course Introduction / Overview:

This comprehensive training course provides an in-depth exploration of the technologies and operational principles governing modern fertilizer production and ammonia plants. In a world reliant on efficient agriculture, the synthesis of ammonia via the Haber-Bosch process remains one of the most significant chemical engineering achievements, a topic thoroughly detailed in seminal works like "Ammonia" by Anders Nielsen. This program delves into the entire value chain, from raw material processing and syngas generation to the intricacies of the ammonia synthesis loop and its subsequent conversion into vital fertilizer products like urea and NPK compounds. Participants will gain a robust understanding of process chemistry, equipment design, operational control, and critical safety management systems. BIG BEN Training Center has designed this course to bridge the gap between theoretical knowledge and practical application, equipping professionals with the skills to enhance plant efficiency, ensure operational safety, and address environmental compliance. The curriculum is meticulously structured to cover everything from fundamental principles to advanced troubleshooting and optimization strategies, making it an indispensable resource for anyone involved in the fertilizer manufacturing industry.

Target Audience / This training course is suitable for:

- Chemical Engineers and Process Engineers.
- Plant Operators and Control Room Technicians.
- Production Supervisors and Managers.
- Maintenance Engineers and Technicians.
- Health, Safety, and Environment (HSE) Officers.
- Quality Control and Assurance Personnel.
- Project Engineers involved in plant commissioning and upgrades.
- Technical Sales and Support Staff in the agrochemical sector.

Target Sectors and Industries:

- Agrochemical and Fertilizer Manufacturing.
- Petrochemical and Chemical Processing.
- Industrial Gas Production.
- Heavy Industrial Manufacturing.
- Engineering, Procurement, and Construction (EPC) firms.
- Governmental bodies, including environmental protection and agricultural agencies.
- Consulting firms specializing in process safety and chemical engineering.

Target Organizations Departments:

- Operations and Production.
- Process Engineering and Technology.
- Plant Maintenance and Reliability.
- Health, Safety, and Environment (HSE).
- Quality Control and Laboratory Services.
- Research and Development.
- Project Management and Engineering.
- Supply Chain and Logistics.

Course Offerings:

By the end of this course, the participants will have able to:

- Analyze the complete ammonia production process, from steam methane reforming to the synthesis loop.
- Understand the various technologies for producing urea, ammonium nitrate, and NPK fertilizers.
- Implement effective process control and optimization strategies to improve plant efficiency and yield.
- Identify and manage critical process safety hazards using tools like HAZOP and LOPA.
- Develop robust procedures for plant start-up, shutdown, and emergency response.
- Troubleshoot common operational problems in ammonia and fertilizer plants.
- Evaluate the environmental impact of plant operations and understand emission control technologies.
- Apply best practices for catalyst handling and management to maximize performance and lifespan.

Course Methodology:

The training methodology employed by BIG BEN Training Center is designed to foster a dynamic and interactive learning environment that maximizes knowledge retention and practical skill development. This course moves beyond traditional lectures to incorporate a blended learning approach. Participants will engage with detailed case studies of real-world plant incidents and operational challenges, allowing for in-depth analysis and group discussion on root causes and corrective actions. Interactive sessions, including workshops on reading P&IDs and process flow diagrams, will be a core component. Team-based exercises will encourage collaborative problem-solving, simulating the cooperative environment of a plant control room. The training will be facilitated by experienced industry experts who provide continuous feedback and share practical insights from their careers. Video demonstrations of key processes and equipment will be used to clarify complex concepts. This hands-on, participant-centered approach ensures that attendees not only learn the theoretical principles but also gain the confidence to apply them effectively in their own operational contexts.

Course Agenda (Course Units):

Unit One: Fundamentals of Ammonia and Fertilizer Production

- Introduction to the global fertilizer industry and its importance.
- Chemistry of nitrogen, phosphorus, and potassium (NPK) fertilizers.
- Overview of the Haber-Bosch process for ammonia synthesis.
- Key raw materials: natural gas, air, water, and steam.
- Thermodynamics and kinetics of ammonia production.
- Introduction to process flow diagrams (PFDs) and piping & instrumentation diagrams (P&IDs).
- Basic principles of chemical process safety.

Unit Two: The Ammonia Production Process in Detail

- Natural gas desulfurization and pre-treatment.
- Primary and secondary steam methane reforming (SMR).
- High and low-temperature shift conversion processes.
- CO2 removal systems (e.g., amine scrubbing).
- Methanation for final purification of synthesis gas.
- Syngas compression and the ammonia synthesis loop.
- Catalyst types, selection, and management in the ammonia plant.

Unit Three: Fertilizer Manufacturing Technologies

- Urea synthesis process from ammonia and carbon dioxide.
- Urea production technologies: prilling vs. granulation.
- Nitric acid production and plant design.
- Ammonium nitrate (AN) manufacturing and safety considerations.
- Production of phosphate and potash fertilizers.
- Formulation and manufacturing of complex NPK fertilizers.
- Coating and finishing of fertilizer products for improved quality.

Unit Four: Plant Operations, Control, and Safety

- Distributed Control Systems (DCS) in modern chemical plants.
- Key process variables and their control strategies.
- Standard operating procedures for start-up and shutdown.
- Emergency shutdown (ESD) systems and procedures.
- Process Safety Management (PSM) and its core elements.
- Hazard and Operability (HAZOP) studies and risk assessment.
- Preventive and predictive maintenance strategies for critical equipment.

Unit Five: Efficiency, Environment, and Troubleshooting

- Energy efficiency and heat integration in ammonia plants.
- Environmental regulations and emission control technologies (NOx, CO2).
- Wastewater treatment and management in fertilizer complexes.
- Troubleshooting common problems in reformers, converters, and synthesis loops.
- Addressing quality issues in final fertilizer products.
- Future trends: green ammonia and sustainable fertilizer production.
- Course review, final assessment, and open discussion forum.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

With increasing pressure for decarbonization, how might the traditional Haber-Bosch process evolve to create 'green ammonia', and what operational shifts would this require in existing plants?

What unique qualities does this course offer compared to other courses?

This course distinguishes itself through its holistic and integrated approach, seamlessly blending the distinct yet interconnected disciplines of ammonia synthesis and downstream fertilizer production. Unlike narrowly focused programs, it provides a complete A-to-Z perspective, from the fundamental chemistry of natural gas reforming to the final granulation of NPK products. The curriculum is deeply rooted in practical reality, emphasizing not just the 'how' but the 'why' behind each operational step, a crucial element for effective troubleshooting and optimization. It moves beyond textbook theory by incorporating extensive case studies on process safety incidents and operational bottlenecks, fostering critical thinking and problem-solving skills. Furthermore, the course content is continuously updated to reflect the latest industry challenges and innovations, including modules on energy efficiency, environmental compliance, and emerging trends like green ammonia. This forward-looking perspective ensures that participants leave not only with a mastery of current best practices but also with an understanding of the future trajectory of the fertilizer industry, preparing them to be leaders in a rapidly evolving field.