AIChE Academy
Connect | Learn | Solve

CHEMICAL ENGINEERING TRAINING + EDUCATION

www.aiche.org/academy

2019 COURSE CATALOG

TABLE OF CONTENTS

Chemicals + Materials

Biological Engineering

Sustainability + Environment

Professional Development

Instructor Bios

AIChE Academy
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Welcome to the latest AIChE Academy catalog. Inside, you'll find nearly 100 courses relevant to Chemical Engineers—and the people they work with—from process safety to capital project planning to bioengineering and more. We've added new eLearning courses and public courses, and we've expanded our ability to bring Academy training to your facility or institution.

AIChE Academy makes it possible to find the finest chemical engineering training in one convenient location. Visit the AIChE Academy website to find content to meet your educational needs and professional development goals. The site is fully searchable by format, subject, and keyword.

AIChE Academy Courses are Created and Taught by Experts.

Every course offered by the AIChE Academy has been developed by professionals with acknowledged proficiency in the subject matter. All course content has been reviewed by teams of experts drawn from these professional bodies:

- **AIChE,** the American Institute of Chemical Engineers, is the world's leading professional organization for chemical engineers. AIChE members work at companies across the chemical enterprise and teach at leading universities in more than 110 countries.
- **CCPS,** the Center for Chemical Process Safety, focuses on process safety R&D. The member companies of CCPS work together to develop and implement guidelines and practices that significantly reduce the risk of process safety incidents.
- **SBE,** the Society for Biological Engineering, organizes conferences, operates research consortia and acts to promote emerging technologies that apply chemical engineering knowledge in biological applications.
- **IfS,** the Institute for Sustainability, serves the needs of and influences the efforts of professionals, academes, industries, and governmental bodies that contribute to the advancement of sustainability and sustainable development.

Choose from Online, In-person and Onsite Course Delivery.

AIChE Academy courses are delivered as online eLearning courses or Face-to-Face public courses. Many subjects are available in both formats, and any course from the AIChE Academy can be delivered onsite at your company. Contact us to find out how any AIChE Academy course can be customized to your company's operations! For a consultation, please contact us at **academy@aiche.org**.

Visit the AIChE Academy for Recorded Conference Presentations, Proceedings, Webinar Bundles and Videos.

AIChE Academy offers more than just the best training for chemical engineers and the people they work with—it's also your go-to source for technical information, including live and archived webinars, conference recordings and proceedings, and videos that illustrate key chemical engineering principles.

I encourage you to visit **www.aiche.org/academy** and see all that the AIChE Academy has to offer.

Sincerely,

Anne A. Schaeffer
Director, AIChE Academy

P.S. Many professional engineers use courses from the AIChE Academy to satisfy their continuing education requirements.*

ICON KEY Use these icons to speed your search. Each course is categorized by skill level, delivery mode and other criteria.

Format

eLearning – Delivered online through AIChE Academy. Courses are available at your convenience and are self-paced.

Public – Delivered live and in person at venues around the country (and sometimes across the globe).

Train-a-Team – Every course in the AIChE Academy can be brought onsite to your company. Courses can be tailored to your needs and delivered in your facility by an industry expert. For more information, visit **www.aiche.org/trainateam**.

Other

Approved – Approved by one or more of the following: New York State Board for Engineering and Land Surveying, Registered Continuing Education Program (RCEP), New Jersey Board of Professional Engineers and Land Surveyors and Florida Board of Professional Engineers. See course page online for complete information on approving authorities.

Bestseller – Denotes AIChE Academy's top selling courses.

Multi-lingual – Courses offered in languages other than English

Bios – Where applicable, the course instructor(s) have been noted at the end of each course description. There are bios for each instructor at the back of the catalog on p. 70. For complete instructor bios, please refer to **www.aiche.org/academy**.

*Many of the courses have been approved by these authorities RCEP, New York State Board for Engineering and Land Surveying, New Jersey Board of Professional Engineers and Land Surveyors and the Florida Board of Professional Engineers. Look for courses with the ☑ icon

AIChE Academy's Public Courses are a great way to get in-person training globally. **Secure your spot today.**

2019 PUBLIC COURSE CALENDAR

2019 CALENDAR

April 23 – 24
Flow of Solids in Bins, Hoppers, Chutes and Feeders
Houston, TX

April 23 – 25
Flow of Solids/Pneumatic Conveying Combo Course
Houston, TX

April 23 – 26
Process Safety Boot Camp
New Orleans, LA

April 25
Pneumatic Conveying of Bulk Solids
Houston, TX

May 6 – 8
HAZOP Studies and Other PHA Techniques for Process Safety and Risk Management
Boston, MA

May 6 – 8
DIERS' Basic Emergency Relief Systems
New Orleans, LA

May 6 – 10
HAZOP Studies, Other Hazard Evaluation Procedures and Advanced Concepts for Process Hazard Analysis Combo Course
Boston, MA

May 8 – 9
Crystallization Operations
Houston, TX

May 9 – 10
Advanced Concepts for Process Hazard Analysis
Boston, MA

May 14 – 15
Conceptual Development and Capital Cost Estimating
Houston, TX

May 14 – 17
Project Evaluation: Operating Cost Estimating Combo Course
Houston, TX

May 16 – 17
Project Evaluation: Operating Cost Estimating and Financial Analysis
Houston, TX

June 10 – 13
Process Safety Boot Camp
Houston, TX

June 11 – 12
Project Management for Chemical Engineers
New York, NY

June 11 – 13
Essentials of Chemical Engineering for Non-Chemical Engineers
Philadelphia, PA

July 9 – 10
Flow of Solids in Bins, Hoppers, Chutes and Feeders
Boston, MA

July 9 – 11
Flow of Solids/Pneumatic Conveying Combo Course
Boston, MA

July 11
Pneumatic Conveying of Bulk Solids
Boston, MA

September 10 – 12
Essentials of Chemical Engineering for Non-Chemical Engineers
Houston, TX

September 17 – 20
Process Safety Boot Camp
Boston, MA

September 24 – 26
DIERS' Basic Emergency Relief Systems
Houston, TX

October 14 – 16
HAZOP Studies and Other PHA Techniques for Process Safety and Risk
Seattle, WA

October 14 – 18
HAZOP Studies, Other Hazard Evaluation Procedures and Advanced Concepts for Process Hazard Analysis Combo Course
Seattle, WA

October 15 – 16
Spreadsheet Problem-Solving for Chemical Engineering
Houston, TX

October 15 – 17
Spreadsheet Problem-Solving and VBA Programming Combo Course
Houston, TX

October 17
Excel VBA Programming for Chemical Engineers
Houston, TX

October 17 – 18
Advanced Concepts for Process Hazard Analysis
Seattle, WA

October 21 – 22
Flow of Solids in Bins, Hoppers, Chutes and Feeders
Los Angeles, CA

October 21 – 23
Flow of Solids/Pneumatic Conveying Combo Course
Los Angeles, CA

October 23
Pneumatic Conveying of Bulk Solids
Los Angeles, CA

December 9 – 11
DIERS' Advanced Emerg+B30ency Relief Systems Design
Houston, TX

December 10 – 13
Process Safety Boot Camp
Houston, TX

DECHEMA
Gesellschaft für Chemische Technik und Biotechnologie e.V.

June 12 – 13
DECHEMA/CCPS' Overview of Risk Based Process Safety
Frankfurt am Main, Germany

September 2
DECHEMA/CCPS' HAZOP Studies/ PHA Concepts Combo Course
Frankfurt am Main, Germany

September 30
DECHEMA/CCPS' Senior Leaders and Process Safety: The Role and The Opportunity
Frankfurt am Main, Germany

Register online at aiche.org/academy

AIChE's Basics of the Chemical Industry

www.aiche.org/ela142 | Course ID: ELA142

AIChE Members – $595
AIChE Undergrad/Grad Student Members – $297.50
Non-Members – $895

Gain a high-level view of the manufacture and markets for roughly 70 important products and intermediates, including simplified flow diagrams for 22 of them. This online course makes the connections from raw basic materials to components into the consumer market.

Look at characterizing fossil fuels—oil, gas and coal—and their abundance and markets. Discuss biomass as a chemical feedstock, steam crackers, and chemical derivatives from coal and natural gas, such as methanol, acetic acid and others. Examine derivatives from ethylene, propylene, mixed C4 streams, and aromatics and review other important processes such as ammonia and chlor-alkali.

You Will Learn:

- How fossil fuels and biomass are characterized, and about their markets as feedstocks for the chemical industry
- The importance and general operation of steam crackers (olefins plants)
- Fundamental process chemistry and markets for over 80 intermediates and products, from light olefins to complex polymers
- Process and general market insight for basic processes such as methanol, ammonia, chlor-alkali, and other many others

Who Should Attend:

- Process engineers
- Chemists
- Market managers
- Those new to the chemical industry

Your Instructor:

Gary Sawyer

AIChE's Maintenance and Reliability for Chemical Engineers

www.aiche.org/ela143 | Course ID: ELA143

AIChE Members – $595
AIChE Undergrad/Grad Student Members – $297.50
Non-Members – $895

Equipment performance is vital to meeting safety, productivity, reliability and cost goals. In this course, you'll learn how to save time and money by keeping your equipment processes and operations within operating windows.

This online course will allow you to make a business case for improving maintenance and reliability by reviewing maintenance and reliability principles and practices you can apply to any asset-intensive setting. In eight modules, you'll address how to eliminate reactive work and perform preventive, precision and lubrication maintenance. You'll understand the importance of setting and monitoring operating windows, adopting equipment care strategies and implementing essential maintenance material management practices. This course also covers performance assessment and analytics.

By the end of the course, you'll have knowledge of many maintenance and reliability best practices and will know how to deliver high reliability while fulfilling your organization's productivity and cost goals.

You Will Learn:

- Build a business plan for improving equipment performance, based on maintenance and reliability best practices
- Develop equipment care strategies around preventive, predictive and operator-driven tasks
- Direct chemical engineers to achieve productivity and cost goals through improved equipment performance
- Determine whether the response to equipment care is based mostly on reactive maintenance or proactive tasks prior to equipment failure
- Develop a plan for implementing maintenance and reliability practices
- Apply maintenance material management practices that support effective equipment care strategies

Who Should Attend:

This course is designed for those with responsibility for managing asset performance, including plant, production and maintenance management professionals as well as process, mechanical and chemical engineers. It will be of special interest to those in the discrete manufacturing industries, including consumer and industrial products. It also applies to process manufacturing and to the oil and gas, chemical, food and beverage and pulp and paper industries. Those in supervision and maintenance that manage infrastructure assets—such as buildings, industrial complexes, government and municipal structures—should also attend.

Your Instructor:

David A. Rosenthal

AIChE's Control System Techniques in Equipment Design and Operations

www.aiche.org/ch762 | Course ID: CH762

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

A high level of automation and sophistication is required to control process parameters and detect equipment faults in today's petrochemical plants. Join control system expert A. S. Rangwala and learn automatic control theory methods that enhance efficiency and provide operational safety by ensuring that process parameters do not exceed design capability. Bring a laptop to this course, in which you'll try out the concepts and tools you learn so that you can apply them in your own environment.

You Will Learn:

- Mechanical, thermal, electrical, electronic, pneumatic and fluid control elements
- Feedback mechanisms
- How to identify forced excitation sources
- Valves for overpressure relief
- Flow regulation and proportional control
- Self-tuning and compensation in controller design
- How to alleviate vibration instability

Who Should Attend:

Professionals in:

- Chemical design and development engineering
- Process control
- Purchasing, sales, manufacture, field repair and inspection of chemical process equipment

Your Instructor:

A. S. Rangwala

AIChE's Distillation in Practice

www.aiche.org/ela112 | Course ID: ELA112

AIChE Members – $895
AIChE Undergrad/Grad Student Members – $447.50
Non-Members – $1,195

ALSO AVAILABLE AS CH004

This online course covers essential distillation concepts likely to be faced by process support, operations, and process design engineering personnel. Along with a review of vapor-liquid equilibrium, this course covers process design, column operation and simulation issues. In addition, you will also learn about specification and selection of the appropriate distillation hardware.

You Will Learn:

- Fundamentals: vapor-liquid equilibrium, stages and transfer units
- Practice: general column design, tray column design, packed column design, other devices, and methods for predicting efficiency
- Other topics: scale-up, start-up & troubleshooting, and enhanced distillation

Who Should Attend:

Engineers or other professionals who must troubleshoot and solve difficult distillation problems in the plant or conceptualize difficult distillation problems in the engineering office or laboratory.

Your Instructor:

John Farone

Register online at www.aiche.org/academy

AIChE's Distillation in Practice

www.aiche.org/ch004 | Course ID: CH004

AIChE Members – $1,895
AIChE Undergrad/Grad Student Members – $947.50
Non-Members – $2,195

ALSO AVAILABLE AS ELA112

While the basic principles underlying distillation remain unchanged, new hardware, problem-solving and troubleshooting strategies, and modeling techniques continue to be developed.

Join distillation expert John P. Farone, get up to date on essential distillation concepts and developments, and learn how to apply them to improve process support, operations and design.

In three days, you'll address essential distillation concepts you're likely to face in process support, operations and design engineering. You'll discover how to specify and select the most appropriate distillation hardware. Plus, you'll learn methods for predicting efficiency using some of today's modeling techniques.

You Will Learn:

- Thermodynamics, vapor-liquid equilibrium, and basic chemical engineering principles
- Techniques for solving simulation issues, process design considerations and column operations
- Guidelines for specifying and purchasing the right hardware
- Problem-solving and troubleshooting distillation problems in the real world
- Predicting efficiency using the latest modeling techniques

Who Should Attend:

New and veteran engineers and others who must troubleshoot and solve difficult distillation problems in the plant or conceptualize problems in the engineering office or laboratory—including those in the areas of:

- Process support
- Operations
- Design engineering

Your Instructor:

John Farone

"The course dealt well with practical aspects of distillation. Instructor was very knowledgeable and promoted a great atmosphere."

—AIChE Academy Course Participant

For 2018 Public Course dates and locations, see page 5.

AIChE's Heat Exchanger Design and Operations

www.aiche.org/ch294 | Course ID: CH294

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Heat exchangers are critical to a wide variety of engineering applications–from power plants to chemical processing facilities. When they go down, you feel the negative impact. Join a heat exchanger expert and get up to date on the latest developments and strategies in heat exchanger design and the diagnosis, correction and troubleshooting of costly operating problems.

In two days, you'll examine in detail the design of shell-and-tube exchanger technology–the most common type of heat exchanger in oil refineries and chemical processes–and learn how to minimize fouling and ensure trouble-free operation. You'll learn how to efficiently operate other types of exchangers, including gasketed plate, spiral plate and air-cooled equipment.

You Will Learn:

- The critical aspects of heat exchanger design
- The thermal design of shell-and-tube heaters, coolers, column reboilers and condensers
- How to quickly and accurately troubleshoot, diagnose and correct operating problems

Who Should Attend:

New and experienced chemical and mechanical engineers involved in plant operations, technical services, or project design; or those who handle projects and assignments related to heat exchanger sizing, specification, and operation.

Your Instructor:

Joseph W. Holmes or S. Greg Starks

AIChE's Industrial Fluid Mixing for Engineers

www.aiche.org/ela115 | Course ID: ELA115

AIChE Members – $695
AIChE Undergrad/Grad Student Members – $347.50
Non-Members – $995

This online course covers fundamentals in mixing theory, including a section on scale-up, practical applications to mixing technology and advanced topics such as the solid-liquid process. Engineers gain an excellent understanding of the fundamentals of mixing and learn how to apply the right technology to the mixing process.

This is a chance to broaden your perspective, whether you're a director of engineering and/or research, a process engineer doing research, a mechanical equipment specialist, a technician, a development/design engineer, a chemist or a vendor engineer.

You Will Learn:

- The fundamentals of mixing
- A comparison of the performance characteristics of fluid foil impellers vs. traditionally designed models
- How to apply Laser Doppler Velocimetry (LDV) data and Computational Fluid Dynamics (CFD)
- How to analyze a variety of geometric variables, including: tank shape, impeller spacing and baffles
- How to scale up and scale down by using practical, proven techniques of meeting geometrical similarity

Who Should Attend:

- Process or mechanical engineers involved in the design and/or selection of mixers
- R&D engineers who use mixers which must be scaled to commercial equipment

Your Instructor:

W. Roy Penney

Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: E eLearning | P Public | Train-A-Team | Approved | Best Seller

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TRAIN-A-TEAM

GROUP EDUCATION & TRAINING FOR CHEMICAL ENGINEERS & THOSE THEY WORK WITH.

Your organization's success depends on employees who are trained and up-to-date on what's new and what's changing relevant to their complex and critically important jobs.

Did You Know?

AIChE® Academy brings a full array of education and training resources to chemical engineers and the companies they work for in two group settings:

TRAIN-A-TEAM ON-SITE APPROACH

TRAIN-A-TEAM ONLINE APPROACH

Reach Your Training Goals Today!

aiche.org/trainateam

The Train-a-Team Benefits

Help your employees grow their knowledge base, develop new skill sets and refine their expertise to build strong teams and improve organizational productivity.

- **Savings.** Save on staff travel time and expenses and receive group discounts.
- **Convenience.** Delivery at a site of your choice and at a time that fits your schedule.
- **Profitability.** Improve organizational performance and capability through workforce development.
- **Consistency.** Establish a common skill level and provide standardized training.
- **Effectiveness.** Increase staff skills, competence, and productivity.
- **Credit.** Participants earn CEUs and PDHs, often used to maintain professional licenses.
- **Access.** Critical staff receive training yet remain in-house and accessible.

MINIMIZE COSTS. MAXIMIZE LEARNING.

Email **sales@aiche.org** or visit **aiche.org/trainateam**

AIChE's Integrated Process Synthesis

www.aiche.org/ch756 | Course ID: CH756

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Join process synthesis and integration experts Diane Hildebrandt and Bilal Patel and learn novel design and analysis techniques you can implement early on to avoid costly revisions to processes while reducing material and energy consumption and carbon dioxide emissions.

In three days, you'll discover tools that allow you to gain insight into a process by emphasizing the unity of the process. You'll learn how to apply mass, energy and entropy balances in an entirely new way for the synthesis of flowsheets. You'll examine how to analyze equipment—such as reactors and distillation columns—using mass, energy and entropy balances to identify, measure, and reduce inefficiencies.

You Will Learn:

- Integrated process synthesis—an overview
- Mass balance
- Energy balance
- Defining the work of separation
- Developing flowsheets

Who Should Attend:

Professionals working with production processes in the chemical industries—including:

- Design engineers
- Developers of new processes
- Process chemical engineers
- Chemical engineers who work with laboratory teams

Your Instructors:

Diane Hildebrandt and Bilal Patel

AIChE's Principles & Practices of Chemical Reactor Design & Operations

www.aiche.org/ch522 | Course ID: CH522

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Improve your ability to design unconventional reactor configurations—even when equations for them are not available—by adopting a new outlook and approach. Join chemical reactor technology expert Uzi Mann and gain knowledge and tools you can apply to the design of any reactor configuration, with any number of reactions, with any stoichiometry, and with any form of rate expression.

This intensive three-day course will broaden your capabilities and prepare you to address and troubleshoot the complex technical challenges you face today.

You Will Learn:

- How to describe reactor operations in terms of dimensionless variables that vary between -1 and 1
- Designing semi-batch reactors, reactors with distributed feed and distillation reactors
- Dimensionless operating curves
- Economic-based optimization and process control
- Determining profit-based vs. yield-based design and operating conditions

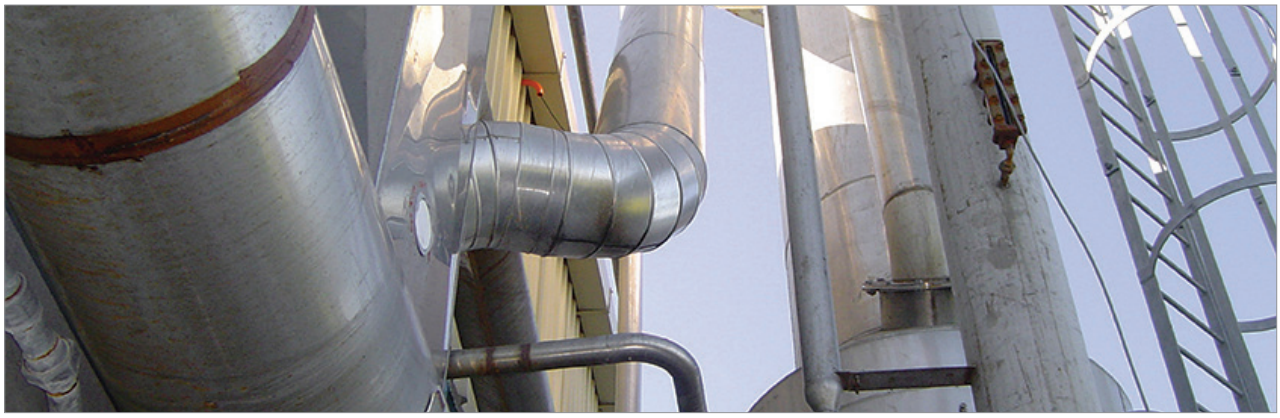
Who Should Attend:

Chemical engineers and other professionals who are involved in the design, operation and optimization of processes with chemical reactors.

Your Instructor:

Uzi Mann

AIChE's Applied Separations — Evaporation and Adsorption



www.aiche.org/ela129 | Course ID: ELA129

AIChE Members – $695
AIChE Undergrad/Grad Student Members – $347.50
Non-Members – $995

Gain a practical understanding of evaporators and adsorption columns used in chemical engineering unit operations and processes.

In this online course, you'll discover how heat transfer occurs in evaporators and learn about evaporator mass and energy balances, sizing calculations, and different types of evaporation equipment. You'll identify energy-saving strategies such as multiple-effect evaporation and vapor recompression. In addition, you'll compare types of evaporators—the advantages, disadvantages and suitable applications of each.

Explore adsorption equilibrium, fixed-bed operation and the mass transfer zone concept. You'll delve into calculation of breakthrough capacity and efficiency of adsorbent usage, absorber design and scale-up considerations. This course also covers activated carbon, the most widely used adsorbent, including types of carbon, design of carbon-handling equipment, regeneration options and factors affecting performance.

You Will Learn:

- Discuss the functioning of evaporators, including: how heat transfer occurs in evaporators, how to size an evaporator for a given application, and how physical properties such as viscosity and boiling point elevation effect evaporator performance
- Describe the principles, advantages and disadvantages of the various types of evaporators, including batch, short- and long-tube vertical, forced circulation, plate and agitated thin-film evaporators, and select the right type for a given application
- Describe how to apply energy-saving strategies such as multiple-effect evaporation and vapor recompression
- Identify strategies for selecting the best adsorbent—including various types of activated carbon, polymeric adsorbents, and zeolite molecular sieves—for a given adsorption challenge
- Analyze equipment used in industrial processes for activated carbon adsorption, including not only the adsorber itself but also regeneration equipment
- Explain how to optimize process conditions for maximum performance of activated carbon and polymeric adsorbents
- Discuss concepts relevant to ion exchange, including: the various types of ion exchange resins, how to predict ion exchange resin performance using equilibrium calculations, and ion exchange process flow diagrams
- Describe the use of zeolite molecular sieves for separation of molecules that are only slightly different in size or polarity

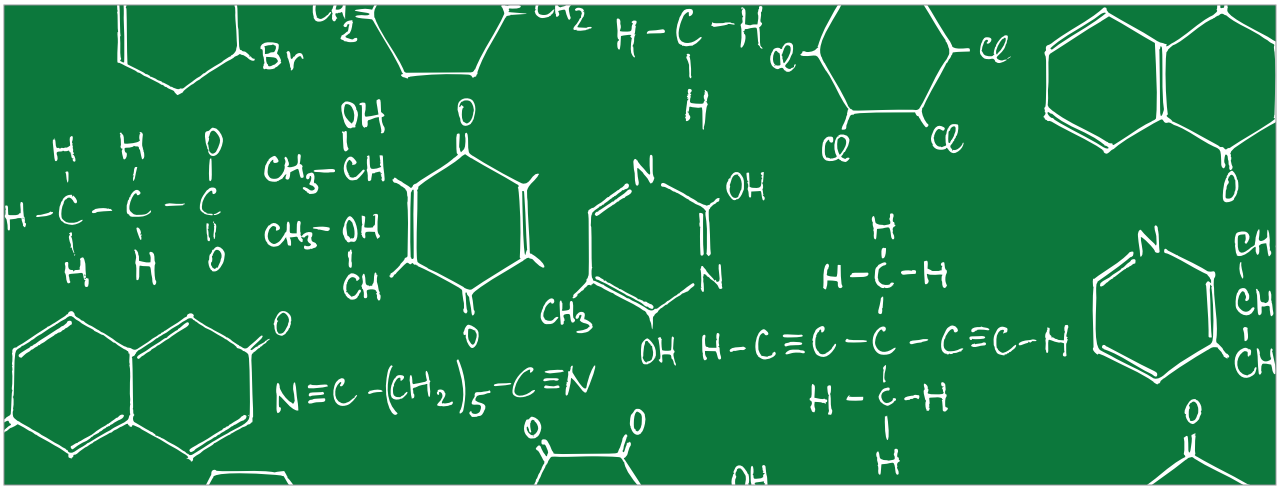
Who Should Attend:

- Chemical engineers
- Mechanical engineers
- Chemical process scientists
- Chemical technologists
- Technical managers
- Those in the bulk and specialty chemical, petroleum, food, flavors and other industries

Your Instructor:

Alan Gabelman

AIChE's Chemical Engineering for Non-Chemical Engineers



www.aiche.org/ch710 | Course ID: CH710

AIChE Members – $1,795
AIChE Undergrad/Grad Student Members – $947.50
Non-Members – $2,095

ALSO AVAILABLE AS ELA110

In today's workplace, non-engineers are increasingly expected to work with chemical engineers on projects, scale-ups and process evaluations. But to do so, you need a solid understanding of basic concepts of chemical engineering analysis, design and calculations. Join chemical engineering expert Jack Hipple and gain the knowledge of the fundamentals of chemical engineering you need to understand, communicate with and work with chemical engineers.

In three days, you'll learn how to hold your own in discussions on safety, industrial hygiene, and reactive chemicals. You'll gain an understanding of the basics of fluid flow, heat transfer, heat exchanger design, and cooling towers, and will learn how to apply them. You'll also learn the basics of solids handling, tank and vessel design, polymerization and polymer processing, and how use this knowledge to sharpen projects and evaluations. Through case studies, you'll see the concepts you learn in action so you can apply them in your workplace when collaborating with chemical engineers on projects, chemistry scale-ups, process evaluations and other initiatives.

You Will Learn:

- The role of chemical engineering and chemistry scale-up
- The basics of stoichiometry
- Commonly used chemical engineering calculations
- The basics of safety, industrial hygiene and reactive chemicals
- What you need to know about fluid flow, heat transfer, heat exchanger design and cooling towers
- Separation technologies—including distillation, absorption, stripping, adsorption, ion exchange and membranes
- What every non-engineer needs to understand about evaporation, crystallization, liquid-solid separations and drying
- Solids handling—the basics
- The basics of tank and vessel design
- Essentials of polymerization and polymer processing
- A working knowledge of process control

Who Should Attend:

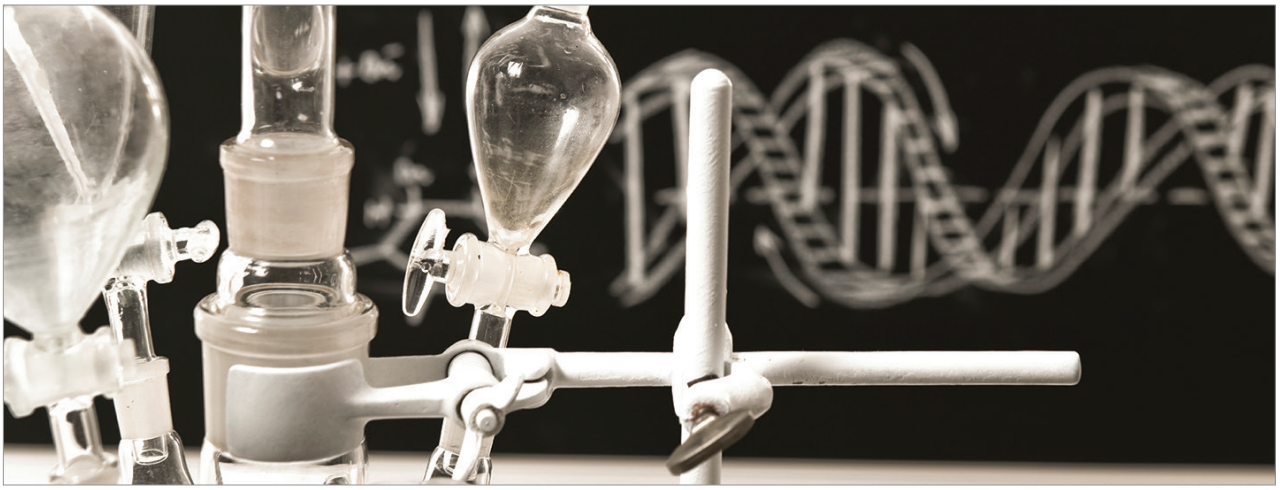
Non-engineers and engineers without formal chemical engineering training who have up to three years of experience working in a plant with chemical engineers. It will be especially valuable to:

- Operating technicians
- Engineering managers who are not chemical engineers
- Chemists
- DHS, EPA and other government employees
- Other engineers

Your Instructor:

Jack Hipple

AIChE's Chemical Engineering for Non-Chemical Engineers



www.aiche.org/ela110 | Course ID: ELA110

AIChE Members – $995
AIChE Undergrad/Grad Student Members – $497.50
Non-Members – $1,295

ALSO AVAILABLE AS CH710

This online course is designed for technicians in the chemical industry and non-chemical engineers who work with or supervise chemical engineers, as well as legal and other professionals who must interact with or manage chemical engineering work.

Participants will learn the basic concepts of chemical engineering, including safety and reactive chemicals, stoichiometry, kinetics, mass and energy balances, pumps and fluid flow, distillation, and other mass transfer operations such as absorption, stripping and chromatography, drying, filtration, crystallization, solids handling, process control, tanks and vessel basics, and cooling towers. Industrial examples are used throughout the course to demonstrate how the fundamentals of chemical engineering are applied in the real world.

You Will Learn:

- About the chemical engineering profession, and what it entails
- Safety and reactive chemical concepts, including reaction stoichiometry
- Chemical stoichiometry and unit conversions
- Mass and energy balances
- Fluid flow and pumping equipment
- Heat transfer and heat exchangers, cooling towers
- Mass transfer concepts, distillation, absorption, stripping/desorption, chromatography, ion exchange, and extraction
- Evaporation, crystallization, filtration, and drying
- Solids handling, characterization, transfer, and storage
- Process control
- Polymers and plastics
- Tanks and process vessels

Who Should Attend:

Engineering managers without a chemical engineering background, chemists, non-chemical engineers, patent attorneys, and legal and government personnel who interface with chemical engineers and the chemical industry. Participants from any size of company or industry in the chemical, petrochemical, and materials processing industries.

Your Instructor:

Jack Hipple

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AIChE's Essentials of Chemical Engineering for Operators

www.aiche.org/ela117 | Course ID: ELA117

AIChE Members – $169
AIChE Undergrad/Grad Student Members – $84.50
Non-Members – $199

A dynamic online course on the fundamentals of chemical engineering for those who are not chemical engineers, but who work with them. This course offers a comprehensive overview of the function, principles, requirements, and operation of process equipment. Throughout the course, professionals will learn key concepts and will develop a deeper understanding of how chemical engineering relates to their disciplines.

You Will Learn:

- How to participate in discussions about conservation principles, chemical reactions thermodynamics, and equilibrium
- The basics of fluid flow and mixing, heat exchangers, chemical reactors and process control
- How to confidently handle complex concepts, including distillation and mass transfer operations
- To broaden your view of chemical engineering and how it relates to your discipline

Who Should Attend:

- Chemists
- Civil and mechanical engineers
- Electrical and industrial engineers
- Construction engineers
- Technical project managers
- Scientists

CCPS' Process Safety Leadership for Front-Line Supervisors

www.aiche.org/ela122 | Course ID: ELA122

AIChE Members and Employees of CCPS Member Companies – $595
AIChE Undergrad/Grad Student Members – $297.50
Non-Members – $895

ALSO AVAILABLE IN SPANISH

Front-line supervisors have more control and influence over process safety than anyone else in the plant. When they do their job well, everyone works safely. Don't take any chances. In this online course, gain the understanding of process safety concepts (and their execution) that you need to successfully implement your organization's game plan for safety. You'll delve into many of the practices and responsibilities that are traditionally in the hands of front-line supervisors—including implementing operating and maintenance procedures, managing contractors, auditing, and identifying hazards and risks.

You Will Learn:

- Operating and maintenance procedures
- Work force involvement
- Contractor management
- Hazard identification and risks
- Incident investigation
- Conduct of operations
- Process safety leadership

Who Should Attend:

Operations and maintenance front-line supervisors responsible for supervising and/or advising unit operators, maintenance crews and contractors.

Your Instructor:

This course was authored by 12 process safety experts. Please visit www.aiche.org/ela122 for more information.

AIChE's Distillation Technology for Operators

www.aiche.org/ela113 | Course ID: ELA113

AIChE Members – $169
AIChE Undergrad/Grad Student Members – $84.50
Non-Members – $199

Gain an understanding of the theory underlying successful distillation processes—and, beyond theory, learn what actually happens in a column.

This online course covers a wide range of topics, from basic column design to installation, start-up, shutdown and more. Your instructor, a distillation technology expert, will detail the critical aspects of operating principles common to most distillation operations, regardless of the distillates being produced.

You Will Learn:

- The fundamentals of distillation and the distillation process
- How to leverage distillation technology basics in your overall system design and in tray and packed-column design
- Advanced knowledge of installation, start-up and shutdown, troubleshooting and distillation column control
- A solid foundation in the principles of operations that apply across all products

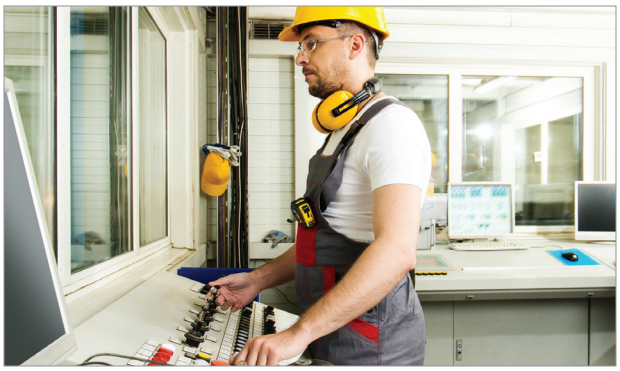
Who Should Attend:

- Engineers or chemists who troubleshoot difficult distillation problems in plant or who conceptualize difficult distillation problems in the engineering office or laboratory
- Distillation veterans
- Distillation newcomers with a few years of experience

Your Instructor:

John Farone

AIChE's Fluid Mixing Technology for Operators



www.aiche.org/ela116 | Course ID: ELA116

AIChE Members – $169
AIChE Undergrad/Grad Student Members – $84.50
Non-Members – $199

Starting with the fundamentals (the basic principles of mixing), this online course continues with practical applications to mixing technology and ends with advanced topics such as solid-liquid processes. Operators will gain an excellent understanding of mixing theories and how they work in today's mixing technology, without getting too product specific.

You Will Learn:

- Mixing theories and how they are applied in the real world
- Advances in mixing technology
- Fundamentals of mixing technology, including physical properties and hydrodynamics
- Practice: mixing equipment, blending, heat transfer and troubleshooting
- An in-depth look at solid-liquid processes and gas-liquid dispersion

Who Should Attend:

- Beginning operators
- Experienced operators
- Technicians or non-engineers who could use a better understanding of mixing theories to improve their performance and results

Your Instructor:

W. Roy Penney

CCPS' Hazard Identification for Operators and Maintenance Workers

www.aiche.org/ch166 | Course ID: CH166

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

This course provides participants with the knowledge and skills to more effectively identify process and mechanical hazards in the workplace, as well as strategize a method for dealing with them.

ALSO AVAILABLE AS ELA121

The course follows a workshop format with several videos, case studies and team breakout exercises. Quizzes are conducted at the end of each module to ensure that participants have a good grasp of the material that was covered. The instructor-led course includes exclusive content not available in the eLearning format.

You Will Learn:

- Introduction to hazards and hazard identification
- Physical and mechanical hazards
- Hazard recognition techniques
- Process hazards
- Use of human senses to identify hazards
- Work hazards
- Hazard evaluation and ranking

Who Should Attend:

- Process operators
- Maintenance craftsmen
- Engineers
- Production foremen and safety specialists

Your Instructor:

Scott Berger or Brian Kelly

AIChE Academy Process Safety Curriculum

Chemical Engineering's Go-To Source for Process Safety Training

The AIChE Academy Process Safety Curriculum was developed by a team of experts to serve as a training guide for Chemical Engineers. It is designed to help guide learners based on their job role. It employs both the CCPS 20 Elements of Risk Based Process Safety framework and the AIChE Body of Knowledge Personas (slightly adapted) to help users determine what courses or other resources to take advantage of.

For more information or questions about the curriculum, please contact **academy@aiche.org**.

AIChE Academy
Connect | Learn | Solve

Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: eLearning | Public | Train-A-Team | Approved | Best Seller

CCPS' Hazard Identification for Operators and Maintenance Workers

www.aiche.org/ela121 | Course ID: ELA121

AIChE Members and Employees of CCPS Member Companies – $129
AIChE Undergrad/Grad Student Members – $64.50
Non-Members – $169

ALSO AVAILABLE AS CH166

ALSO AVAILABLE IN SPANISH

This online course helps operators learn how to recognize and respond to hazards at the field level. Attendees learn how to identify, rank and address the physical and process safety hazards they may encounter in the workplace. Process hazards are less obvious than physical hazards, and they can't always be detected at first glance. As a result, additional effort and different approaches may be required to identify process hazards so that they are addressed appropriately.

You Will Learn:

- Introduction to hazards
- Physical and process hazards
- Human behavior
- Addressing and preventing hazards

Who Should Attend:

Industrial plant operations and maintenance workers who need to have practical methods for identifying and managing physical and process hazards. This course could also benefit:

- Those who are planning on participating in a formal Process Hazard Analysis (PHA) or safety review
- Those responsible for providing resources for hazard control and elimination
- Safety inspectors or regulators
- Safety professionals

Your Instructors:

This course was authored by 12 process safety experts. Please visit www.aiche.org/ela121 for more information.

An AIChE Technology Alliance
CCPS
Center for Chemical Process Safety

The Center for Chemical Process Safety (CCPS) is a not-for-profit, corporate membership organization within AIChE that identifies and addresses process safety needs for a variety of facilities involved with handling, storing, using or processing, and transporting hazardous materials.

Learn more at **www.aiche.org/ccps**

CCPS' Process Safety Boot Camp

www.aiche.org/ch900 | Course ID: CH900

AIChE Members and Employees of CCPS Member Companies – $2,195
AIChE Undergrad/Grad Student Members – $1,097.50
Non-Members – $2,495

Available outside of North America as CH910/Foundations of Process Safety.

CCPS' Process Safety Boot Camp, AIChE Academy's most popular course, was developed especially for companies looking to train their staff in the fundamental concepts of Process Safety. It is widely used by corporate training departments across different sectors of the chemical enterprise. Companies large, small and in between use CCPS' Process Safety Boot Camp to ramp up staff knowledge to a common level quickly and easily.

This intensive 4-day course is taught by two seasoned instructors, each with a minimum of 25 years of experience in process safety. The agenda covers key process safety areas, including Risk-based Process Safety, Process Hazard Analysis, Regulatory Compliance and Process Safety in Plant and Design Operations.

You Will Learn:

- The Four Pillars and 20 Elements of Risk-Based Process Safety
- The different types of Process Hazard Analysis, including an introduction to HAZOP
- An overview of OSHA's PSM regulations and EPA's RMP regulations
- How to incorporate Process Safety Management into Process Design and Plant Operations
- The concept of Layers of Protection to prevent and/or mitigate loss-of-containment events
- The principles of Risk Analysis and Risk Management
- How to consider Inherently Safer Processes during plant design

Who Should Attend:

Technical staff in the process industries, pipeline industries, utility companies, and engineering service companies who need to move beyond an understanding of personal safety and learn the basics of Process Safety and Process Safety Management, including:

- Chemical Engineers
- Process Design Engineers
- Manufacturing Engineers
- Chemists
- Mechanical and Reliability Engineers
- Instrumentation/Automation Engineers
- Shift Supervisors
- Lead Operators
- EHS Specialists
- Managers who wish to gain a more comprehensive understanding of risk-based management system best practices

Your Instructors (two of these):

Donald Abrahamson, Scott Berger, Jack Chosnek, James Conner, Steve Eason, Walter Frank, Alexandre Glitz, Dennis C. Hendershot, John Herber, David Hill, Jerry Jones, B. Karthikeyan, Brian Kelly, Ellen Lenz, Jack McCavit, Dan Miller, John Murphy, Louisa Nara, Frank Renshaw, Robert Rosen, Néstor Sposito, Byron Sun, Jenny Wang

Please refer to index on p. 70 for all instructor bios.

Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: E eLearning | P Public | Train-A-Team | Approved | Best Seller

CCPS' Process Safety Boot Camp (cont'd)

COURSE OVERVIEW:

Day 1

- Introduction
- Occupational safety vs. process safety
- Business case for process safety
- Key principles of process safety
- Anatomy of an incident
- Containment and control
- Prevention
- Mitigation

Day 2

- Introduction to management systems and risk-based process safety
- Process safety culture & compliance with standards
- Inherently safer concepts
- Process design
- Process safety competency
- Workforce involvement
- Human factors
- Stakeholder outreach
- Process knowledge management
- Understanding material hazards

Day 3

- Specific hazards
- Chemical hazards
- Reactivity
- Toxicity
- Corrosivity
- Inherent safety
- Hazard identification and risk analysis
- Hazard evaluation techniques
- Consequence and impact frequency
- Risk analysis
- Risk criteria
- Risk acceptance
- Operating procedures
- Safe work practices

Day 4

- Hot work permits, etc.
- Asset integrity and reliability
- Contractor management
- Training and performance assurance
- Management of Change (MOC)
- Operational readiness & pre-startup safety reviews
- Conduct of operations
- Emergency management and incident investigation
- Measures, metrics and auditing compliance
- Management review and continuous improvement
- Additional EPA RMP regulations

CCPS' Overview of Risk-Based Process Safety

www.aiche.org/ch925 | Course ID: CH925

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

This course will introduce you to CCPS' Risk-Based Process Safety (RBPS) approach, including the four pillars and twenty elements that define the structure of RBPS. Developed especially for companies to train employees in the basics of Risk-Based Process Safety, this course will serve as an excellent starting point for the exploration of the steps and procedures involved in providing a safe operating environment.

You Will Learn:

- The definition and importance of Risk-Based Process Safety (RBPS)
- The four pillars of RBPS:
  - Commit to Process Safety
  - Understand Hazards and Risk
  - Manage Risk
  - Learn from Experience
- The twenty elements of RBPS

Who Should Attend:

Those involved in designing, implementing and maintaining a successful process safety management system, including:

- Process safety specialists and process safety managers
- Operations and plant managers
- Engineers and supervisors

Your Instructor (one of these):

Donald Abrahamson, Scott Berger, Charles Cowley, Dennis Hendershot, Jerry Jones, John Herber, John Murphy or Louisa Nara

GOT A GROUP TO TRAIN?

Bring AIChE Academy to you! Look for the Train-a-Team link throughout the book or visit **www.aiche.org/trainateam**

AIChE Academy
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Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: eLearning | Public | Train-A-Team | Approved | Best Seller

CCPS' 20 Elements of Risk-Based Process Safety (RBPS)

www.aiche.org/ela120 | Course ID: ELA120

AIChE Members and Employees of CCPS Member Companies – $995
AIChE Undergrad/Grad Student Members – $497.50
Non-Members – $1,295

This online course will introduce you to the CCPS Risk-Based Process Safety Management (RBPS) approach, described in the CCPS book *Guidelines for Risk-Based Process Safety*. It covers the four pillars and twenty elements that define the structure of the RBPS approach. The course will help you design, implement, and maintain a risk-based process safety management system that will fit your company's needs and resources.

You will learn the definition and importance of RBPS and learn the four pillars of RBPS. Key principles and essential features for each of the twenty elements that make up the pillars will be discussed.

The four pillars are:

- Commit to Process Safety
- Understand Hazards and Risk
- Manage Risk
- Learn from Experience

You Will Learn:

- The importance of RBPS and how it fits into business success
- The details of the twenty elements of RBPS
- How to design, implement, and maintain an RBPS management system that fits the culture, needs and resources of your company, and that will meet the company's process safety goals

Who Should Attend:

Those involved in designing, implementing and maintaining a successful process safety management system in your company, including:

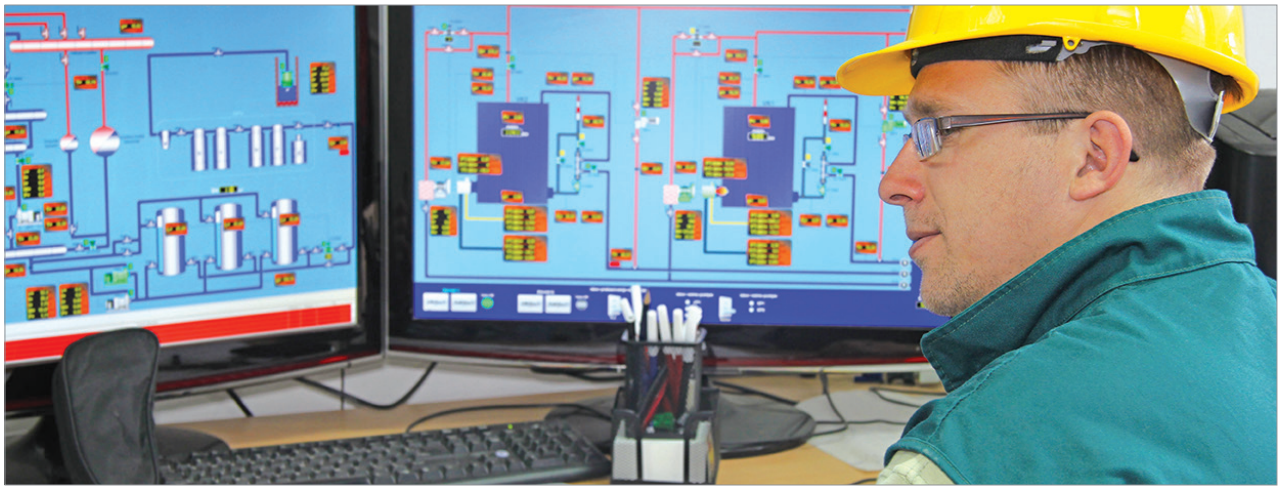
- Process safety specialists and process safety managers
- Operations and plant managers
- Engineers and supervisors

Your Instructors:

This course was developed by 30 renowned Process Safety experts. Please visit www.aiche.org/ela120 for more info.

Register online at www.aiche.org/academy or call 1-800-242-4363 (or 1-203-702-7660 outside the U.S.)

CCPS' Process Safety Management Overview



www.aiche.org/els105 | Course ID: ELS105

AIChE Members and Employees of CCPS Member Companies – $795
AIChE Undergrad/Grad Student Members – $397.50
Non-Members – $1,095

This online course is an overview of the need for process safety and the tools used to implement process safety management systems. It covers the U.S. OSHA PSM 14 regulatory requirements as well as the Center for Chemical Process Safety (CCPS) 20-element approach to process safety.

Course attendees will learn about the history of accidents leading up to the recognition that process safety technology and education were needed. You will learn about the U.S. OSHA process safety regulatory requirements and the Center for Chemical Process Safety (CCPS) approach to process safety management. You will be instructed in the use of several of the more common process safety management tools.

You Will Learn:

- Process Hazard Analysis (PHA)—several of the more common methodologies
- Management of Change (MOC)—perhaps the best way to control hazards
- Mechanical Integrity vs. Reliability—regulatory requirements vs. what you really should do to keep your plant running safely
- Incident investigation—lessons learned and shared
- Layer of Protection Analysis (LOPA)—a system management approach as well as an investigative technique
- Risk estimation

Who Should Attend:

Engineers and other technical professionals who play key roles in the management of their organizations' process safety. Those who should attend include PHA team leaders and other professionals who must know how to select and apply various PHA methods.

Your Instructor:

Adrian Sepeda

An AIChE Technology Alliance
CCPS
Center for Chemical Process Safety

The Center for Chemical Process Safety (CCPS) is a not-for-profit, corporate membership organization within AIChE that identifies and addresses process safety needs for a variety of facilities involved with handling, storing, using or processing, and transporting hazardous materials.

Learn more at **www.aiche.org/ccps**

CCPS' The OSHA Regulatory Approach to Process Safety Management

www.aiche.org/ch501 | Course ID: CH501

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Your responsibility to protect workers and the environment from hazardous chemicals requires thorough knowledge of the latest OSHA and EPA regulatory requirements.

Join process safety and risk management expert Don Abrahamson for an up-to-date look at the OSHA PSM Regulation 29CFR 1910.119 and the EPA Prevention Program process safety regulatory requirements. You'll leave with the knowledge you need to effectively implement, evaluate and audit an OSHA or EPA process safety management program in your organization.

In three days, you'll gain new insight through lectures, discussions and problem-solving sessions.

You Will Learn:

- Your regulatory obligations under OSHA PSM Standard 29CFR 1910.119 and EPA Prevention Program 40 CFR Chapter 1, Part 68
- Fulfilling PSM regulatory requirements in your workplace: what is needed and expected
- OSHA's 14 key PSM elements
- EPA's Risk Management Program Process Safety Regulation

Who Should Attend:

New and experienced front-line engineers responsible for design, maintenance, manufacturing or supervision, as well as managers and engineers involved in regulatory compliance.

Your Instructor:

Donald Abrahamson

CCPS' OSHA Process Safety Management Review

www.aiche.org/ela150 | Course ID: ELA150

AIChE Members and Employees of CCPS Member Companies – $395
AIChE Undergrad/Grad Student Members – $197.50
Non-Members – $695

Take this fundamental course and gain an introduction to Process Safety Management. In just two short hours, you'll learn how and when to apply the OSHA standard (the Process Safety Management standard: OSHA 1910.119) and see how it relates to the Process Safety Management system developed by the Center for Chemical Process Safety (CCPS).

You Will Learn:

- The history behind the creation of the Occupational Safety and Health Administration (OSHA) Process Safety Management (PSM) standard
- Intent of the OSHA PSM standard
- How and when and to apply the OSHA PSM standard
- How to write a PSM program plan
- CCPS' 14 Elements of Process Safety and how they relate to the OSHA PSM standard

Who Should Attend:

Engineers, supervisors and managers in the chemical processing industries who are involved in chemical plant operations, process design, and process safety technology, and who need a basic understanding of the OSHA Process Safety Management standard.

Your Instructor:

John Murphy

Register online at www.aiche.org/academy

CCPS' What Every New Engineer Needs to Know About Process Safety

www.aiche.org/ela154 | Course ID: ELA154

AIChE Members and Employees of CCPS Member Companies – $295
AIChE Undergrad/Grad Student Members – $147.50
Non-Members – $595

Gain the process safety knowledge you need to be effective in your career. In this online course, you'll gain a broad overview of what process safety is, why it is important, and its applications in the process industries.

Process safety is a top priority for any company operating in the chemical and allied industries, yet it doesn't always receive the attention it should. Now you can understand why process safety is vital and learn what important questions you should be asking as you start your career as a practicing engineer.

Take this course and start to build your process safety knowledge base. You'll learn key facets of fundamental topics, including hazard identification, inherently safer design, mechanical integrity and emergency response planning. And you'll leave with a framework for deciding what additional areas of process safety you can learn about as your career progresses.

You Will Learn:

- How to describe the key elements of process safety
- How to identify key concepts and terminology, and how they apply to process safety
- How to locate other resources to help further your process safety education
- How to describe several means of identifying hazards
- How to identify several common means of modeling hazards
- How to describe several methods for reducing the likelihood of a loss-of-containment event

Who Should Attend:

Any young professional engineer just getting started in their engineering career, especially in: Upstream, Midstream, Refining, Chemicals, and Manufacturing.

Your Instructor:

Phillip R. Hodge

CCPS' Managing Process Safety Risks During Organizational Change

www.aiche.org/ch525 | Course ID: CH525

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Organizational change is normal and inevitable as companies seek to become more profitable, increase market share, and reduce manufacturing costs. But when not properly evaluated and controlled, changes to equipment in a facility can lead to serious incidents with potentially severe consequences. And because the effects of organizational change on process safety can be harder to see, it is less commonly recognized than other types of change.

Acquisitions, mergers and joint ventures, new and revised corporate policies and procedures, task allocation changes, changes in job responsibilities, loss of key personnel, or even changes in shift hours can have an adverse impact on process safety. Because there is a tendency to focus on managing physical changes, most Management of Change (MOC) systems overlook or only superficially address Organizational Change Management (OCM) and the impact of organizational changes on process safety.

This course provides an in-depth understanding of the framework for establishing OCM programs and implementing OCM procedures for different types of changes. You'll also learn effective utilization of OCM risk analysis methods/tools for evaluating organizational changes through illustrated case studies and lessons learned, including:

- Modification of working conditions
- Personnel changes
- Task allocation changes
- Organizational hierarchy changes
- Organizational policy changes

The course focuses on effective utilization of the following OCM risk analysis methods/tools for evaluating organizational changes:

- What-if analysis
- Checklist approach
- Bow tie method
- Activity mapping

You Will Learn:

- Organizational change key concepts and definitions: A selection of Organizational Change Management (OCM)-related incidents
- Corporate standards for OCM
- How to conduct OCM risk assessment
- Tools and techniques for analyzing organizational changes

Who Should Attend:

Process safety professionals and managers who play key roles in evaluating and managing process safety risks during organizational change.

Your Instructor:

Scott Berger, Umesh Dhake or Louisa Nara

Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: E eLearning | P Public | Train-A-Team | Approved | Best Seller

CCPS' Senior Leaders & Process Safety: The Role & The Opportunity

www.aiche.org/ch902 | Course ID: CH902

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

You are an executive or senior manager. Your company has made major investments into process safety systems such as Management of Change, Risk Identification and Mechanical Integrity. It is important to examine the role you personally have in leading the organization to bottom-line process safety results–and the role that each of your reports should have. What are the routine activities where your participation can make a difference? What questions and areas of focus are appropriate for your position?

This interactive course will examine the role that culture plays in catastrophic events, the critical role you have personally in establishing culture, and what good culture for Process Safety looks like.

You Will Learn:

- Impacts of process safety failures
- Critical cultural enablers
- Understanding threats to process safety
- The vital systems of prevention
- Assessing the health of organizational process safety and the management toolset
- Emergency preparedness

Who Should Attend:

Senior leaders in the petrochemical and petroleum production industries who have accountability for performance of manufacturing/production.

Your Instructor:

Scott Berger or James Conner

AIChE Academy Process Safety Curriculum

Chemical Engineering's Go-To Source for Process Safety Training

The AIChE Academy Process Safety Curriculum was developed by a team of experts to serve as a training guide for Chemical Engineers. It is designed to help guide learners based on their job role. It employs both the CCPS 20 Elements of Risk Based Process Safety framework and the AIChE Body of Knowledge Personas (slightly adapted) to help users determine what courses or other resources to take advantage of.

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AIChE Academy
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Key to icons: E eLearning | P Public | Train-A-Team | Approved | Best Seller

CCPS' The Importance of Codes and Standards for Process Safety

www.aiche.org/ela155 | Course ID: ELA155

AIChE Members and Employees of CCPS Member Companies – $395
AIChE Undergrad/Grad Student Members – $197.50
Non-Members – $695

Compliance with the Process Safety Management rule, OSHA 1910.119, is a requirement for any plant processing highly hazardous materials exceeding threshold quantities. Now you can learn how existing industry standards can help you meet that requirement. This online course provides an introduction to how industry standards and standards organizations can be used to build a Process Safety Management (PSM) program that complies with the rule.

Take this course, and you'll learn the elements of the rule that can be supported with existing industry standards. You'll learn how to build a hierarchy of documents, from industry standards to plant procedures, that address the rule's requirements. You will also learn how benchmarking and reaching out to other organizations can address areas where a specific standard does not exist.

You will understand how specific standards, such as mechanical integrity, must be implemented to meet sections of the rule. You will get an overview of the documentation requirements for compliance. And you'll see how industry standards help assure compliance with Recognized and Generally Accepted Good Engineering Practices (RAGAGEP). You'll also look at examples of what results from lack of compliance.

You Will Learn:

- How to evaluate a plant procedure against a requirement in the PSM rule to determine if it is acceptable
- How to determine whether plant documentation meets the rule
- How to use API standards and develop a corporate standard to overlay on this document
- How to use an industry standard and develop a data sheet for procurement of equipment
- To understand the basics of a piping specification
- To outline the steps required to implement an addenda or deviation to a standard, and the rigorous process needed to approve this through the management of change process
- To utilize concepts from this course to develop better teams for management of change and process hazard analysis efforts

Who Should Attend:

Anyone who works in an operating environment, particularly one that uses hydrocarbons, can benefit from this course. It is suitable for engineers in all disciplines and career stages who would benefit from building a foundation of knowledge about this critical subject, including engineers working in: plant design, plant operations, standards implementation/compliance, senior plan leadership, and other technical and operating personnel.

Your Instructor:

Michael R. (Rick) Hoffman

AIChE's Combustible Dust Hazards: Flash Fires and Dust Explosions

www.aiche.org/ch034 | Course ID: CH034

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Dust hazards and explosions are all too common in the process safety industry and can lead to injuries, fatalities, property damage, business interruption, and environmental pollution.

Join combustible dust expert Dr. Erdem Ural for an up-to-the-minute look at how to identify, respond to, control and eliminate dust hazards while fulfilling your regulatory obligations as an employer.

In two days, you'll learn how OSHA's Combustible Dust National Emphasis Program addresses dust explosions and fire hazards in facilities and impacts how you handle powder and bulk materials, as well as fugitive dust in your plant.

You Will Learn:

- How to spot dust explosion hazards hidden in many workplaces
- Tools to help you identify and assess the existence, severity and consequences of a hazard
- How to control and eliminate hazards
- How to assess the adverse effects of protection and prevention systems

Who Should Attend:

Professionals concerned with the risks and vulnerabilities associated with dust hazards and explosions–including:

- Chemical engineers
- Mechanical engineers
- Process engineers/scientists
- Fire protection professionals
- Plant, process safety, and risk managers
- Facility managers and all others who need to be aware of the risks and vulnerabilities in plants

Your Instructor:

Erdem Ural

GOT A GROUP TO TRAIN?

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Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: E eLearning | P Public | Train-A-Team | Approved | Best Seller

CCPS' Incident Investigation

www.aiche.org/ch850 | Course ID: CH850

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Accidents are significant events that trace their roots back to management system failures. They often result from a single failure. That failure, however, may be a symptom of deeper problems within the operation of a plant or facility. Only with a full understanding of what happened, how it happened and why it happened can effective remedial actions be taken. Join an incident investigation expert for an in-depth look at the systematic process of examining and evaluating the causes of an incident.

In three days, you will learn how to set up and manage an investigation, gain tools for evidence preservation and witness interviewing techniques, and examine causal analysis and ways to establish root cause(s).

You Will Learn:

- Incident reporting
- Trend analysis and pattern recognition
- How to set up and staff a formal investigation
- How to conduct a root-cause analysis
- Formal reporting and presentation

Who Should Attend:

Professionals concerned with the risks associated with dust hazards and explosions—including:

- Chemical and mechanical engineers
- Process engineers/scientists
- Fire protection professionals
- Facility, process safety, and risk managers

Your Instructor:

Scott Berger or Brian Kelly

CCPS' Inherently Safer Design

www.aiche.org/ch800 | Course ID: CH800

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Inherently safer product and process design (ISD) is a way to eliminate or significantly reduce hazards—rather than develop add-on protective systems and procedures. You'll examine risk management layers of protection—inherent, passive, active and procedural—and how and why to build features from all categories into your program. By the end of the course, you'll have the tools, resources and knowledge to build safety into any phase in the life cycle of a chemical process and to eliminate or significantly minimize hazards to protect your people, the environment and your business.

You Will Learn:

- What is inherently safer design?
- The history of ISD and lessons to be learned
- Basic concepts and philosophy
- The process safety management hierarchy
- Strategies for identifying inherently safer options
- Tools and resources to help you implement ISD

Who Should Attend:

Professionals responsible for or involved in process development, design and operation, including:

- Chemical engineers
- Mechanical engineers
- Process engineers and scientists
- Chemists

Your Instructor:

Dennis C. Hendershot

CCPS' Recognizing Catastrophic Incident Warning Signs

www.aiche.org/ch901 | Course ID: CH901

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Do you understand why you are having process safety incidents, and what to do to prevent them and minimize their impact? What if you could predict that an incident was going to happen before it did? You can't predict exactly when an incident will occur, but you can practice a higher degree of situational awareness and key in on the incident warning signs that occur before an incident—and then act on the warning signs once you have identified them.

This course will provide guidance and real-world experience on how to recognize catastrophic incident warning signs. Identifying these subtle indicators of weakness in existing business processes and safety programs is an excellent way to drive continued improvement in your process safety.

You Will Learn:

- Introduction to incident warning signs
- Leadership & cultural warning signs
- Physical warning signs
- Asset integrity warning signs
- Analyzing risk and managing change warning signs

Who Should Attend:

Engineers, supervisors, plant managers, operators and technicians who work in the chemical process industries.

Your Instructor:

James Conner, Scott Berger, or Louisa Nara

CCPS' Layer of Protection Analysis (LOPA)

www.aiche.org/ela109 | Course ID: ELA109

AIChE Members and Employees of CCPS Member Companies – $695
AIChE Undergrad/Grad Student Members – $347.50
Non-Members – $995

This online course presents the Layer of Protection Analysis (LOPA) methodology used worldwide in the process industries for simplified, rule-based risk analysis. The course covers the basic LOPA approach to selecting and analyzing potential incident scenarios.

You will learn the finer points of topics such as enabling conditions and conditional modifiers, as well as the logistical aspects of planning and executing a LOPA study, including documentation and program management. You'll also gain CCPS guidance on initiating events, independent protection layers, enabling conditions and conditional modifiers—including the likelihood of ignition.

You Will Learn:

- The basic principles of the LOPA approach
- Selecting scenarios for analysis
- Executing each step of the LOPA method for scenario risk analysis
- Identifying and evaluating independent protection layers
- Understanding and applying enabling conditions and conditional modifiers
- Closing the risk gap
- Managing LOPA implementation, updates and follow-up

Who Should Attend:

Hazard evaluation teams, dedicated site or corporate LOPA teams, and those who manage LOPAs, as well as expert analysts and safety teams.

Your Instructor:

Robert Johnson

CCPS' HAZOP Studies

www.aiche.org/els104 | Course ID: ELS104

AIChE Members and Employees of CCPS Member Companies – $795
AIChE Undergrad/Grad Student Members – $397.50
Non-Members – $1,095

This online course covers the concepts and techniques of the Hazard and Operability (HAZOP) Study methodology, including related matters of preparation, team meeting facilitation and reporting. It includes worked examples and references to additional resources.

Attendees will learn the anatomy of process safety incidents, including process hazard analysis terminology, the basic HAZOP Study approach to developing potential incident scenarios, the estimating of scenario risk as a means to determine the adequacy of safeguards, the application of the HAZOP Study method to procedure-based operations, and the logistical aspects of planning and executing a HAZOP Study team review. This course is the culmination of over 25 years of teaching and employing the HAZOP Study methodology in a variety of process industries, by the lead contract author of CCPS' Guidelines for Hazard Evaluation Procedures, Third Edition, and the instructor of the AIChE continuing education course on "HAZOP Studies and Other PHA Techniques for Process Safety and Risk Management."

You Will Learn:

- The anatomy of process safety incidents
- The HAZOP Study method for scenario development
- Continuous-process example
- Determining the adequacy of safeguards
- Developing findings and recommendations
- Variations on the basic HAZOP Study method
- Application to procedure-based operations
- Batch-operation example
- Preparing for and leading HAZOP Study team reviews
- Updating and revalidating HAZOP Studies

Who Should Attend:

This course is not intended to replace full HAZOP team leader (facilitator) training, but it is a good refresher for anyone who has led HAZOP Studies, as well as for:

- HAZOP Study team members
- Coordinators of process safety management programs
- Professionals responsible for addressing the findings and recommendations generated by HAZOP Study teams

Your Instructor:

Robert Johnson

CCPS' HAZOP Studies and Other PHA Techniques for Process Safety and Risk Management

SAVE $795
or more when you take CH157 and CH754 together.
Just register for course CH759: HAZOP Studies/Process Hazard Analysis Combo Course.
www.aiche.org/ch759

www.aiche.org/ch157 | Course ID: CH157

AIChE Members and Employees of CCPS Member Companies – $1,895
AIChE Undergrad/Grad Student Members – $947.50
Non-Members – $2,195

Process Hazard Analysis (PHA) goes beyond merely identifying whether a hazard exists. It involves understanding the negative impact of the hazard in the workplace and knowing how to eliminate it. Join hazard risk/evaluation expert Robert Johnson as he addresses how to prepare for, conduct and report an effective PHA while complying with the latest regulations. Attend and you'll receive the CCPS book Guidelines for Hazard Evaluation Procedures, 3rd Edition, which you can refer back to on the job for a refresher of the effective evaluation methods that process safety demands.

In three days, you'll get up to date on your obligations under the OSHA PSM Rule and EPA RMP regulations. You'll learn how to determine the adequacy of your safeguards and report findings and recommendations. You'll examine various hazard evaluation methods, including the HAZOP Study, and how to select the method appropriate for your facility. The course concludes with a look at hazard evaluation of procedure-based operations and PLC-controlled processes, how to conduct the final meeting and quality check, and reporting techniques.

After three days, you'll know how to select and apply various PHA methods and will have the knowledge and skills necessary to more effectively lead PHA teams and manage process safety in your organization.

You Will Learn:

- The anatomy of a process safety incident
- Hazard review logistics—preparation, team leading, reporting and follow-up
- OSHA and EPA requirements for PHA
- Tips for leading common PHA methods—including those used for procedure-based operations
- The HAZOP Study: fundamental concepts and methodology
- Tools and techniques for analyzing scenario risks and determining the adequacy of safeguards

Who Should Attend:

Engineers and other technical professionals who play key roles in the management of their organization's process safety. Those who should attend include PHA team leaders and other professionals who must know how to select and apply various PHA methods.

Your Instructor:

Robert Johnson

Please refer to index on p. 70 for all instructor bios.

CCPS' Advanced Concepts for Process Hazard Analysis

SAVE $795
or more when you take CH754 and CH157 together.
Just register for course CH759: Process Hazard Analysis/ HAZOP Studies Combo Course.
www.aiche.org/ch759

www.aiche.org/ch754 | Course ID: CH754

AIChE Members and Employees of CCPS Member Companies – $1,495
AIChE Undergrad/Grad Student Members – $747.50
Non-Members – $1,795

A laptop is required for this course.

Safety demands a deep knowledge and application of effective hazard analysis methods. In this highly interactive course, you'll have the opportunity to expand your basic understanding of process hazard analysis and will learn how to extend order-of-magnitude scenario risk calculations to other uses. Join Robert W. Johnson, take a detailed look at the HAZOP Study and other PHA methods, and engage in exercises that will give you hands-on experience applying key concepts learned. You may take this advanced course sequentially with CCPS' HAZOP Studies and Other PHA Techniques for Process Safety and Risk Management (CH157) or separately.

In two days, you'll work with a team to learn and practice the PHA techniques, including Layer of Protection Analysis (LOPA), Safety Integrity Levels (SILs) determination and analysis of chemical reactivity hazards and security risks. Using a spreadsheet provided during the course, you'll extend qualitative HAZOP Studies to evaluate order-of-magnitude scenario risks, then examine the concept of importance measures applied to PHAs and learn how to use a PHA to determine required SILs. You'll conclude the course by surveying the tools useful in PHAs for evaluating fire, explosion and toxic release impacts.

When you attend this course, you'll also receive the CCPS book *Guidelines for Initiating Events and Independent Protection Layers in Layer of Protection Analysis*.

You Will Learn:

- How to calculate action item importance measures
- How to determine the safety integrity levels for a safety-instrumented system
- Strategies for reporting your study results

Who Should Attend:

Any engineer who conducts or is involved in process safety hazard analysis—including:

- Chemical engineers
- Mechanical engineers
- Process engineers
- Process safety/risk managers
- Facility managers

Your Instructor:

Robert Johnson

CCPS' Process Safety Management for Biodiesel

www.aiche.org/ela100 | Course ID: ELA100

AIChE Members and Employees of CCPS Member Companies – $595
AIChE Undergrad/Grad Student Members – $297.50
Non-Members – $895

OSHA is closely monitoring the biodiesel industry. In this online course, you'll learn how to improve your process safety management and avoid the accidental release of chemicals in your plant. You'll get up to speed on the standards and regulations impacting you as a biodiesel producer. You'll identify the components of a successful process safety program and learn how to implement them—including process hazard analysis, standard operating procedures, safe work practices, mechanical integrity, management of change, auditing process safety systems and emergency response procedures. Throughout the course, you'll tackle and solve a variety of issues and compliance challenges unique to the biodiesel environment.

You Will Learn:

- Preventing fires in your biodiesel plant
- Understanding methanol toxicity and sodium hydroxide
- Standards and regulations impacting biodiesel producers
- The biodiesel process
- Using foam for biodiesel
- MSDS requirements

Who Should Attend:

Chemical engineers who work in the biodiesel industry and are responsible for, or involved in, process safety management.

CCPS' Process Safety Management for Bioethanol

www.aiche.org/ela124 | Course ID: ELA124

AIChE Members and Employees of CCPS Member Companies – $595
AIChE Undergrad/Grad Student Members – $297.50
Non-Members – $895

Process safety management is one of the most frequently cited hazards at ethanol plants by OSHA. In this online course, you'll learn how to improve your process safety and avoid the unexpected release of toxic, reactive, or flammable liquids or gases in your processes involving highly hazardous chemicals. You'll gain a valuable overview of the standards and regulations impacting you as a bioethanol producer. You'll identify the components of a successful process safety program and learn how to implement them—including process hazard analysis, standard operating procedures, safe work practices, mechanical integrity, management of change, auditing process safety systems and emergency response procedures. Throughout the course, you'll tackle and solve a variety of issues and compliance challenges unique to the bioethanol environment.

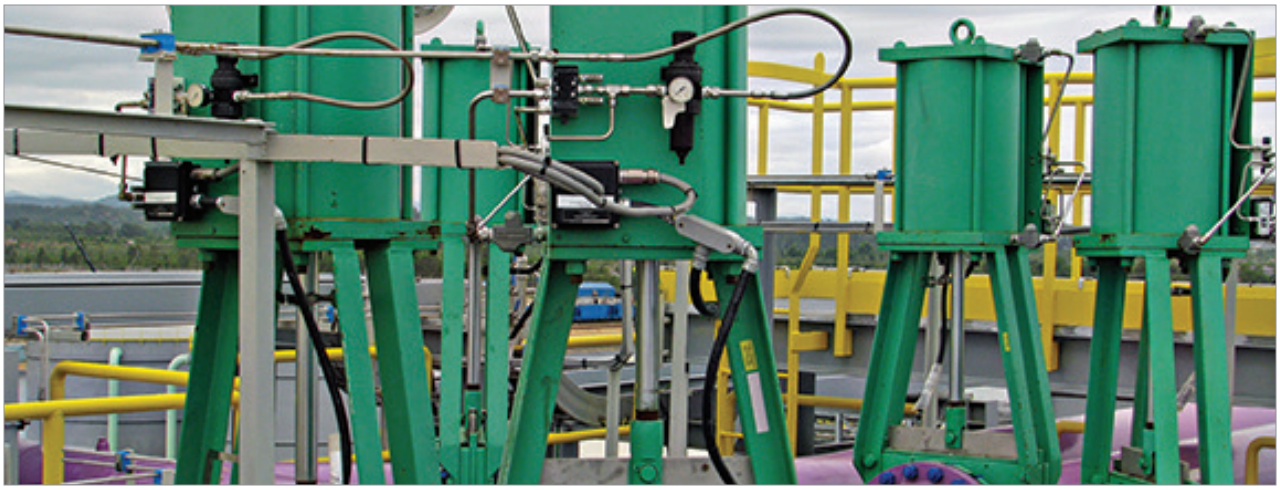
You Will Learn:

- Lessons from the Barton Solvents explosion
- Preventing fires in your ethanol plant
- Understanding the flashpoint of ethanol
- OSHA regulations impacting bioethanol producers
- Protecting your plant from dust explosions
- Staying on top of process safety with written checklists

Who Should Attend:

Chemical engineers who work in the bioethanol industry and are responsible for, or involved in, process safety management.

DIERS' Basic Emergency Relief System Design



www.aiche.org/ch172 | Course ID: CH172

AIChE Members – $1,895
AIChE Undergrad/Grad Student Members – $947.50
Non-Members – $2,195

Take the first step toward becoming proficient in ERS design and evaluation. In three days, you'll gain an introduction to pressure relief safety design with Design Institute for Emergency Relief Systems (DIERS) technology. This course is recommended prior to taking DIERS' Advanced Emergency Relief System Design. Together, the two DIERS courses form the basis of a solid fundamental understanding of pressure safety relief design.

The course includes coverage of DIERS liquid vapor disengagement technology, two-phase vapor liquid flow through relief systems, and techniques for reactive relief design. From state-of-the-art venting and flow technology to relief system piping, you'll gain information that will be invaluable whether you operate, design or manage chemical processes that require emergency overpressure relief devices.

You Will Learn:

- An introduction to the broad topic of emergency relief system design
- How to achieve compliance with established codes, standards and design practices in the broad area of emergency pressure relief and effluent containment
- How fluid flow models are used in pressure safety relief design
- The requirements for relief system piping
- Conservative assumptions typically made to determine the required load for pressure relief systems
- Where to obtain resources and references to guide further development as a skilled ERS engineer
- The first steps to becoming proficient in the complex field of ERS design and evaluation

Who Should Attend:

This introductory course is designed to meet the needs of engineers responsible for operating, designing or managing chemical processes that require overpressure relief devices. It will also be beneficial to engineers seeking more information about state-of-the-art venting and flow technology, as well as to those responsible for the safe handling of the effluent from an emergency relief device.

Your Instructors (two of these):

Todd Brandes, Robert D'Alessandro, Rahul Raman, Dan Smith

AIChE Academy
Connect | Learn | Solve

Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: eLearning | Public | Train-A-Team | Approved | Best Seller

DIERS' Advanced Emergency Relief System Design

www.aiche.org/ch173 | Course ID: CH173

AIChE Members – $1,895
AIChE Undergrad/Grad Student Members – $947.50
Non-Members – $2,195

OSHA has recognized Design Institute for Emergency Relief Systems (DIERS) methods as good engineering practice for process safety management of highly hazardous materials. If you're responsible for the safe handling of the effluent from relief systems, this course will teach you how to apply the DIERS techniques for providing adequate pressure relief for runaway reactions and other pressure-producing events.

Applying DIERS technology in your facility

This advanced course covers the Design Institute for Emergency Relief Systems (DIERS) techniques for providing adequate pressure relief for runaway reactions and other pressure-producing events that result in two-phase flow. Each participant receives the texts: *Emergency Relief Systems Design Using DIERS Technology* (published by AIChE) and *Guidelines for Pressure Relief and Effluent Handling Systems* (published by CCPS and includes CCflow computer routines available by download).

You Will Learn:

- The broad topic of emergency relief systems design, with an emphasis on DIERS methodology
- How to achieve compliance with established codes, standards and design practices in the broad area of emergency pressure relief and effluent containment
- The application of the DIERS technology for data acquisition and two-phase venting calculations for the severe case of runaway chemical reactions
- Available computational models and computer programs through demonstrations and worked example
- To utilize real-world scenarios and to understand how lack of knowledge on basic pressure relief systems principles can have fatal consequences
- The first steps to becoming proficient in the complex field of ERS design and evaluation

Follow-up work will be required to gain proficiency in the application of this complex technology. The course texts and extensive notes serve as study guides.

Who Should Attend:

Engineers responsible for operating, designing or managing chemical processes that require emergency overpressure relief devices to ensure the safety of the facility in the event of runaway reactions or other pressure-producing events. Engineers who want to learn more about state-of-the-art venting and flow technology. Those responsible for the safe handling of the effluent from an emergency relief device will find this course invaluable.

Prerequisites:

The course assumes that the attendees have thorough understanding and real-world experience working with the basic chemical engineering principles of reaction kinetics, fluid flow, thermodynamics, heat transfer, mass transfer, and heat and material balances. Further, some application of these disciplines in basic emergency relief systems design or evaluation is expected. We recommend taking CH172 prior to attending.

Your Instructors (two of these):

Robert D'Alessandro, William Ciolek, Benjamin McDavid, Theodore Nelson

SAChE Certificate Program

The SAChE Certificate Program offers working engineers an easy way to access a selection of knowledge about chemical process safety. Developed as a supplement to the undergraduate curriculum, these online courses also serve as an excellent introduction or refresher to chemical process safety for working professionals. **For more information, visit www.aiche.org/academy and search "SAChE".**

Pricing for all SAChE Courses:

AIChE Members and Employees of CCPS Member Companies – $169
AIChE Undergrad/Grad Student Members – Free
Non-Members – $199

ENGLISH
SPANISH
MANDARIN
PORTUGUESE

Course may be available in these languages.

NEW! An Introduction to Managing Process Safety Hazards

www.aiche.org/ela953 | Course ID: ELA953

EN SP MA

Process safety is a vital part of everyday operations in chemical engineering. This course explains how a system of process safety management can reduce the potential effects of process hazards. Students will be introduced to the risk-based process safety management system developed by the Center for Chemical Process Safety (CCPS), the world standard for this science. Lectures cover how process safety compares to personal safety and discusses historical events that have led to today's process safety regulations. Students will learn what a good process safety culture looks like and will explore a Management of Change (MOC) case study to understand how MOC helps prevent accidents. In addition, the course will cover safeguards and how safety systems are actually used.

Basics of Laboratory Safety

www.aiche.org/ela909 | Course ID: ELA909

EN SP

This course provides a complete review of safety for laboratories handling hazardous chemicals. It also covers the safe use of key related lab equipment. While the discussion is aimed at laboratory scale, it introduces wider process safety management concepts such as toxicity and toxic levels, flammability, use of safety data sheets, job safety analysis, bio-safety levels, and fire and explosion prevention. Lab-specific subjects such as inspections, personal protective equipment, hazardous material storage, and waste disposal are also fully covered.

Chemical Process Safety in the Chemical Process Industries

www.aiche.org/ela901 | Course ID: ELA901

EN

Get a solid introduction to the application of chemical process safety technology in an actual chemical facility. This course covers the concepts of corporate safety programs, laboratory safety inspections, personal protective equipment and process area safety features and procedures. It also covers Design Institute for Emergency Relief Systems (DIERS) methods for characterizing runaway reactions, equipment and methods for characterizing flammable dusts and vapors, and informal and formal safety reviews.

NEW! Chemical Reactivity Hazards

www.aiche.org/ela962 | Course ID: ELA962

EN SP

Today's chemical engineers must be able to spot potential hazards for uncontrolled chemical reactions. In this intermediate course, students will learn the various types of chemical reactivity hazards and study real-world examples of process safety incidents caused by uncontrolled reactions. Gaining an understanding of common situations where chemical hazards exist, students will learn how to avoid unintended reactions as well as how to control intended reactions. Students will discover how to use compatibility matrix applications and will be able to identify the correct methods to contain and control different types of reactivity hazards.

Dust Explosion Control

www.aiche.org/ela906 | Course ID: ELA906

EN SP

Dust explosions continue to occur in the chemical industry, killing workers, injuring others, and damaging industrial facilities. The U.S. Chemical Safety Board has made recommendations for preventing dust explosions. In this session, you'll learn what those recommendations are and how they must be applied to minimize and control the hazards related to dust explosions.

SAChE Certificate Program (cont'd)

NEW! Fire Hazards

www.aiche.org/ela963 | Course ID: ELA963

EN SP

Uncontrolled fire can have devastating consequences in an industrial setting. Thus, anyone working in a process industry should be aware of potential fire hazards. In this intermediate course, students will study real incidents of fires in process industries, learn to evaluate fire risks and impacts, and discover how to prevent and control fires. By taking an in-depth look at different types of fires (including beneficial applications), learning the necessary conditions for fires to develop, and assessing the flammability of various materials and fuels, this course will equip students to spot and control fire hazards in a range of process industries. Students will be able to assess the impact of fire on people and equipment and suggest fire prevention and mitigation measures for different hazard situations.

NEW! Hazard Recognition

www.aiche.org/ela951 | Course ID: ELA951

EN SP MA

Knowing what to do in chemical engineering starts with recognizing hazards. This introductory course will expand students' knowledge of hazards found in chemical plants and other similar industrial operations where chemical engineers are employed. Students will learn how to recognize common types of hazards they might encounter, as well as to understand what these hazards mean in the overall system. Students will also learn to recognize conditions that may increase the severity of these hazards.

NEW! Hazards and Risk: What Can Go Wrong?

www.aiche.org/ela970 | Course ID: ELA970

EN

In chemical processing, understanding how adverse incidents can arise is an essential component of effective process safety management. This intermediate course is the first of a group directed at the management of hazards and risk. Students will examine the concepts of hazards, consequences and risk and will learn how physical conditions and material properties can present hazards in a process. Finally, students will discuss how failures in selected equipment categories and deficient performance in management systems and procedures can allow hazards to evolve into adverse incidents.

Using case studies, the course will introduce students to the thought process safety practitioners use to anticipate hazardous situations when participating in hazard identification and risk assessment activities. This course positions students to better appreciate the courses that immediately follow in sequence, which will describe the tools available to manage hazards and risks after they are identified and understood.

NEW! Hazards and Risk: Introduction to Pressure Protection

www.aiche.org/ela971 | Course ID: ELA971

EN

Pressure that gets out of control has been the cause of many of the most devastating incidents in the history of chemical processing. The science of overpressure and its prevention and mitigation impact nearly all elements of process safety management. Engineers working in process safety need to have a fundamental knowledge of pressure relief concepts, even if they are never involved in the actual design of pressure relief. This course will provide that knowledge in an orderly progression, with concepts illustrated by numerous case studies.

Students will be introduced to the nature of overpressure and the types of scenarios that can cause it in chemical processing. Students will then learn the types of devices available to provide pressure relief, as well as discuss the types of information needed to size relief for the various scenarios discussed. Finally, the course will present an overview of the basic approaches to safely mitigating the discharges from relieved pressure.

NEW! Identifying & Minimizing Process Safety Hazards

www.aiche.org/ela952 | Course ID: ELA952

EN SP MA

When working with potentially hazardous materials, it's important to have the right tools to handle them. This introductory course reviews the tools with which students will need to be familiar in order to identify, minimize and manage process hazards. Students will explore what "inherently safer design" means and will learn about consequence and risk. Additionally, this course takes hazards into the real world with the introduction of initiators and a case study of an accident.

NEW! Inherently Safer Design

www.aiche.org/ela984 | Course ID: ELA984

EN

Inherently Safer Design (ISD) takes a proactive approach to process safety, aiming to prevent hazards from entering manufacturing processes rather than merely to manage them. Students who take this advanced course will come to understand ISD as a way of thinking rather than a specific tool. The course covers all aspects of ISD, from basic concepts and approaches to challenges in practical application.

Students will learn to evaluate hazard reduction and ISD principles as well as to use the Management of Change (MOC) PSM element to incorporate and maintain ISD changes in proposed process changes. Last, students taking this course will acquire knowledge of which ISD approaches may be most effective at different stages of a process life cycle.

SAChE Certificate Program (cont'd)

Nitrogen's Role in Safety

www.aiche.org/ela910 | Course ID: ELA910

EN SP MA POR This course focuses on nitrogen, which is a staple of the chemical industry. Because it is an inert gas, nitrogen is suitable for a wide range of applications covering various aspects of chemical manufacturing, processing, handling, and shipping. Nitrogen is an excellent blanketing that enables the safe storage and use of flammable compounds and can help prevent combustible dust explosions. It is, however, a significant asphyxiant, and safety principles must be employed in its handling and use.

This two-part lesson will introduce the main safety aspects of nitrogen, first as a safeguard and then as a potential hazard.

Process Safety Lessons Taught from Experience

www.aiche.org/ela908 | Course ID: ELA908

EN Examine important case histories related to process safety—including Bhopal, Seveso, examples of tank failures and T2—and how to use lessons learned to avoid similar mistakes. This course can be used in safety orientations at industrial facilities.

Risk Assessment

www.aiche.org/ela903 | Course ID: ELA903

EN Explore the latest methods for detecting, preventing and mitigating risks in plants. In this course, you'll learn how methods of risk assessment, management and reduction are related and how to ensure they function together successfully in your operation. You'll learn how to assess the health effects of risks, perform a what-if analysis, and plan and implement a Hazard and Operability (HAZOP) Study. You'll delve into screening analysis techniques, checklist reviews, fault tree and event tree analysis, preliminary hazards analysis and chemical plume and dispersion analysis.

Runaway Reactions

www.aiche.org/ela902 | Course ID: ELA902

EN Before you can handle chemical reactions safely, you must first understand them. In this course, you'll identify potential runaway reactions and gain tools for sizing relief systems to safely control and contain them.

NEW! The Importance of Process Safety

www.aiche.org/ela950 | Course ID: ELA950

EN Process safety is an increasingly critical aspect of chemical engineering. This course, taught in three interactive learning units, serves as the perfect introduction to its principles. Students will learn how process safety is defined and how it relates to the AIChE Code of Professional Ethics. After exploring the Four Pillars of Risk-Based Process Safety, they'll review case studies to understand how process safety functions in the real world. Students will emerge from this course with a solid process safety foundation that will be important both for the rest of their SAChE certification training and for their futures in chemical engineering.

NEW! Toxicological Hazards

www.aiche.org/ela961 | Course ID: ELA961

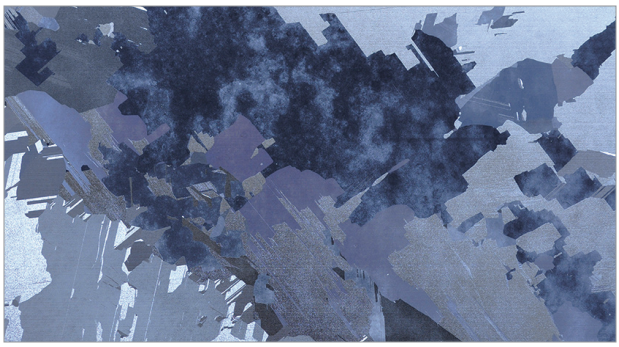
EN Toxicology is the quantitative and qualitative study of the effects of toxicants on biological organisms. This intermediate course explains key concepts related to toxicological hazards. Students will be introduced to vocabulary used to describe specific toxic effects, as well as to resources available to characterize the hazardous properties of chemicals. This course also covers how toxicants can enter biological organisms and how this information is used in the prevention and detection of toxic exposure. Finally, this course also lays the groundwork for other Level 2 courses by explaining how to calculate, estimate and communicate the values of airborne chemical concentrations in several release scenarios.

NEW! Understanding Hazards & Risk

www.aiche.org/ela969 | Course ID: ELA969

EN SP Designed for juniors and seniors who are enrolled in upper-level chemical engineering classes, this course explores the most technical of the four pillars of Risk-Based Process Safety (RBPS): "Understand Hazards and Risk." Part one, Process Knowledge Management, details the most important elements of process knowledge, and how to manage it and measure its effectiveness. Part two explores the major techniques and tools associated with Hazard Identification and Risk Assessment (HIRA). This lecture will illustrate how the various HIRA tools are used to discover potential hazards, and how these tools fit into the overall RBPS system. By focusing on understanding hazards and risk, students will gain important knowledge about how to prevent catastrophic incidents.

AIChE's Crystallization Operations



www.aiche.org/ch110 | Course ID: CH110

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Crystallization can be a powerful separation tool in a broad range of industries. But to optimize it, you must clearly understand the process. Join crystallization expert Wayne Genck for a practical overview of the basics of crystallization, precipitation, and how to apply the fundamentals of crystal growth and nucleation to industrial processes.

In two days, you'll learn about the theory of material, energy and population balances and how to apply it in the production of amorphous and crystalline materials. You'll also explore how to develop methods for scaling up crystallizers and precipitators.

You Will Learn:

- To understand polymorphs and cocrystals
- Crystal size distribution
- Crystal purity and the effects of additives
- Batch and industrial crystallizers
- The mixed-suspension, mixed-product removal crystallizer

Who Should Attend:

Scientists and engineers who are required to understand, optimize and control crystallization processes, especially those who are:

- Engaged in the process development, engineering or operation of organic or inorganic crystallization processes
- Responsible for solving challenges associated with separations involving crystallization

Your Instructor:

Wayne Genck

AIChE's Crystallization Process Development

www.aiche.org/ela101 | Course ID: ELA101

AIChE Members – $695
AIChE Undergrad/Grad Student Members – $347.50
Non-Members – $995

This online course provides an in-depth overview of an integrative approach for crystallization development—using models to analyze the SLE behavior of the system, validating the model using relevant experimental data, and systematically synthesizing a crystallization process based on the solid-liquid equilibrium (SLE) behavior. Starting with fundamental issues such as solubility and physical properties, we will discuss the relevant theories, methods, experimental techniques, and design methods that have been used in many industrial applications for developing an optimum crystallization process. Various examples will be provided throughout the course.

You Will Learn:

Participants will learn about the solid-liquid equilibrium (SLE) phase diagram and its usage in synthesizing crystallization processes, systematic methods for generating and evaluating crystallization process alternatives using SLE phase diagrams, and calculation and experimental methods for generating SLE phase diagrams.

Who Should Attend:

- Chemists and engineers engaged in the development of processes or operations that involve crystallization
- Process engineers interested in learning about logical and systematic approaches for synthesizing and developing crystallization processes

Your Instructor:

Christianto Wibowo

AIChE's Flow of Solids in Bins, Hoppers, Chutes and Feeders

SAVE $795
or more when you take CH032 and CH033 together.
Just register for course CH757: Flow of Solids/Pneumatic Conveying Combo Course.
www.aiche.org/ch757

ALSO AVAILABLE AS ELS102

www.aiche.org/ch032 | Course ID: CH032

AIChE Members – $1,495
AIChE Undergrad/Grad Student Members – $747.50
Non-Members – $1,795

Too often, bulk solids are being handled without a good understanding of how to correctly design, select, troubleshoot, maintain and purchase bulk solids handling equipment. As a result, costly flow problems occur that slow production. In this course, you'll learn proven design and troubleshooting principles for handling bulk solids in bins, hoppers, feeders and transfer chutes for safe and trouble-free plant operation.

In two days, you'll review the fundamentals of bulk material flow and examine common flow problems, types of flow patterns in equipment and how flow properties of bulk solids are measured. You'll study feeder design, learn proven troubleshooting techniques and gain insight into flow problems that occur when handling fine powders. The instructor also covers common mechanisms of segregation and solutions to these costly problems and gives practical advice for using flow-aid devices.

Throughout the course, real-life industrial case histories will illustrate the complex concepts you'll learn. In addition, workshops help increase your understanding.

You Will Learn:

- The pitfalls of poor bulk solids handling
- Common flow problems and their costly consequences
- The flow patterns and features of silos, bins and hoppers
- Testing bulk solids flow properties and how to use the results
- Solving ongoing bulk solids feeder problems
- Why fine powders can have restricted or uncontrolled flow rate
- Step-by-step procedures for designing a bin or silo
- Practical solutions to segregation mechanism problems
- Selecting the appropriate common flow-aid device
- How to avoid transfer chute plugging and how to minimize wear and dusting

Who Should Attend:

Those involved in designing, selecting, troubleshooting, maintaining or purchasing bulk solids handling equipment—including:

- Plant and project managers
- Operation and process managers
- Project, process and maintenance engineers
- Unit operators and superintendents
- Anyone new to the field of bulk solids handling

Your Instructor:

Eric Maynard, Herman Purutyan, Thomas Troxel or Andres Orlando

AIChE's Flow of Solids in Bins, Hoppers, Chutes and Feeders

www.aiche.org/els102 | Course ID: ELS102

AIChE Members – $795
AIChE Undergrad/Grad Student Members – $397.50
Non-Members – $1,095

E ☑

ALSO AVAILABLE AS CH032

This online course provides a fundamental grounding in the key areas of bulk solids handling equipment selection, design, and troubleshooting. Strategies for alleviating costly flow problems in silos, bins, hoppers, feeders, and transfer chutes are presented, as well as proven techniques to design solids handling equipment to operate efficiently, safely, and reliably.

The lectures are supplemented with practical examples and actual industrial case histories to illustrate the complex concepts taught.

You Will Learn:

- Bulk solids handling fundamentals
- Flow patterns in bins and hoppers
- Flow properties and their application to design/ troubleshooting
- Fine powder handling phenomena
- Common segregation mechanisms for powders and solids
- Proven solutions with segregation for powders and solids

Who Should Attend:

Those involved with designing, troubleshooting, maintaining, or purchasing bulk solids handling equipment:

- Plant and project managers
- Operation or process managers
- Project and maintenance engineers
- Personnel new to the field of bulk solids handling

Your Instructor:

Eric Maynard

AIChE Academy
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AIChE's Pneumatic Conveying of Bulk Solids

SAVE $795
or more when you take CH033 and CH032 together.
Just register for course CH757: Pneumatic Conveying/ Flow of Solids Combo Course.
www.aiche.org/ch757

ALSO AVAILABLE AS ELA111

www.aiche.org/ch033 | Course ID: CH033

AIChE Members – $1,195
AIChE Undergrad/Grad Student Members – $547.50
Non-Members – $1,395

Although many pneumatic conveying equipment advances have been made, costly problems—including wear, attrition, rate limitation and line plugging—continue to occur. Learn how to apply practical design and troubleshooting principles to improve the efficiency, safety and reliability of pneumatic conveying systems transporting powders and bulk solids.

In one day, you'll review the fundamentals of gas-solids flow and address common pneumatic conveying problems, modes of transport in a pipeline, and scale-model tests and their use in systems design and evaluation of poorly operating systems. You'll discuss line chargers (feeders), proven pipeline layout rules, and criteria for elbow/bend selection. The instructor will also cover more specialized topics, including dense phase conveying systems and gas-solids separators such as cyclones, filters and bag houses. Real-life industrial case histories will help increase your understanding of the theory and application taught.

You Will Learn:

- Modes of conveying: dilute phase and dense phase
- Types of systems: positive pressure, vacuum, pull/push and closed loop
- The science underlying gas and solids flow through pipelines
- To understand key terms—like "saltation and pickup velocity" and "solids loading ratio"
- How to read a state diagram illustrating system performance
- The four primary system components: Gas mover, silo/feeder, pipeline/bends and separator
- How to select elbows, line chargers and other key primary system components
- To know the features of solid separators—cyclones, filter/collectors and bag houses
- Dense phase conveying technology—what you need to know
- Troubleshooting common conveying problems—including wear, attrition, rate limitation and line plugging
- Applying safe handling practices for the pneumatic conveying of combustible solids

Who Should Attend:

Engineers involved in designing, selecting, troubleshooting, maintaining or purchasing pneumatic conveying equipment—including:

- Plant and project managers
- Operation and process managers
- Project, process and maintenance engineers
- Unit operators and superintendents
- Professionals new to the field of pneumatic conveying

Your Instructor:

Eric Maynard, Herman Purutyan, Thomas Troxel or Andres Orlando

Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: E eLearning | P Public | Train-A-Team | Approved | Best Seller

AIChE's Pneumatic Conveying of Bulk Solids

www.aiche.org/ela111 | Course ID: ELA111

AIChE Members – $595
AIChE Undergrad/Grad Student Members – $297.50
Non-Members – $895

E ✓

ALSO AVAILABLE AS CH033

Although many pneumatic conveying equipment advances have been made, costly problems–including wear, attrition, rate limitation and line plugging–continue to occur. This online course will help you learn how to apply practical design and troubleshooting principles to improve the efficiency, safety and reliability of pneumatic conveying systems transporting powders and bulk solids.

In this course, you will review the fundamentals of gas-solids flow and address common pneumatic conveying problems, modes of transport in a pipeline and scale-model tests and their use in systems design and evaluation of poorly operating systems. You'll discuss line chargers (feeders), proven pipeline layout rules and criteria for elbow/bend selection.

You Will Learn:

- Modes of conveying: dilute phase and dense phase
- Types of systems: positive pressure, vacuum, pull/push and closed loop
- To understand key terms–like "saltation and pickup velocity" and "solids loading ratio"
- The four primary system components: gas mover, silo/feeder, pipeline/bends and separator
- Dense phase conveying technology

Who Should Attend:

Industrial plant operations and maintenance workers who need to have practical methods for identifying and managing physical and process hazards.

Your Instructor:

Eric Maynard

AIChE's Particle and Bulk Solids Characterization Technology

www.aiche.org/ch763 | Course ID: CH763

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

✓

Given the wide range of technologies available today for powder and particle characterization, selecting the best option for an application is not easy. Join particle characterization and technology experts Remi Trottier and Karl V. Jacob to gain a solid understanding of the basics of particle and bulk solids characterization necessary to properly select instruments and validate data, and for a look at the latest commercially available technologies.

In two days, you'll gain characterization and data interpretation skills to better control particulates, particulate formulation, suspensions and dispersions.

You Will Learn:

- Instrument evaluation and proper selection
- Particle size and bulk powder data interpretation
- Ensemble and fractionation methods
- Single particle counting methods
- Measurement of bulk powder properties
- Method development and validation

Who Should Attend:

Scientists and engineers with little or no knowledge of particle and bulk solids characterization technology–including:

- Plant engineers
- Project engineers
- Project managers

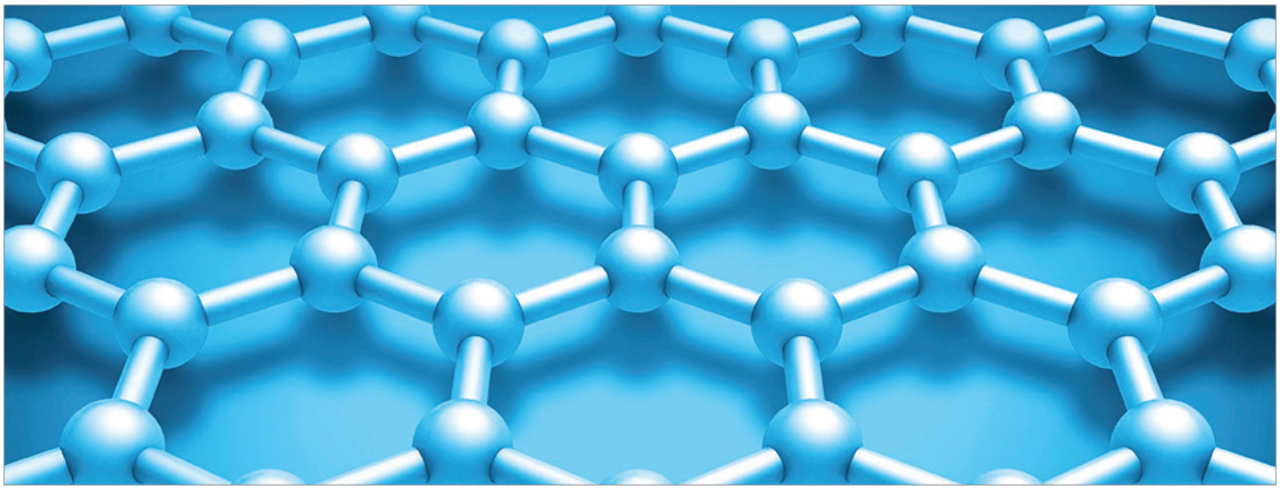
Your Instructors:

Karl V. Jacob and Remi Trottier

Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: E eLearning | P Public | Train-A-Team | ✓ Approved | ★ Best Seller

AIChE's Particle Technology



www.aiche.org/els106 | Course ID: ELS106

AIChE Members – $895
AIChE Undergrad/Grad Student Members – $447.50
Non-Members – $1,195

The importance of knowledge of the science of particulate materials to the process industries cannot be overemphasized. Very often, difficulties in the handling or processing of powders are ignored or overlooked at the design stage, with the result that powder-related problems are the cause of an inordinate number of production stoppages.

This online course is intended as an introduction to particle technology. The topics included have been selected to give coverage of the broad areas of particle technology: particle size analysis, packed and fluidized beds, storage and transport (hopper design, pneumatic conveying, standpipes, slurry flow), separation (filtration and gas cyclones), and safety (fire and explosion hazards, health hazards).

You Will Learn:

- Particle technology in the process industries
- Single particles in fluids
- Particle size measurement
- Flow of fluids through packed beds of particles
- Fluidization
- Pneumatic transport of powders

Who Should Attend:

Engineers and scientists in process industries where particulate solids are handled and processed, including:

- Those in the pharmaceutical, chemical and mineral processing industries
- Those new to working with powders

Your Instructor:

Martin Rhodes

SBE's Biomanufacturing for Chemical Engineers

www.aiche.org/ela103 | Course ID: ELA103

AIChE and SBE Members – $995
AIChE and SBE Undergrad/Grad Student Members – $497.50
Non-Members – $1,295

Delve into the fundamentals of biomanufacturing. You'll focus on the unit operations utilized to manufacture biological drug products. After an overview of product types, processes, and current Good Manufacturing Practice, you'll address the maintenance of cell lines and growth of cells in a bioreactor. Topics such as mass transfer, process control, and product expression are emphasized. In the second half of the course, lectures focus on downstream unit operations that harvest cells, remove byproducts or contaminants, and fill the final bulk product.

You Will Learn:

- How biopharmaceutical production is regulated
- Cryopreservation
- Basics of metabolism and nutrition requirements
- Cell growth for industrial production
- Centrifuge process and performance parameters
- Stages of a process for production of a biopharmaceutical, including objectives of and equipment used for each stage
- GMP and key requirements
- Common chromatography techniques used in biomanufacturing and the protein property exploited in each
- Techniques used to protect product from microbial contamination during bulk filling

Who Should Attend:

Any chemical engineer working in a design, operations, or support function within a biopharmaceutical or vaccine company.

Your Instructor:

This course was developed in conjunction with the Biomanufacturing Training and Education Center (BTEC) at NC State.

Hear what companies are saying about AIChE's Train-a-Team.

www.aiche.org/trainateam

Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: eLearning | Public | Train-A-Team | Approved | Best Seller

SBE's Bioseparations: Principles, Applications and Scale-Up

www.aiche.org/ch401 | Course ID: CH401

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Gain a solid understanding of the principles, applications and scale-up of bioseparation processes and learn how to apply them to your day-to-day work. In two days, you'll learn the most important unit operations in industrial bioseparation processes and how to avoid mistakes when analyzing and interpreting bioseparation data. You'll find out how to select appropriate bioseparation equipment and techniques for successful scale-up. Plus, you'll cover other relevant topics, from filtration and extraction to chromatography, adsorption and drying.

You Will Learn:

- The basic science and mechanisms of various types of bioseparations
- Assaying the biological activity and purity of bioproducts: how to identify and select the right laboratory methods
- How to perform engineering analyses of bioseparation processes

Who Should Attend:

Engineers and scientists who need a better understanding of the bioseparation processes. It will be especially valuable if you're in these industries:

- Pharmaceutical
- Biotechnology
- Food

Your Instructor:

Roger Harrison

Society for Biological Engineering
An AIChE Technological Community

The Society for Biological Engineering (SBE) is an AIChE Technological Community, leading engineers and scientists dedicated to advancing the integration of biology with engineering.

SBE is committed to promoting the integration of biology with engineering and realize its benefits through bioprocessing, biomedical and biomolecular applications.

Learn more and join at **www.aiche.org/sbe**

SBE's Biotechnology for Chemical Engineers

www.aiche.org/ela102 | Course ID: ELA102

AIChE and SBE Members – $995
AIChE and SBE Undergrad/Grad Student Members – $497.50
Non-Members – $1,295

Learn the fundamentals of biotechnology with this course designed for chemical engineers working in design, operations, or other support functions.

This online course focuses on the methods used to develop cell lines to produce a variety of biological drug products. It begins by presenting an overview of microorganisms, other cells, and identification techniques commonly used. These concepts are then used to introduce the methods used for cell line development, metabolic engineering, and several "omics" tools. The final session focuses on expression and purification of biological drug products, monitoring cell growth and product expression, and fermentation/cell culture.

You Will Learn:

- Survey of microorganisms and cells
- Microbial and cell identification by morphology, physiology and genome sequencing
- Overview of biological drug products
- Basic genetic engineering of microorganisms for cell line development
- Metabolic engineering and use of "omics"
- Expression and purification of biological drug products
- Monitoring cell growth and product expression
- Basic concepts of fermentation and cell culture

Who Should Attend:

Any chemical engineer working in design, operations, or a support function who wants a deeper understanding of the fundamentals of biotechnology processes.

Your Instructor:

This course was developed in conjunction with the Biomanufacturing Training and Education Center (BTEC) at NC State.

IfS' Product Stewardship

www.aiche.org/ela136 | Course ID: ELA136

AIChE and IfS Members – $695
AIChE and IfS Undergrad/Grad Student Members – $347.50
Non-Members – $995

Gain new insight into the practice of product stewardship from the perspective of chemical product manufacturers.

You'll learn the concepts and principles underlying product stewardship as well as the roles and responsibilities through each stage of the life cycle. Examine how products are developed, produced and managed to minimize the risks to health and the environment while maximizing value to customers.

Delve into the importance of understanding and engaging all stakeholders, managing product stewardship as a company, and individual roles and responsibilities. Address product life cycle thinking perspectives, risk characterization and risk management, and the necessity of compliance. Define what is "green" and consider how business-to-business interactions influence product stewardship.

While this course is relevant to all products and their life cycles (because all products contain chemicals), it is especially valuable to those directly involved as raw material suppliers, manufacturers, users or disposers affected by a product and its associated processes. It is also relevant for those who influence a product's environmental and health risk management.

You Will Learn:

- Drivers for product stewardship
- Meaning and sources of "risk" and risk perception
- How risk reduction and management can be achieved
- Compliance's role at setting a minimum for product stewardship
- Broad range of potential legal requirements
- How governments try to minimize risk and cost/benefit considerations
- What "green" or "safe" product claims entail, and standards for making claims
- The value chain/supply chain in product stewardship
- How business customers influence product stewardship
- Voluntary and not-so-voluntary standards
- Ethical challenges that go beyond compliance
- Components of a product stewardship program for a chemical company using ACC Responsible Care Product Safety Code
- Challenges for product stewardship

Who Should Attend:

- Professional product stewards and environmental health and safety specialists
- Researchers
- Process engineers and operations supervisors
- Product managers
- Marketers
- Regulatory and legal specialists
- Purchasers
- Environmental and human health scientists
- Business managers
- Government regulators
- NGOs (non-governmental organizations)

Your Instructor:

Georjean Adams

IfS' Supply and Value Chain Management for Engineers

www.aiche.org/ela133 | Course ID: ELA133

AIChE and IfS Members – $695
AIChE and IfS Undergrad/Grad Student Members – $347.50
Non-Members – $995

Explore key supply chain management principles, strategies, risks and opportunities that you may be expected to know in your production, manufacturing or management role.

Sustainability expert Jeffrey Seay begins with an overview of what a supply chain is, how it works, the importance of matching supply and demand, and stumbling blocks within the supply chain that you should keep on your radar. You'll also address supply chain management–its different features and principles, key issues that drive sustainability, and customer/supplier relationships.

You Will Learn:

- How to identify the components of a supply chain
- How to examine the key features of supply chain management
- The linkages between supply and demand
- How to identify the key issues for sustainable supply chain management
- The risk and opportunities found within the supply chain
- How supply chain management is linked with sustainability

Who Should Attend:

- Production
- Manufacturing
- Management

Your Instructor:

Jeffrey Seay

institute for sustainability
An AIChE Technological Community

The Institute for Sustainability (IfS) is an AIChE Technological Community, serving the needs of and influencing the efforts of professionals, academes, industries, and governmental bodies that contribute to the advancement of sustainability and sustainable development.

Learn more and join at **www.aiche.org/ifs**

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Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: eLearning | Public | Train-A-Team | Approved | Best Seller

IfS' Essentials of Environmental Life Cycle Assessment

www.aiche.org/ela141 | Course ID: ELA141

AIChE and IfS Members – $695
AIChE and IfS Undergrad/Grad Student Members – $347.50
Non-Members – $995

Improve the environmental profile of your company's products and processes using Life Cycle Assessment (LCA).

In today's world, more and more companies recognize their environmental responsibilities run from "cradle to grave." Understanding how your company's products measure up requires new tools for looking at environmental impacts across the production process.

Now you can get up to date on the latest advancements in Life Cycle Assessment (LCA), a powerful and evolving toolset for managing environmental impacts and sustainability. In this online course, taught by a leading expert in sustainability, you'll explore the role that life cycle information in the hands of companies, governments and consumers may have in improving the environmental impact of consumer products and the industrial processes behind them. This eight-unit course provides an overview that will help any attendee better understand how LCA is conducted and the impact it can have. Government policymakers will learn how to make environmentally driven policies at the local, state and national levels. Product manufacturers will discover how to advance sustainability. University students will identify environmental assessment tools. And members of NGOs and consumer protection groups will learn how to promote proper environmental product labeling.

You Will Learn:

- Overview of life cycle–the concept behind the methodology, the history of its development, and ISO standards that provide the LCA framework
- Life cycle thinking–the series of activities a product is associated with along its life cycle
- Goal and scope definition–properly defining the goal of an LCA
- Life cycle inventory–different methodological approaches
- Impact assessment and the details of impact modeling
- Interpretation and reporting–how to analyze, interpret and report LCA results while maintaining transparency
- Global application of LCA as an environmental management tool and for assessing environmental impact
- Sustainability assessment–how to bring these tools together in a comprehensive decision-making process

Who Should Attend:

Attend this course if you're interested in gaining a fuller understanding of Life Cycle Assessment and how it applies to your situation. Anyone charged with implementing or overseeing an LCA for their products and processes should attend, including:

- Product manufacturers
- Engineers and managers
- Government policymakers
- NGOs (non-governmental organizations) members
- Members of consumer protection groups

Your Instructor:

Mary Ann Curran

AIChE's Professional Ethics & Excellence for Chemical Engineers

www.aiche.org/ela127 | Course ID: ELA127

AIChE Members – $395
AIChE Undergrad/Grad Student Members – $197.50
Non-Members – $695

As a chemical engineer, your actions affect the health, safety and welfare of society. That means your ethical conduct as a professional is of the utmost importance. In this online course, you'll gain an introduction to key issues in engineering ethics while you prepare to confront and resolve the inevitable ethical dilemmas you'll encounter in your career.

You Will Learn:

- The basis for codes of engineering ethics, and their limitations
- Main principles underlying most codes of engineering ethics
- Understanding ethics in terms of human interactions
- The many needs met through work
- Key principle for handling all human interactions
- Ways to enhance your experience of work—and that of the people around you

Who Should Attend:

Engineers and managers across all sectors who want to better understand engineering ethics and develop the skills that lead to professional excellence. Whether you're new to engineering or a seasoned veteran, you'll gain insight and tools you can immediately put into practice in your workplace to raise the ethics bar and achieve the highest professional standards in engineering.

Your Instructor:

Alan Rossiter

AIChE's Intellectual Property for Chemical Engineers

www.aiche.org/els107 | Course ID: ELS107

AIChE Members – $895
AIChE Undergrad/Grad Student Members – $447.50
Non-Members – $1,195

Protecting intellectual property is increasingly important to engineers and the firms they work with. Yet many engineers do not understand the complexities of the America Invents Act (AIA), or what patent legislation means in practice.

In this online course, you'll get the most current information regarding the new U.S. Patent laws and learn how to work with them to protect the technologies, processes or products you are developing. By enrolling in this course, you will be exposed to numerous basic patent laws and corresponding strategy, including: AIA practices and regulations, intellectual property laws, and principles such as patents, trade secrets, copyrights and trademarks.

You Will Learn:

- The first-to-file system
- Providing types of prior art to invalidate patents
- Providing many ways to challenge patents, both pre- and post-grant
- Providing defenses to patent infringement

Who Should Attend:

Engineers involved in R&D and/or IP development/ management may find this course particularly useful.

Your Instructor:

Heath Briggs

AIChE's Six Sigma: A Practical Overview

www.aiche.org/ela108 | Course ID: ELA108

AIChE Members – $695
AIChE Undergrad/Grad Student Members – $347.50
Non-Members – $995

Six Sigma is successfully practiced throughout the chemical engineering industry for improvement, organization and problem-solving. In this course, you'll learn how to apply the tools and methodologies of Six Sigma, Lean and Change Management in ways that are important to you as a chemical engineer in today's world.

This course is about getting better at processes, roles, metrics and operations. You'll learn how to drive change effectively and stay close to your stakeholders and customers. You'll explore risk management and how to ensure your outcomes are achieved and supported by stakeholders. In addition, you'll gain a better understanding of the people dynamics of teams and learn how to improve your team adoption efforts and team effectiveness.

By the end of the course, you'll be able to write a simplified project charter and high-level process map, and to use an effective process to develop a deeper understanding of root causes and their impact on a problem. You'll also be equipped with risk management tools to predict and prevent failures and align better with stakeholders important to your project and career.

After taking this course, you will be able to:

- Describe the 8 basic components of Lean, Six Sigma and Change Management
- Write a simplified project charter
- Draft a high-level process map
- Utilize an effective process to identify root causes and their impact on the problem
- Identify risk management tools used to predict and prevent failures
- Describe strategies to align with stakeholders important to your project and career
- Identify which roles are needed in the Six Sigma project team
- Describe how to identify and maintain sponsorship of the initiative

Who Should Attend:

Project leaders, engineers who lead groups, change agents, risk managers, and leaders in operational excellence, continuous improvement, quality control and team effectiveness.

Your Instructor:

Janet Hammill

For 2018 Public Course dates and locations, see page 5.

AIChE's Introduction to Project Management

www.aiche.org/ela149 | Course ID: ELA149

AIChE Members – $395
AIChE Undergrad/Grad Student Members – $197.50
Non-Members – $695

Research shows 80% of those with project management responsibilities have received no training. This eLearning course will bring you up to speed quickly on basic project management vocabulary and techniques—so you will be ready when you're tapped on the shoulder and appointed project manager.

This practical and concise introduction to project management will help you anticipate and manage the challenges ahead. You'll learn how to develop a project plan, gain understanding of the project management life cycle and knowledge areas, and become aware of how project management has developed as a science in the United States.

Designed for novice project managers who find themselves "in charge" but aren't sure where to start or how to proceed, this course provides the solid grounding in project management basics needed to meet milestones and deliverables with confidence.

You Will Learn:

- How to identify the benefits of using project management techniques
- To list the process groups required to manage a project
- How to recognize key technical project management knowledge areas
- To list several elements of a well-written project plan

Who Should Attend:

Novice and aspiring project managers who want to expand their knowledge of fundamental project management techniques and vocabulary.

Your Instructors:

Gwenn Carr and Gary Englehardt

Hear what companies are saying about AIChE's Train-a-Team.

www.aiche.org/trainateam

Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: eLearning | Public | Train-A-Team | Approved | Best Seller

AIChE's Project Management for Chemical Engineers

www.aiche.org/ch138 | Course ID: CH138

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

In today's global and fast-paced world, the ability to manage complex projects is vital to keep up with industry's demands and needs. Yet many chemical engineers have had no formal training in project management and lack the skills required to bring projects in on time and within budget. Join project management experts Gwenn Carr and Gary Englehardt and gain the skills, as well as time-tested and proven templates, that will ensure your project is a success.

In two highly interactive days, you'll walk through the key steps of successful project management—including how to initiate, plan, control, monitor, execute and close out projects. Bring your project with you and be ready to fully participate in this course.

You Will Learn:

- The difference between successful and unsuccessful projects
- The characteristics of effective project leaders
- Common elements of every successful project plan
- Gaining buy-in from stakeholders
- Developing a communication plan

Who Should Attend:

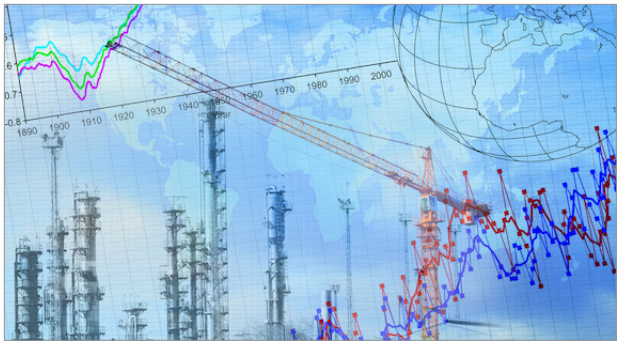
Chemical engineers who face the challenge of managing projects—including:

- New project managers
- Experienced project managers
- Virtual team project managers

Your Instructors:

Gwenn Carr and Gary Englehardt

AIChE's The Keys to Managing a Capital Project Successfully



www.aiche.org/ch149 | Course ID: CH149

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Capital projects present significant challenges such as risk, cost and schedule. In this face-to-face course, learn tips and techniques that will help you to successfully manage a capital project. Learn strategies for detail planning, monitoring and controlling a capital project and get hands-on practice using instruments that allow you to more effectively and efficiently manage projects.

You Will Learn:

- How to construct a work breakdown structure to use in planning the project
- How to construct appropriate risk handling instruments
- How to create and complete appropriate stakeholder and communication management instruments

Who Should Attend:

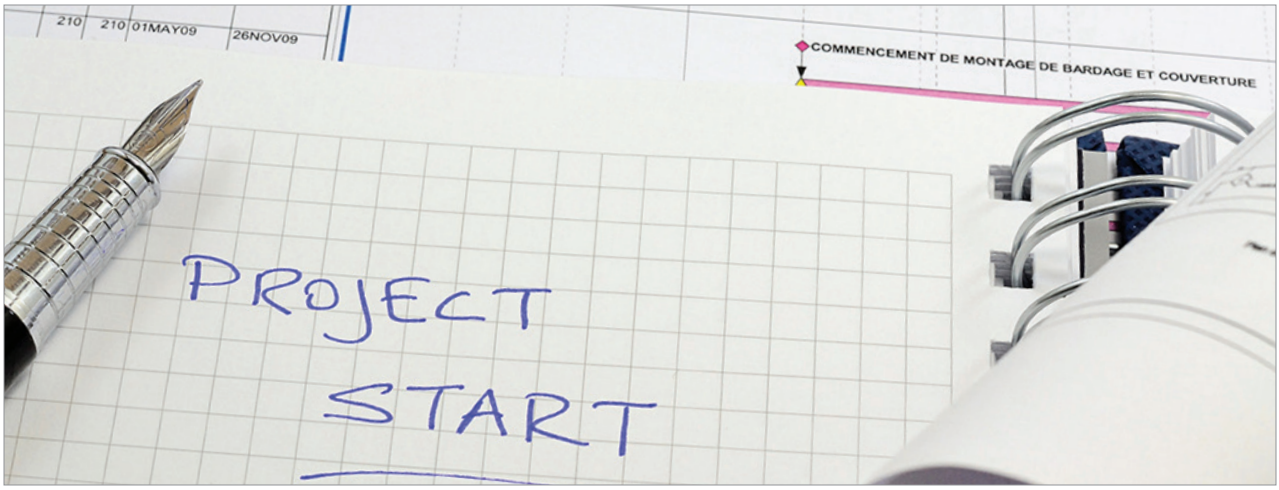
Those who are managing capital projects, including Managers, Project Coordinators and Project Managers.

Your Instructor:

Gwen Carr, Gary Englehardt or Fred Williams

Please refer to index on p. 70 for all instructor bios.

AIChE's The Three Keys to Managing a Project Successfully



www.aiche.org/ch137 | Course ID: CH137

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Projects come with many moving parts, unknown variables—and landmines. No project manager has a crystal ball to predict and manage the risk ahead. But it may be mitigated. Be ready by mastering the three most important skills that will help you manage and control projects and achieve success. Attend this one-day course and learn how to plan a project, handle risk and manage communications with the stakeholders who need to stay informed.

First, you'll learn how to create a project plan that guides the execution and control of your project. You'll identify the components of a solid plan and the various areas it must cover. You'll then learn how to build a work breakdown structure and use it to organize your project and its diverse tasks. Next, you'll address how to identify potential risks, understand where they can emerge and apply proven risk-management tools to eliminate them early on. The third skill you'll learn is how to build a communication plan and leverage it to identify stakeholders and make sure communication with them is efficient and timely.

Templates will be provided in this course that you can scale for use on your own projects, large and small. Learn-by-doing techniques will be used to introduce and reinforce the skills and techniques you learn.

You Will Learn:

- How to develop a project plan
- Building a work breakdown structure
- Identifying and managing risks
- Identifying stakeholders
- Creating a communications plan

Who Should Attend:

- Professionals who manage projects of any size or level of complexity
- Engineers who lead project teams

Your Instructor:

Gwen Carr, Gary Englehardt or Fred Williams

AIChE's Modeling Techniques in Excel

www.aiche.org/ela181 | Course ID: ELA181

AIChE Members – $395
AIChE Undergrad/Grad Student Members – $197.50
Non-Members – $695

Develop a deeper knowledge of spreadsheets, especially Excel, which you need to improve your financial and evaluation modeling and analysis. This online course will bring you up to speed on the features of Excel that best apply to the specific evaluations chemical engineers get involved with, and how to use them to develop your own models.

Modeling expert Robert Salvin will begin by introducing the concept of modeling and different types of models. You'll review key Excel principles and then, through the use of three example models—budget, project decision-making and financial statement—you'll learn how to apply these principles. This course also highlights the features of Excel that best apply to these models.

In addition, you'll review key evaluation principles—time value of money, present value and rate of return—and how to use Excel to generate these values. You'll identify spreadsheet errors chemical engineers commonly make and will learn how to avoid them. Throughout the course, you'll learn practical skills to improve your day-to-day modeling efforts, such as how to best organize a spreadsheet, develop an evaluation model in Excel, and apply model guidelines to your own work.

You Will Learn:

- The organization of a spreadsheet and what it consists of
- How to best develop an evaluation model in Excel
- What Excel functions are available to project evaluation
- The meaning of net present value and rate of return
- Pitfalls of using spreadsheets and how to avoid them
- What financial statements are

Who Should Attend:

Any engineer who is involved in project development, evaluation and decision-making and who needs to use Excel spreadsheets for financial and evaluation analyses.

Your Instructor:

Robert Salvin

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AIChE's Spreadsheet Problem-Solving for Chemical Engineers

www.aiche.org/ch764 | Course ID: CH764

AIChE Members – $1,495
AIChE Undergrad/Grad Student Members – $747.50
Non-Members – $1,795

ALSO AVAILABLE AS ELS101

Spreadsheets are the chemical engineer's tool of choice for day-to-day problem-solving; however, most chemical engineers have little formal training in their application to typical scenarios. This two-day course provides a comprehensive, hands-on overview of spreadsheet applications, focused on the needs of chemical engineers. Join expert instructor David Clough, who has taught this course over 100 times, as he provides dozens of useful tips and techniques to fill gaps in your spreadsheet knowledge.

In two days, you will implement typical chemical engineering calculations using Excel, including material and energy balances, fluid flow and heat transfer, separations, chemical reactions and flowsheets. You will learn methods for solving algebraic and differential equations associated with these scenarios. You will analyze data with spreadsheet methods, including statistical methods and model-fitting. Optimization methods for process design, scheduling and economics are also included.

You Will Learn:

- Improve your basic skills with Excel so that your work is more efficient and reliable
- Develop well-organized, well-documented spreadsheets for chemical engineering calculations that can be understood by other engineers (and... by you, a few months down the road)
- Use Excel's built-in functions for calculations and table-based operations
- Set up spreadsheet-based flowsheet calculations, including processes with recycle streams
- Carry out model-fitting calculations using regression techniques, both linear and nonlinear
- Learn targeting and case study techniques
- Set up cash flow tables for venture-guidance profitability analysis

Who Should Attend:

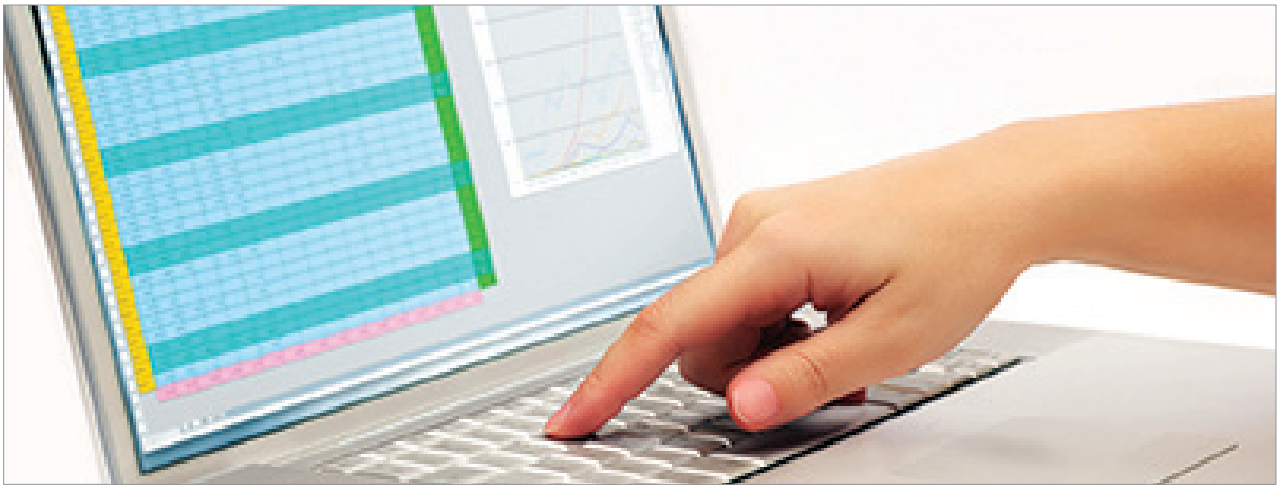
Chemical engineers with basic knowledge of Excel and common spreadsheet operations. Those involved in process engineering, design and economic evaluation, research and development, and chemical engineering education will find value in this course.

Your Instructor:

David Clough

SAVE $795
or more when you take CH764 and CH766 together.
Just register for course CH768: Spreadsheet Problemsolving/ Excel VBA Programming Combo Course.
www.aiche.org/ch768

AIChE's Spreadsheet Problem-Solving for Chemical Engineers



www.aiche.org/els101 | Course ID: ELS101

AIChE Members – $1,095
AIChE Undergrad/Grad Student Members – $547.50
Non-Members – $1,395

ALSO AVAILABLE AS CH764

Many chemical engineers are self-taught in the use of spreadsheets for day-to-day problem-solving, which is testimony to the inherent usefulness of this tool. Although spreadsheet software was developed for financial calculations, engineers and scientists in all fields have found spreadsheets to be their tool of choice. In this online course, Dr. Clough will provide instruction using Excel to illustrate a wide range of spreadsheet applications and skills that are relevant to the calculations and problem-solving encountered by practicing chemical engineers.

You will learn how to bring the many features and capabilities of Excel to the challenge of solving problems that you encounter in your work.

You Will Learn:

- Excel basic skills–improving your efficiency
- Working with tables of data and information
- Process calculations, including flow sheeting and economic analysis
- Applied statistics, including regression analysis
- Solving equations–algebraic and differential
- Programming in Excel using VBA

Who Should Attend:

Chemical engineers who already have some level of proficiency with Excel and use spreadsheeting as a common software tool for problem-solving. Knowledge of programming in VBA is not required nor expected.

Your Instructor:

David Clough

AIChE's Excel VBA Programming for Chemical Engineers

www.aiche.org/ch766 | Course ID: CH766

AIChE Members – $1,195
AIChE Undergrad/Grad Student Members – $547.50
Non-Members – $1,395

ALSO AVAILABLE AS ELA118

If you know your way around Microsoft Excel and you're ready to learn Visual Basic for Applications (VBA) programming, this course is for you. Join chemical engineer and VBA expert David Clough for an intensive, hands-on introduction to the built-in programming capabilities of Microsoft Excel and its companion VBA programming language. Learn how to take your spreadsheet problem-solving skills to the next level.

In one day, you'll learn how to improve your efficiency and enhance your spreadsheets by incorporating VBA. You'll discover how to create time-saving shortcuts via VBA macros and to develop user-defined functions to package custom chemical engineering calculations. You'll also learn how to manage information between the spreadsheet and VBA environments. And you'll see how to design and implement interfaces, including user forms and communication, with other software packages, such as process simulators. Throughout the day, you'll cover dozens of topics—everything from creating Excel add-ins to user interfaces—that will improve your Excel problem-solving skills immediately.

You Will Learn:

- How to work back and forth between Excel and VBA
- Recording and editing macros
- Debugging VBA code
- Developing Excel add-ins
- VBA programming fundamentals and techniques
- Excel user interfaces: message and input boxes and user forms

Who Should Attend:

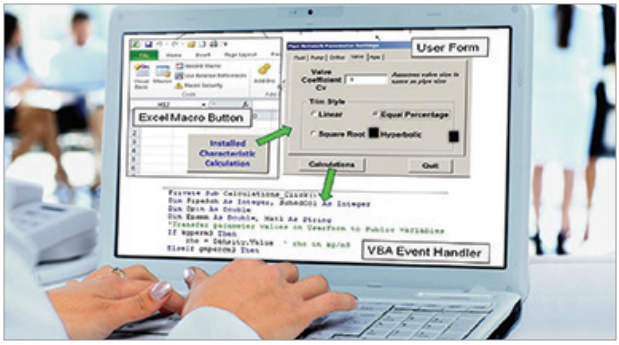
Engineers or scientists who have been working with Excel for some time, have basic spreadsheet skills and basic knowledge of computer programming, or have attended AIChE's Spreadsheet Problem-Solving for Chemical Engineers (CH764).

Your Instructor:

David Clough

SAVE $795
or more when you take CH766 and CH764 together.
Just register for course CH768: Excel VBA Programming/ Spreadsheet Problemsolving Combo Course.
www.aiche.org/ch768

AIChE's Excel VBA Programming for Chemical Engineers



www.aiche.org/ela118 | Course ID: ELA118

AIChE Members – $795
AIChE Undergrad/Grad Student Members – $397.50
Non-Members – $1,095

If you know your way around Microsoft Excel and you're ready to learn Visual Basic for Applications (VBA) programming, this course is for you. In this online course, chemical engineer and VBA expert David Clough will introduce the built-in programming capabilities of Microsoft Excel and its companion VBA programming language. Learn how to take your spreadsheet problem-solving skills to the next level.

You Will Learn:

- How to work back and forth between Excel and VBA
- Recording and editing macros
- Debugging VBA code
- Developing Excel add-ins
- VBA programming fundamentals and techniques
- Excel user interfaces: message and input boxes and user forms

Who Should Attend:

Engineers or scientists who have been working with Excel for some time, have basic spreadsheet skills and basic knowledge of computer programming, or have taken AIChE's Spreadsheet Problem-Solving for Chemical Engineers course.

Your Instructor:

David Clough

AIChE's Cash Flow Principles for Chemical Engineers

www.aiche.org/ela147 | Course ID: ELA147

AIChE Members – $395
AIChE Undergrad/Grad Student Members – $197.50
Non-Members – $695

Projects can fail or succeed based on cash flow, yet many chemical engineers don't truly understand cash flow or its role in project evaluation. In this course, you'll learn the principles of cash flow, ways to assess its value based on the concept of the time value of money (TVM), and how to use this knowledge to determine the value of projects.

You'll begin with a discussion of what cash flow is and the concepts of compounding and discounting. You'll also explore capital and capital structure, present value and rate of return. By the end of the course, you'll have a basic understanding of cash flow principles and how to apply them to any plant-related project.

You Will Learn:

- Definitions of cash flow
- Principles of compounding and discounting
- Capital, capital structure and the WACC
- Present value and rate of return
- Use of these concepts in project evaluation

Who Should Attend:

This course is designed for any engineer involved in evaluating or recommending projects.

Your Instructor:

Robert Salvin

For 2018 Public Course dates and locations, see page 5.

AIChE's Chemical Process Economic Evaluations

www.aiche.org/ela151 | Course ID: ELA151

AIChE Members – $595
AIChE Undergrad/Grad Student Members – $297.50
Non-Members – $895

Make crisper, more comprehensive decisions about proposed and ongoing projects in your portfolio with this online course.

This course will prepare you to undertake the kind of thoughtful, quantitative analysis that will guide you through development stages. You'll learn how to avoid two undesirable outcomes as your projects progress through increasingly costly stages—investing in further development when a positive outcome is unlikely and dropping a project too early that would have significant benefit if successful. You'll address how to uncover the value proposition, perform heat and material balance calculations and make process design considerations. You'll also examine how to develop operating costs and margin calculations, size equipment, estimate capital and calculate metrics such as NPV and IRR from cash flows. By taking part in example problems, you'll see how to frame the value proposition, work through the mechanics of determining operating and capital costs, and calculate economic metrics. In addition, sensitivity analyses will illustrate how to easily uncover and communicate leveraging issues.

You Will Learn:

- Understanding the terminology used in developing the costs of production, capital costs, cash flow analysis and profitability metrics
- How to apply basic principles of process economics to improve design decisions
- How to analyze and compare alternative technologies and scenarios
- Evaluating early-stage projects for technical and business assumptions critical to project success
- Formulating value propositions based on sound process design
- How to communicate findings in an effective and illustrative way that encompasses the breadth of evaluation
- Using structured methods to identify customer needs, establish target performance specifications, generate and select product ideas, and establish final product specifications

Who Should Attend:

This course is designed for those who are involved in new and ongoing projects, developing value propositions or providing economic evaluations, including:

- Process engineers
- Technology development professionals
- Project engineers
- Business decisions analysts
- R&D
- Plant project managers
- Business portfolio managers
- Those providing input to process and project economics

Your Instructor:

Gary Sawyer

AIChE's Decision and Risk Analysis for Projects

www.aiche.org/ela126 | Course ID: ELA126

AIChE Members – $495
AIChE Undergrad/Grad Student Members – $247.50
Non-Members – $795

Involved in chemical engineering project development, evaluation and decision-making? Learn how to avoid "gut-feel" decisions and minimize risk.

Take this eLearning course to review and learn how to choose from different decision-making methods that will help you make the right investment choices for your company. The course begins with a brief summary of the time value of money, present value and profitability indices, and how to turn them into key economic parameters. You'll examine how to apply the decision-making methodology to different types of project decisions. You'll learn how to choose from mutually exclusive projects, build multi-project portfolios, assess tolling options versus direct manufacturing, select research and development projects, handle licensing and royalty issues, manage joint ventures, and acquire assets and companies. Through discussion and examples, the concept of introducing the probability of outcomes will be demonstrated. The instructor will also cover formal approaches to assessing risk and discuss how to integrate them into the decision process.

You can expect to explore a range of techniques, from the simplest use of sensitivity analysis to the use of the more complex Monte Carlo simulation approach. Throughout the course, practical exercises and problems will bring the concepts you learn to life.

You Will Learn:

- Describe a disciplined approach to decision making
- Rank projects within certain constraints
- Interpret the role of probability in the decision process
- Calculate various economic parameters, including NPV
- Identify tools and resources to assist in decision making

Who Should Attend:

Any engineer involved in project development, evaluation and decision-making in the chemical, petrochemical, petroleum and other manufacturing environments—including:

- Those new to engineering
- Engineers in managerial positions
- Operating plant personnel
- Professionals in corporate and R&D

Your Instructor:

Robert Salvin

Please refer to index on p. 70 for all instructor bios.

AIChE's Economic Evaluation for Chemical Engineers

www.aiche.org/ela125 | Course ID: ELA125

AIChE Members – $795
AIChE Undergrad/Grad Student Members – $397.50
Non-Members – $1,095

What keeps you up at night? Are you concerned about staying competitive? Do you have the right tools to know whether your projects are helping you do that? The fact is, you need accurate economic evaluations of capital projects to keep your plant competitive and its resources optimized. But for chemical engineers without much experience in this area, determining the value of a project may be a daunting task.

This introductory course eliminates the confusion surrounding economic evaluations. You'll learn key principles and concepts in a way that enables you to apply them to any capital project of any size. Starting with a review of cash-based accounting principles and a deep discussion of what capital is, you'll go on to review evaluation concepts and methods, including lease-vs-buy analyses.

Using real-world engineering examples and a class problem, the course illustrates these concepts in a way any chemical engineer can relate to. Examine overall company performance metrics and valuations and the role they play. After completion, you'll understand how to apply these concepts and principles to projects you are currently working on.

You Will Learn:

- A review of cash-based accounting principles
- What capital is, its sources, the Weighted Average Cost of Capital (WACC) and capital budgeting
- The time value of money, discounting and present value
- Recommended evaluation methods and assessment criteria
- How to build evaluation models with a class exercise
- How to analyze the results and assess risk
- Other types of evaluations: indirect capital, lease-vs-buy, etc.

Who Should Attend:

This course will serve as a valuable introduction for new chemical engineers involved in evaluating the economics of capital projects. It also will be a great refresher for experienced engineers who want to deepen their knowledge of methods used to assess projects, from plant projects to major strategic investments.

Your Instructor:

Robert Salvin

AIChE's Conceptual Development and Capital Cost Estimating

www.aiche.org/ch139 | Course ID: CH139

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

To secure the adequate funding of engineering projects in the process industries, you need to accurately identify the project's overall scope and monetary cost. Deficient conceptual estimates can cost you time and money and even threaten the viability of the project. Study with a project development/cost estimating expert and gain a thorough grounding in the basics of conceptual development and capital cost estimating.

In two days, you'll learn important estimating terminology and concepts and how to perform the different types of project estimates. You'll examine how to predict and account for equipment costs, installation factors and cost escalation. Plus, you'll delve into the detailed cost estimating process, including methodology and mechanical estimating methods. By the end of the course, you'll have the knowledge and skills necessary to conceptualize projects and develop timely and accurate cost estimates that positively impact all of your engineering projects.

You Will Learn:

- How to effectively conceptualize projects
- How to perform cost estimating based on project type, size and location
- Applying cost-estimating techniques
- Dealing with uncertainties and risks inherent in cost estimating
- Understanding the capital cost estimating process

Who Should Attend:

Professionals involved in conceptualizing engineering projects and developing timely cost estimates. It will be of special value to decision-makers in the process industries—including:

- Plant engineers
- Project engineers
- Project managers
- Plant maintenance personnel
- Engineering managers

Your Instructor:

John Williams or Theodore Williams

SAVE $795
or more when you take CH139 and CH140 together.
Just register for course CH758: Conceptual Development/ Project Evaluation Combo Course.
www.aiche.org/ch758

AIChE's Project Evaluation: Operating Cost Estimating & Financial Analysis

www.aiche.org/ch140 | Course ID: CH140

Available as Train-a-Team offering.
For more information, visit **www.aiche.org/trainateam**

Project evaluation is a critical and highly specialized skill that directly impacts the bottom line. When analyzing any technical or engineering project as a prospective investment, it's vital to make an accurate estimate of operating expenses and return on investment. In this course, a project development expert will guide you through the steps the best engineers follow to make sound economic evaluations of projects, designs and alternatives.

In two days, you'll gain a practical framework for evaluating technical and engineering projects and gain a better understanding of the evaluations others make. You'll learn how to accurately estimate operating expenses and calculate return on investment. You'll examine how to conduct a cash flow analysis of financial, operating and investment activities, including how to conduct a discounted cash flow (DCF) analysis to evaluate the attractiveness of an investment and how to use net present value (NPV) and the internal rate of return (IRR) to appraise long-term projects.

You Will Learn:

- A value-oriented perspective on potential projects
- How to accurately estimate operating expenses
- ROI: how to calculate it
- Key cash flow analysis terms you need to understand—including:
  - Discounted cash flow (DCF)
  - Net present value (NPV)
  - Internal rate of return (IRR)

Who Should Attend:

Technical managers, R&D personnel, managers, project engineers and project managers involved in projects in the process industries—including:

- Chemical
- Pharmaceutical
- Biological
- Petrochemical
- Materials
- Petroleum
- Gas

Your Instructor:

John Williams or Theodore Williams

SAVE $795
or more when you take CH140 and CH139 together.
Just register for course CH758: Project Evaluation/ Conceptual Development Combo Course.
www.aiche.org/ch758

Register online at **www.aiche.org/academy** or call **1-800-242-4363** (or 1-203-702-7660 outside the U.S.)

Key to icons: eLearning | Public | Train-A-Team | Approved | Best Seller

AIChE's Value Propositions for Your Chemical Process Project

www.aiche.org/ela180 | Course ID: ELA180

AIChE Members – $395
AIChE Undergrad/Grad Student Members – $197.50
Non-Members – $695

Review the basics of value propositions, where you'll learn metrics, models, strategies and best practices you can use on your next chemical process project. Gain the knowledge you need to eliminate off-spec material reruns, calculate utility charges for maintenance activities, optimize multi-product campaign strategies, value multi-step reaction and distillation improvements, and more.

You Will Learn:

- The various metrics used to quantify a value proposition
- How to define the financial term "margin"
- The basics of developing value propositions for plant reliability improvement projects
- How to create simple material balance models for yield improvement studies
- How to tie campaign strategies to available storage and calculate savings from different strategies
- Strategies for organizing a team approach with an efficient work flow

Who Should Attend:

- Process engineers
- Researchers
- Production engineers
- Project engineers
- Project managers
- Project champions

Your Instructor:

Gary Sawyer

Courses from AIChE Academy Will Help Develop Your Skills

Whether you're looking to add a new skill, brush up on a subject you haven't touched in a while or need to learn about an emerging area, AIChE Academy has the courses to fit your needs.

AIChE ACADEMY TOP 10:

- **ELA109:** CCPS' Layer of Protection Analysis (LOPA)
- **ELA110:** AIChE's Chemical Engineering for Non-Chemical Engineers
- **ELA120:** CCPS' 20 Elements of Risk Based Process Safety (RBPS)
- **ELA121:** CCPS' Hazard Identification for Operators and Maintenance Workers
- **ELA121_ES:** CCPS' Identificación de Peligros Para los Operadores y Trabajadores de Mantenimiento
- **ELA122S:** CCPS' Process Safety Leadership for Front-Line Supervisors – Spanish
- **ELA156:** CCPS' Management of Change: Overview and Case Study Applications
- **ELS101:** AIChE's Spreadsheet Problem Solving for Chemical Engineers
- **ELS104:** CCPS' HAZOP Studies
- **ELS105:** CCPS' Process Safety Management Overview

AIChE Academy
Connect | Learn | Solve

Register for these or any other course at www.aiche.org/academy

Donald Abrahamson

Don Abrahamson has over 40 years of experience in operations and engineering roles to draw from, in a wide range of areas: process safety management, operations management, process safety engineering, technical management, quality assurance management, process development and research. He recently retired from Celanese as their Global Process Safety Manager. He also worked for Occidental Chemical for over 32 years. He has conducted PHAs, audits, incident investigations and/or training on four continents: the Americas, Europe and Asia. He has four US Patents from his work in research and development. He holds a BS in Chemical Engineering from Cleveland State University. CCPS projects: Process Safety Boot Camp.

Georjean L. Adams

Georjean Adams is a recognized environmental and health chemical legislative and regulatory expert focused on managing chemical risks with innovative approaches toward sustainability by integrating the needs of the public, government and industry. She has significant and diverse experience within a multinational manufacturing company, preceded by work at USEPA. She has broad experience in development and management of practical EHS systems which have proven effective across companies, customers and government.

Scott Berger

Scott Berger has nearly forty years of experience in process safety and EHS management. From 2001–2015, he served as Executive Director of the Center for Chemical Process Safety (CCPS). Under his leadership, the body of knowledge and scope of practice of process safety expanded both technically and globally, growing from a primarily technical practice to one involving leadership, culture, and business. Transformative initiatives under his leadership included the Business Case for Process Safety, the fundamentals of Process Safety Culture, the next-generation Guidelines for Risk-Based Process Safety, development and deployment of global process safety metrics, the Process Safety Boot Camp, and Process Safety Vision 20/20.

Prior to CCPS, Berger led EHS initiatives at the technology-manufacturing-business interface for Rohm & Haas and Owens Corning, reducing risk through technology and management and creating value through process safety, pollution prevention, and sustainability.

Todd Brandes

Todd Brandes is a Principal Engineer with SI Group, serving in the company's Operational Excellence organization. He has over 20 years' experience in process development, evaluation, design, simulation, and controls, which has included work on a wide range of specialty chemical commercial products such as alkylated phenols, flame retardants, organometallic catalysts, and active pharmaceutical ingredients. For most of his career, Todd has been involved in all aspects of the design of pressure relief systems: scenario identification and modeling, valve and disk sizing, two-phase flow, and piping design. In recent years, he has focused on chemically reactive system testing and dynamic simulation of runaway reactions. For many years, Todd has trained coworker engineers at Albemarle Corporation and SI Group on pressure relief design.

Todd graduated from Clemson University with B.S. and Ph.D. degrees in Chemical Engineering. He is a registered professional engineer in South Carolina and a senior member of AIChE.

Heath Briggs

Heath J. Briggs is a chemical engineer and a registered patent attorney with more than 10 years of patent prosecution experience. Heath has significant patent prosecution experience in the chemical area, especially in the areas of materials science (e.g., metallurgy) and organic chemistry. He represents several Fortune 500 companies in this area, managing their worldwide patent portfolios. Since 2005, Heath has served as an Adjunct Professor at the University of Colorado Boulder, where he teaches engineering students a self-designed course on intellectual property law. Heath is involved in the community, where his passion is to educate aspiring inventors and entrepreneurs about intellectual property.

Jack Chosnek

Jack Chosnek has over forty years of experience in the petrochemical industry, the majority involving process safety in some regard. He worked for Celanese Corporation for 25 years in R&D, Tolling, Pilot Plants, Operations, Process Engineering and Process Safety Management, in both management and staff positions. He is President and Principal at KnowledgeOne LLC, where he has consulted for companies in the chemical, refining, oil and gas, offshore, and LNG industries, implementing process safety management systems, facilitating PHAs and LOPA/SIL studies, conducting incident investigations, and conducting process safety audits and gap analyses. He has developed software for PHA facilitation, Management of Change (MOC), and a Hazards Register. Jack is the Chair of the Technical Advisory Committee of the Mary Kay O'Connor Process Safety Center (MKOPSC). Jack has published more than 15 papers and is a listed contributor to the 4th edition of Frank Lees' *Loss Prevention in the Process Industries*. He is an AIChE Fellow and a Licensed Professional Engineer in the State of Texas. He is the holder of three patents related to chemical production.

Gwenn Carr

Gwenn Carr, a Project Management Professional (PMP), has been a project manager, consultant and educator for over 25 years. She has worked with many companies in various industries and is the coauthor of chapters in the *Field Guide to Project Management*. Her interest in improving the skills of project teams grew from her frustration while working with teams who had been assigned to projects and had received no training or guidance. A kinesthetic learner, Ms. Carr uses "learn by doing" techniques in her seminars and workshops to introduce and reinforce project management techniques and skills.

William Ciolek

William Ciolek is a Principal Design Engineer with UOP, a Honeywell Company, where he is the lead specialist for pressure relief worldwide. For 30 years, he has consulted on the gamut of pressure relief problems and related process safety elements. Bill has trained hundreds of engineers at UOP and Amoco Corporation on pressure relief design. He served as chairman of the DIERS Users Group subcommittee on incidents and case histories, and he is a current member of the API Subcommittee on Pressure-Relieving Systems. A graduate of Michigan State University, he specializes in development of relief analysis methods.

David Clough

Dr. David Clough has been teaching spreadsheets to undergraduate chemical engineers for 40 years as a professor in the Department of Chemical and Biological Engineering at the University of Colorado. Professor Clough's research is in applied process control. He also served as Associate Dean of Engineering at Colorado for seven years, and he currently represents Colorado to the NCAA as the campus's Faculty Athletics Representative. Dr. Clough has taught over 130 AIChE short courses on spreadsheet problem-solving and programming for ChEs since 1989.

James Conner

Jim Conner joined CCPS as a Staff Consultant in 2011. He has 35 years of experience in chemical process engineering, chemical manufacturing operations, and R&D across operations in Asia, Europe, Middle East, and North America. Most recently, Jim held the position of Sr. Vice President, Operations, for Enerkem, a solid waste-to-chemicals startup venture. Prior to Enerkem, he served as Vice President, Operations and Technology, for Celanese, with responsibility for domestic and international operations and R&D facilities. He was also accountable for the design and startup of a world-scale greenfield plant in China. His career has included management positions in plant operations, process safety, process engineering and process control in both chemical manufacturing and the manufacture of synthetic fibers. He has expertise in chemical plant management, process optimization and control, management of process and control, management of process safety, incident investigation, conduct of operations, and organizational change management. Jim has both a BS in Chemical Engineering and a Masters in Environmental Engineering from Rice University in Houston, TX.

Charles Cowley

Charles Cowley is a mechanical engineer with 34 years in the oil industry, including 27 years with Shell. Career accomplishments include: project team leader developing Shell HSSE Control Framework, Shell Downstream 'Hearts & Minds' safety culture program leader, primary author of Shell guide 'Competence Assurance of HSSE Critical Positions', led several major incident investigations, Chief Engineer in Shell Morocco, 15 years in Shell major projects, Upstream and Downstream, and Independent Safety Consultants. In 2012, Charles became a CCPS Process Safety Consultant.

Mary Ann Curran

Mary Ann is an internationally recognized expert in Life Cycle Assessment (LCA). Through years of research, networking, and publishing, she developed an in-depth knowledge of the field and created an extensive network of LCA researchers and practitioners worldwide. Before retiring from the EPA in late 2012, Mary Ann's research activities included the development of LCA methodology, the performance and review of life cycle case studies, planning life cycle workshops and conferences, and the development of life cycle data and resources. Building awareness within and outside the Agency regarding the importance of LCA to the protection of human health and the environment, her activities contributed to her laboratory's reputation as a leader in LCA research and development. She now offers her knowledge and experience as an independent consultant.

Mary Ann has authored and coauthored numerous papers and book chapters which address the LCA concept and its applications. She has presented LCA-related talks at technical meetings across the US and in Europe, South America, South Africa, Asia, and Australia.

Robert D'Alessandro

Robert D'Alessandro has over 35 years of experience in chemical engineering as a department manager, project manager, process engineer, and technology specialist. He recently retired from Evonik Corporation after more than twenty-three years of service in various positions. In his last position at Evonik, he served as the Director of the Process Technology Department, where he led a team of more than 40 engineers and technicians in providing process engineering services in both North America and South America to improve existing process plants and to design new process plants. Robert has been an active member of the AIChE Design Institute for Emergency Relief Systems (DIERS) Users Group since its inception in 1986. Robert received his BS in Chemistry and Mathematics from Fordham University in 1976, his BS in Chemical Engineering from Columbia University in 1978, and his MS in Chemical Engineering from Manhattan College in 1981. He is a Registered Professional Engineer in the State of Alabama and a Fellow of the American Institute of Chemical Engineers (AIChE).

Umesh Dhake

Umesh Dhake, Asia Pacific Regional Manager for the Center for Chemical Process Safety (CCPS), is a chemical engineer with more than 15 years of experience in risk consulting. Previously, Umesh worked with ABS Consulting, Risk Division, and with Germanischer Lloyd GmbH. He was involved in Preliminary Hazard Analysis, Consequence Analysis, QRA studies, MAH Bow Tie development, SIL verifications as per IEC 61511, and Fit for Purpose Certifications for offshore aging assets such as pipelines and platforms. Umesh is also Lead Auditor, Lead Tutor for Quality, Environmental, and Occupational Health & Safety management systems.

Steve Eason

With over 35 years of industrial experience, Steve Eason recently retired from Honeywell as Corporate Global Process Safety Manager. Steve developed and deployed Honeywell's corporate PSM policies while implementing a comprehensive, global corporate PSM and RMP audit program. Steve previously served as Director of Engineering, Chemicals, and Director of Process Technology UF6 at Honeywell. Before Honeywell, Steve was the Vice President of Process Technology for E&J Gallo Winery, where he led the implementation of chemical engineering principles into winemaking. Steve's 23 years at Air Products and Chemicals included roles in production and process engineering; technical and project management at several US sites; and executive levels, including Global Process Technology Manager for Chemicals. He holds a BS in Chemical Engineering from New Mexico State University (NMSU) and an MS in Chemical Engineering from Lehigh University. Steve is a registered professional engineer in NM, PA, NJ and CA, as well as a Certified Process Safety Auditor.

Gary Englehardt

Gary Englehardt, a Project Management Professional (PMP), has been involved in projects for over 30 years as a project engineer and consultant. He has helped numerous companies in the process industries improve the skills of their teams and obtain better project results. He has coauthored chapters in several respected project management books.

John Farone

John P. Farone is a consultant to the chemical industry with over 40 years of experience in process separations, process simulation and equipment design. He has unique knowledge of the practical design and operation of trayed and packed distillation towers and their internals. Previously, he was with The Dow Chemical Company for 36 years, where he specialized in process engineering in distillation and stripping. He is currently a consultant with Fractionation Research Inc. (FRI) and the Separations Research Program (SRP) at the University of Texas at Austin.

Walt Frank

Walt Frank, PE, has a BS degree in chemical engineering from the Rose-Hulman Institute of Technology. He has over 40 years of experience in the chemical process industries, having held assignments in plant technical support, production supervision, R&D, major capital project design and startup, and process safety consulting.

His career includes 24 years with DuPont and ten years with ABS Consulting. He founded Frank Risk Solutions, Inc., in 1997. Walt's consulting expertise includes process safety management program development, evaluation, and improvement; safety culture and organizational effectiveness evaluation and improvement; and explosion hazards evaluation and control, with a particular emphasis on combustible dust fire and explosion hazards.

Walt is a Professional Engineer, licensed in Delaware, and is an AIChE Fellow, CCPS Fellow, and Emeritus Member and Staff Consultant for CCPS. He is also an API-qualified assessor in the API Process Safety Site Assessment Program.

Alan Gabelman

Alan Gabelman's long, successful career in flavors, fermentation and specialty chemicals has included assignments in process engineering, manufacturing, research and development, and scale-up. He has worked for industry leaders such as Firmenich, Givaudan, Hercules and Stauffer Chemical Company, where he held positions ranging from Production Engineer to Process Science Director. As President of Gabelman Process Solutions, Alan currently provides consulting services in separations and process engineering globally. Alan's expertise includes numerous separation processes and other chemical engineering unit operations, equipment selection, design and sizing, process simulation, P&ID development, and process economics. Alan holds BS, MChE and PhD degrees in chemical engineering from Cornell University, the University of Delaware, and the University of Cincinnati, respectively. He is a licensed Professional Engineer, as well as an adjunct instructor in chemical engineering at the University of Cincinnati. Alan has edited a book on bioprocess flavor production, and he has authored several peer-reviewed scientific papers and a book chapter.

Wayne Genck

Dr. Wayne Genck is president of Genck International, a consulting firm specializing in crystallization and precipitation. He has consulted with over 250 companies on a wide range of issues, including the impact of impurities, the effect of additives, scale-up, and more. Dr. Genck has written chapters on crystallization for two industry handbooks as well as numerous articles published in chemical engineering magazines.

Alexandre Glitz

Alexandre Glitz retired from Petrobras, the Brazilian oil company, after 35 years. He has a Civil Engineering degree and a post-grad degree on Safety Engineering from Paraná Federal University (Brazil). His experience includes 25 years in an oil refinery as Safety Engineer, Safety Manager and HSE Coordinator for new projects. At the company's Corporate HSE, he coordinated the implementation of Corporate HSE Guidelines (focus on occupational and process safety) and served as Corporate Safety Manager for 8 years until his retirement.

He worked in the Paraná Fire Department as a fire prevention and design analysis specialist. His experience includes teaching post-graduation courses in Safety and Risk Management for Safety Engineers.

Janet Hammill

Janet Hammill is an employee of The Dow Chemical Company, a global diversified chemicals company. She is a graduate of the Carnegie-Mellon University Chemical Engineering Master's program with an undergraduate degree in chemistry. In her position as Organizational Effectiveness Leader and Master Black Belt (MBB), she has applied Six Sigma methodology to build roadmaps of process excellence and mentor performance improvement

teams. She is currently providing Organizational Effectiveness support as an MBB for the Ras Tanura Integrated Project, a proposed joint venture between Dow and Saudi Aramco to build the world's largest petrochemical facilities. She has led improvement teams in HR, IT, Procurement, Finance, Manufacturing, Sales and Marketing, Customer Service, Logistics and Order to Cash. During the past 25+ years she has managed and led teams for GE Plastics, Alcoa and ARCO, with line management responsibilities in R&D, application technology, e-procurement and ERP benefits realization.

Janet has led teams in Asia, Europe and North America, each of which has delivered between $10–30 MM in improved cash flow and improved pricing management during the past 5 years, with performance goals and process capability increasing each year.

Roger G. Harrison

Dr. Roger Harrison is one of the first authors (with three coauthors) of the highly acclaimed textbook *Bioseparations Science and Engineering*, which has been adopted by courses at more than 60 universities throughout the world. Before becoming a professor in the University of Oklahoma School of Chemical, Biological and Materials Engineering, he worked at Phillips Petroleum Company and at Upjohn, where he focused on bioseparations.

Dennis C. Hendershot

Dennis C. Hendershot is a chemical engineer with 45 years of experience in process research and development, plant design and startup, and process safety. From 1970 until his retirement in 2005 as a Senior Technical Fellow, he worked at Rohm and Haas Company. He then joined Chilworth Technology Inc. as a Principal Process Safety Specialist (retiring again in 2009) and joined the Center for Chemical Process Safety (CCPS) of the American Institute of Chemical Engineers as a Staff Consultant. With CCPS, he has worked with the Inherently Safer Design Subcommittee and the Risk Tolerance Criteria Subcommittee, and he serves as editor of the *Process Safety Beacon*. From 2005–2007, he was a member of the BP North American Refineries Independent Safety Panel, chaired by former United States Secretary of State James Baker. Dennis received his Bachelor of Science degree from Lehigh University and his Master of Science degree from the University of Pennsylvania.

John Herber

John Herber joined CCPS in 2009 after a 33-year career with 3M Company that included positions in process and project engineering, production operations and corporate safety. In Corporate Safety Services, John developed programs for improving PSM systems across 3M's global operations, including PSM metrics, Process Hazard Management policy and implementation guidance. As a PSM consultant, John has performed audits, facilitated PHAs and assisted with PSM program development and training. John has a BS in Chemical Engineering from Purdue.

CCPS projects: Process Safety Boot Camp Training Program, *Process Safety Beacon* and Process Safety Moments.

Diane Hildebrandt

Diane Hildebrandt is SARChI Professor of Sustainable Process Engineering and Director of the Centre of Material and Process Synthesis (COMPS) at the University of the Witwatersrand, Johannesburg, South Africa. She obtained her BSc and PhD in Engineering and Chemical Engineering from the University of the Witwatersrand.

Professor Hildebrandt is the first female chemical engineer to have been awarded an 'A' rating by South Africa's National Research Foundation. She and colleague Professor David Glasser were jointly awarded the Bill Neale-May Gold Medal by the South African Institute of Chemical Engineers. This was the first time the award had been made to an academic. She was also a recipient of the Vice Chancellor's Researcher Award, University of the Witwatersrand. Diane was the winner of the 2009 Distinguished Woman Scientist of the Year award (Department of Science and Technology, South Africa) as well as the African Union (AU) Scientific Award.

Professor Hildebrandt is a Fellow of the Royal Society of South Africa and has been elected to the Academy of Sciences and the Academy of Engineering of South Africa.

David Hill

David Hill, President of Practical Process Safety LLC, has over 30 years of industrial experience. His careers range from Corporate Principal Risk Engineer for Occidental Chemical, Property Insurance Loss Prevention Specialist for Factory Mutual Global, and Chief Engineer Officer for international cargo ship companies. His work experiences have taken him to over 85 countries. While working for Occidental Chemical for nearly 20 years, his responsibilities included developing, implementing, and applying process safety programs relating to mechanical integrity, hazard and consequence analysis, fire protection systems, capital project oversight, property insurance risk assessment, incident investigation, audits, assessments, and training. David's extensive experience in mechanical integrity provides him with a wide range of problem solving skills and practical program development knowledge.

Before Occidental Chemical, David was a Loss Prevention Specialist for Factory Mutual Global and a national board-certified Boiler and Pressure Vessel Inspector. In this position, he was a field engineer for 6 years, travelling worldwide to conduct risk assessments and process safety audits at chemical plants, gas plants, nuclear refining facilities, gold mines, and power generation plants. As a Loss Prevention Specialist, he assisted clients on the development and implementation of practical mechanical integrity programs to increase reliability and prevent accidents. On cargo ships, David worked in "the guts" of ship engine rooms, where he operated and maintained large-scale machinery such as 30,000 BHP diesel engines and steam turbines, power generating equipment, fire protection equipment, and refrigerated cargo systems.

David is a Mechanical Engineer/Chief Engineer Officer, having graduated from Glasgow College of Nautical Studies in Scotland.

Jack Hipple

Jack Hipple is a 30-year veteran of the chemical industry. He was previously responsible for global chemical engineering research at Dow Chemical and its Discovery Research New Ventures program. He also managed chemical material technology projects for the National Center for Manufacturing Sciences, new product development in the protective equipment area at Ansell Edmont, and process scale-up for aerogel materials at Cabot Corporation. He is currently a principal with TRIZ and Engineering Training Services LLC, providing consulting and innovation workshops focusing on TRIZ Inventive Problem Solving and introductory chemical engineering training.

He has been the public and onsite instructor for AIChE's Chemical Engineering Essentials and ASME's Inventive Problem Solving ('TRIZ') courses for 13 years. Jack has served as chair of AIChE's Management Division and recently completed a 3-year term on AIChE's Board of Directors, serving on its Finance and Center for Chemical Process Safety committees. He served as an SME on IRI's Disruptive Innovation task force.

Phillip R. Hodge

Mr. Hodge works at BakerRisk's Houston office in the Process Safety Group. His work focuses on risk-based design of new facilities, as well as risk-based upgrades to existing facilities using BakerRisk's dispersion and blast modeling software tools, SafeSite3G© and QRATool©. Phillip performed studies for a wide variety of chemistries, including gas plants, refineries, polyethylene plants, and ammonia production facilities. He conducted CO2 gas ingress tests to determine building toxic response and optimize shelter-in-place procedures and buildings to meet toxic risk criteria. He also worked on several research endeavors such as the efficacy of water curtain mitigation of ammonia, the modeling of the consequences from the release of pyrophoric materials, and the vulnerability of safety-critical equipment to fires and explosions. Phillip Hodge supervises the BakerRisk Intern Program and coordinates the BakerRisk new hire training program. Additionally, he prepared the "What Every New Engineer Needs to Know about Process Safety" course for AIChE Academy, Fundamentals of Process Safety.

Phillip has worked with the Mary K. O'Connor Process Safety Center under the direction of Dr. M. S. Mannan at Texas A&M University. While there, he worked on several projects ranging from off-shore reliability assessments to chemical plant antiterrorism. His master's thesis was entitled "Determining Bounds for a Pressure Hazard Rating to Augment the NFPA 704 Standard" and required extensive knowledge of reactive chemicals and adiabatic calorimetry. His coursework focused on process safety and quantitative risk analysis. Phillip is a contributor to Franklin Lees' *Loss Prevention in the Process Industries, 4th Edition*. While working for ExxonMobil Chemical, he designed a new curriculum for the company's "Fundamentals of Safety" course, which is used as an introduction to all elements of process safety for ExxonMobil Chemical and Refining. Phillip was a Welch Fellow and George Holmes Richter Research Award winner for his research on novel MRI contrast agents with Dr. L. Wilson, and on molecular motorized "nanocars" with Dr. J. Tour. He focused on synthetic organic chemistry and chemical education while employed as a chemistry instructor in the Katy, TX, school system for two years, where he wrote new curriculum materials and coordinated the school's chemical hygiene and safety program. He also worked with the FIRST (For the Inspiration and Recognition of Science and Technology) organization to introduce engineering concepts into the high school curriculum.

Michael (Rick) Hoffman

Rick Hoffman is a registered professional Mechanical Engineering and Certified Maintenance and Reliability Professional. Hoffman has over 40 years of experience in plant, corporate and consulting roles in the refining, petrochemical and synthetic fuels industries. The main focus of his career has been in plant reliability improvement. He has held worldwide responsibility for mechanical engineering, strategic maintenance, mechanical integrity, standards, capital project support, vendor qualification and high-level troubleshooting for a major petrochemical and refining company. Hoffman also has experience implementing and auditing the PSM rule.

Joseph W. Holmes

Joseph W. Holmes, Principal Engineer, Research & Software Integration, holds BS and MS degrees in Chemical Engineering from Texas A&M University, College Station, Texas (TX), USA. Holmes brings to this position more than 30 years of software development experience. Prior to focusing on the integration of products obtained via an alliance with Honeywell, he served as the project manager for HTRI Xchanger Suite and its components. He has assisted in the development and updating of several HTRI workshops and is a knowledgeable, experienced HTRI workshop instructor. Before joining HTRI, Holmes worked for Bryan Research and Engineering, Bryan, TX, as a process research and development engineer. Holmes is a member of AIChE and a licensed Professional Engineer (PE) in Texas.

Karl V. Jacob

Karl V. Jacob is a Fellow in Engineering Sciences at The Dow Chemical Company. He is also founder of the Solids Processing Lab at Dow in Midland, Michigan. For the last three decades, he has worked on a vast array of particle technology problems, with particular expertise in silo/hopper design, powder mechanics, pneumatic conveying, particle engineering and drying.

Karl is a chemical engineering graduate of Case Western Reserve University. He is a former member of the AIChE Board of Directors and a past chair of the Particle Technology Forum.

Robert Johnson

Mr. Johnson is a Fellow of AIChE and an industry leader in the development and dissemination of risk analysis methods and risk management strategies. Since 1978, Mr. Johnson

has helped clients prioritize risk reduction options; develop corporate and plant technical safety programs; identify inherently safer processes; train PHA team leaders; and analyze fire, explosion, and toxic release hazards. Mr. Johnson teaches AIChE continuing education courses on HAZOP Studies and on Advanced Concepts for Process Hazard Analysis, and he teaches process safety in the Chemical and Biomolecular Engineering Department at The Ohio State University.

Among his many contributions to the loss prevention literature, Mr. Johnson was primary contract author of *Guidelines for Enabling Conditions and Conditional Modifiers in Layer of Protection Analysis* and *Guidelines for Hazard Evaluation Procedures, Third Edition*, as well as two books on chemical reactivity hazards, all published by the AIChE Center for Chemical Process Safety. He is also author of two process safety sections in *Perry's Chemical Engineers' Handbook*.

Mr. Johnson holds BS and MS degrees in chemical engineering from Purdue University. He is president of the Unwin Company consultancy, having previously held Senior Engineer positions with Hercules and DuPont and a Research Leader position at Battelle.

He is past chair of the AIChE Safety & Health Division and serves as a member of the CCPS Safety and Chemical Engineering Education (SAChE) Committee.

Jerry Jones

Jerry L. Jones, PE, joined CCPS as a staff consultant in 2012. He has over 40 years of experience across many industry sectors, including facilities for oil production and refining, commodity chemicals, specialty chemicals and polymers, pharmaceuticals, and electronics industry materials. He has worked in process development and engineering, plant design, EHS, and process safety functions, and has supported manufacturing operations in over a dozen countries while an employee of Monsanto, SRI International, Raychem, and Genentech/Roche. He has extensive experience with the implementation of risk-based management systems, including those for process safety. He earned BS and ME degrees in chemical engineering from Cornell and an MS in environmental engineering from Stanford. He is a licensed professional engineer in Illinois and California, and he holds a number of safety-related certifications. CCPS projects: Process Safety Boot Camp Training Program, Process Safety in Bioprocess Manufacturing Facilities, and Process Safety in Laboratories and Pilot Plants.

B. Karthikeyan

B. Karthikeyan is a chemical engineer from Madras University, India, with over 35 years of experience in the chemical process industry. He is a senior member of AIChE. He is the founder/director of Prism Consultants, Chennai, India, established in 2001. His core areas of expertise include implementation of risk-based process safety management as per current best practices, process safety training, incident investigations, process hazard analysis and PSM audits. He has provided consultancy services to over 100 chemical process industries in Asia-Pacific, Europe, South Africa and the Middle East. He has authored a book on process safety management, has presented papers on PSM in national and international seminars, and is an avid blogger on process safety.

Brian Kelly

Brian Kelly has been a part-time staff consultant with AIChE's Center for Chemical Process Safety (CCPS) since 2005. He was employed for 35 years with Imperial Oil Enterprises (Exxon) and Syncrude Canada Ltd. Brian has an extensive background in engineering, major capital projects, oil refinery operations and process safety. He has participated in numerous process safety audits and incident investigations in the energy sector, and he has taught courses and consulted on process safety matters worldwide. Brian received his BASc and MASc degrees in chemical engineering from the University of Ottawa (Canada). In 2010, he received the Chemical Institute of Canada's Process Safety Award for his many years of outstanding service in the process safety field.

His CCPS projects include: Process Safety Boot Camp, Hazard Identification, Recognizing Catastrophic Incident Warning Signs, and Dealing with Aging Process Equipment. Brian resides in Calgary, Alberta.

Ellen Lenz

Ellen Lenz has over 30 years of experience in the chemical industry. She has held positions in project management, research and development, process safety, and operations during her 22 years at LyondellBasell Industries and 9 years at BASF Corporation.

Ellen has expertise facilitating PHAs, developing process safety standards and guidelines, transferring process safety information across organizations, and conducting EH&S audits.

Ellen received a BS in Chemical Engineering from the University of Maryland and an MBA from the College of William & Mary.

Uzi Mann

Dr. Uzi Mann is a retired professor of chemical engineering at Texas Tech University. He has taught chemical reactor design at undergraduate and graduate levels for over 30 years, and he received several teaching awards. In academe, he successfully obtained numerous research grants from government agencies (NSF, DOE, USDA) and industry to develop innovative chemical reactor operations. Prior to joining academe, he conducted industrial R&D work for 5 years on improving chemical reactor performances. He holds several patents on chemical reactor configurations. Dr. Mann was invited to write the chapter on chemical reactor technology for the 7th edition of the renowned *Kirk-Othmer Encyclopedia of Chemical Technology*. Dr. Mann continues to serve as a consultant to industry in the area of chemical reaction engineering.

Eric Maynard

Eric Maynard is the Director of Education and a Senior Consultant with Jenike & Johanson, Inc., which is recognized as the world's leading engineering firm specializing in bulk solids handling technology. Eric received his B.S. in Mechanical Engineering from Villanova University and his M.S. in Mechanical Engineering from Worcester Polytechnic Institute.

During his 18 years at Jenike & Johanson, he has workedon more than 500 projects designing materials handling and pneumatic conveying systems for powders and bulk solids such as cement, coal/coke, limestone, resins, biomass, calcined nuclear waste, foods, and pharmaceuticals. He is the cement industry and crushing technology specialist at Jenike & Johanson, and he has valuable experience with dust explosivity and OSHA's National Emphasis Program (NEP) on Combustible Dust Handling (CPL 03-00-008).

Eric routinely lectures on the storage, flow, and pneumatic conveying of bulk solids for companies and at established industrial-focused conferences. He has published over 30 technical articles on solids flow and pneumatic transport.

Jack McCavit

Jack McCavit retired from Celanese Chemical Company after 35 years of experience in operations management and practical application of process safety management systems. Jack served as the BP Baker Panel's technical project manager and was a part of the team that monitored BP's implementation of the Baker Panel recommendations. Jack served as the committee chair for CCPS' Guidelines for Risk-Based Process Safety. He graduated from Texas Tech University with a BS in chemical engineering.

Benjamin McDavid

Benjamin McDavid is a Process Safety Engineer with Ashland Inc. He has 20 years of experience in process safety, process engineering design and operations, and has worked for engineering companies, construction companies, and operating companies. He has performed pressure relief design using DIERS technology since 1997. He has been active with the DIERS Users Group since 2000. He is a professional engineer in the state of West Virginia.

Dan Miller

Dan Miller retired in 2016 following a 39-year career with BASF. During the first half of his career, Dan managed operations of production facilities at BASF's Geismar, Louisiana, site, including the design, construction, commissioning and on-going operation of 8 new process plants employing varying technologies. In 1995, he transferred to BASF's global headquarters in Ludwigshafen, Germany, making the career path change into process safety. Between 1995 and 1999, Dan was involved in supporting the process safety evaluation of major capital investment projects in Germany, Belgium and the Asia-Pacific region. It was also during this time that BASF formed a global steering committee for process safety, serving as senior member from 1998 until his retirement.

From 2000–2016, Dan led the North America Process Safety Center of Expertise for BASF. Dan served on the ACC Process Safety Committee from 1998–2016 and on the CCPS Technical Steering Committee from 2011–2016. He was BASF's representative to the International Process Safety Group (IPSG) from 2002–2016 and served as its Chair from 2008–2011.

Dan is driven by a management system approach to achieving process safety excellence, with a strong focus on raising awareness through training, from the executive level to the shop floor. Dan has a BS in Chemical Engineering from the University of Toledo and continues to serve on the college's Industrial Advisory Board. Dan became an instructor with CCPS in 2016.

John Murphy

John Murphy, PE, has more than 40 years of experience in chemical manufacturing and process safety, with jobs in the chemical industry, consulting and government. He has retired from the U.S. Chemical Safety and Hazard Investigation Board, where he served as lead investigator. John also retired from The Dow Chemical Company, where he was a leader in process safety. He has a BS in Chemical Engineering from Tufts University and an MBA from Central Michigan University. John has special expertise in incident investigation and root cause analysis, reactive chemicals management, and process safety management. John is a Professional Engineer, licensed in the state of Texas, and is an AIChE Fellow, CCPS Fellow and Emeritus Member and Staff Consultant for CCPS.

CCPS projects: Process Safety Boot Camp Training Program, Independent Protection Layers and Initiative Events, Conditional Modifier Project.

Louisa Nara

Louisa Nara is the Technical Director of the Center for Chemical Process Safety (CCPS) for the American Institute of Chemical Engineers (AIChE). She has over 33 years of experience in the chemical, petrochemical, pharmaceutical and food industries, and has worked for and with more than 65 companies. Louisa joined AIChE/CCPS after 15 years with Bayer, where she held positions of increasing responsibility, including: Manager, Process Safety and Crisis Management; Director of HSE, Security and Emergency Response at Bayer's largest US Manufacturing site; and Director, Risk Management and Compliance, NAFTA. Louisa's roles and responsibilities within CCPS include overseeing the development of projects in the CCPS technical portfolio, developing and enhancing CCPS' educational offerings, developing and deploying new tools, and enhancing value for corporate member sponsors. She holds a BS in Chemical Engineering from West Virginia University and an MS in Environmental Engineering from Villanova University, and is a Certified Compliance and Ethics Professional (CCEP). Louisa was elected to the West Virginia University Chemical Engineering Academy for her outstanding professional accomplishments.

Theodore Nelson

Dr. Theodore Nelson is focused on performing pressure relief and flare system (PRFS) evaluations for clients in the petrochemical, chemical and pharmaceutical industries. He has proven experience with conducting incident investigations as well as a demonstrated record of addressing safety solutions. Dr. Nelson also has extensive experience in safety technologies; safety testing; process technology; Design Institute for Emergency Relief Systems (DIERS) methodology; Center for Chemical Process Safety (CCPS) guidelines; process safety management; hazard and operability studies; quantitative risk analysis; and ASME, OSHA, and NFPA guidelines.

Dr. Nelson is a safety consultant for IoMosaic, CBI, Honeywell and Noblis (a nonprofit scientific and engineering company in support of projects with the Department of Defense, DOE and other government agencies). Dr. Nelson is an AIChE Fellow and a former officer and member of the board of directors of his local section.

Andres Orlando

Dr. Andres Orlando is a project engineer with Jenike & Johanson. Andrés received his B.S. in Mechanical Engineering and Ph.D. in Granular Mechanics from Clarkson University. His graduate studies focused on computational modeling of granular materials flows and comparing numerical models against physical experiments. Prior to joining Jenike & Johanson, he spent a year at the University of Southern California researching the micromechanical behavior of sheared sands. As a project engineer for Jenike & Johanson, he troubleshoots and recommends corrective action for solids flow problems, provides recommendations to avoid solids flow–related problems in new installations, and designs customized bulk solids handling equipment. In addition, Andrés regularly lectures on the flow of solids in bins, hoppers, and chutes.

Bilal Patel

Bilal Patel is a consultant at the Centre of Material and Process Synthesis (COMPS), University of the Witwatersrand, Johannesburg, South Africa. He obtained his BSc and PhD in Chemical Engineering from the University of the Witwatersrand.

He has received numerous awards during his PhD studies, including the NRF Scarce Skills Scholarship and the Mellon Postgraduate Mentoring Programme Scholarship.

His research interest is in the field of process synthesis and integration. He is particularly interested in developing systematic methods and tools to aid in flowsheet synthesis, especially tools that can be implemented in the conceptual phase of the design process. These tools should aid in setting targets for processes in order to ensure that they are designed to be efficient, environmentally friendly and sustainable.

W. Roy Penney

W. Roy Penney, Ph.D., worked for more than 25 years with leading industrial companies such as Phillips Petroleum, Monsanto, A. E. Staley, and Henkel Corp. The author of more than 40 technical publications, and the creator of numerous computerized mixing equipment design programs, he is currently a professor of chemical engineering at the University of Arkansas.

Herman Purutyan

Herman Purutyan is the CEO of Jenike & Johanson Inc., a world-renowned engineering consulting firm specializing in the storage, flow and processing of powder and bulk solids. He has been recognized worldwide for his technical ability and experience in the field of storage and flow of solids. He has 20 years of experience designing solids handling systems and troubleshooting handling programs in a wide variety of industries.

Rahul Raman

Rahul Raman graduated from Carnegie Mellon University with a Dual Master's Program in Chemical Engineering and Engineering & Technology Innovation Management in 2012. He provides PSM consulting services to the oil and gas industry in Process Safety Information and Management of Change. He provides technical stewardship to the organization and is a subject matter expert on pressure relief systems. He has actively participated in and contributed to the Design Institute for Emergency Relief System (DIERS) User Group Meeting and API Sub-Committee for Pressure Relief Systems. He completed his Bachelor's of Technology in Chemical Engineering from Anna University in 2007.

A. S. Rangwala

A. S. Rangwala has worked for 35 years in the mechanical design and structural dynamics of compressors and gas turbines in aircraft engines and steam and gas turbines for power plant applications. He has worked at General Electric Company's Steam Turbines Department in Schenectady, NY, and at General Electric Company's Aircraft Engines Group in Cincinnati, OH, and Lynn, MA. He is the author of the book *Control System Trends and Turbo-Machinery Dynamics: Design and Operation*. He is technical director of the Machinery Dynamics Group of the Center for Engineering Technology in Orlando, FL.

Frank Renshaw

Frank Renshaw is a certified safety professional, certified industrial hygienist and EHS consultant, and has 35 years of experience with Dow Advanced Materials (formerly Rohm and Haas Company). He served as EHS Director for Specialty Materials, Corporate Safety Director and Corporate Industrial Hygiene Director for Rohm and Haas. He chaired the company's Code of Safe Manufacturing Practice Committee, coordinated business-wide initiatives on closed-system chemical operations, and led Major Accident Prevention studies involving coatings, adhesive, and plastics additives processes. He served on new acquisition teams in Europe and Asia and on a plant start-up team for a coatings facility in Russia. He is co-chair of NIOSH's Manufacturing Sector Council and has published work related to the National Prevention through Design Initiative. Frank received his B.S. degree from the University of Iowa, his M.S. degree from the University of Minnesota, and his Ph.D. from the University of Cincinnati.

Martin Rhodes

Martin Rhodes holds a Bachelor's degree in chemical engineering and a PhD in particle technology from Bradford University in the UK. He has industrial experience in chemical and combustion engineering as well as many years' experience as an academic at Bradford and Monash Universities. He has research interests in various aspects of gas fluidization and particle technology, areas in which he has many refereed publications in journals and international conference proceedings. Martin has served on the editorial boards of Powder Technology and KONA and on the advisory board of Advanced Powder Technology. Martin has a keen interest in particle technology education. He has published books and CD-ROMs on laboratory demonstrations and has directed continuing education courses for industry in the UK and Australia. He was co-founder of the Australasian Particle Technology Society. Martin is Professor Emeritus in the Department of Chemical Engineering at Monash University, Australia.

Robert Rosen

Bob is currently a Staff Consultant and Instructor for CCPS. He has over 15 years of experience in chemical production management; five years in project and process engineering management; and 20 years in the safety, health and environment area. From 1997 through 2003, he was the Director of Emergency Response and Issue Management for BASF Corporation in Mount Olive, NJ. Since 2003, Bob has done Occupational Safety, Process Safety and Emergency Response consulting. Prior to 1997, Bob worked for Merck, Polaroid, Story Chemical, and Polysar. Bob received a B.Ch.E. in 1966 from Clarkson University. He is a Fellow of the American Institute of Chemical Engineers.

David A. Rosenthal

David Rosenthal, P.E., leads Reliability Delivery and Asset Management for Jacobs Engineering Group in Houston, TX, where he implements methods and practices to maintain their client's assets in the US. He has been involved in Reliability and Maintenance for over 30 years. His previous positions included roles as Reliability Manager for Marsulex, working the coke cutting, handling, and transport assets across five refineries. He has also been a Maintenance Director with MEMC in Houston in polysilicon manufacturing. As a reliability consultant, David assisted LanXess (which produces Butyl Rubber) and Kellogg's (in their Snack Foods Division) in the development of their reliability programs.

The majority of his career was with Rohm and Haas Company, a specialty chemical manufacturer. He was their Maintenance and Reliability leader in their Acrylic Acid Deer Park, TX, facility and a Manufacturing Manager leading their corporate Manufacturing Excellence deployment throughout its businesses. His role in their Corporate Asset Management group in the mid-90s developed the company's competency in Reliability and Equipment Utilization improvement. Assignments during his twenty-eight-year career included process, project engineering and technical management roles in various facilities.

Dave was the 2012 President of the American Institute of Chemical Engineers. He has served on the National level as their Treasurer, Board of Director, and chair of various committees since 1990.

Dave graduated from Drexel University with a B.S. in Chemical Engineering and from the University of Texas with an M.S. in Chemical Engineering. Dave is a registered professional engineer in Pennsylvania.

Alan Rossiter

Alan Rossiter is President of Rossiter & Associates, a consulting firm dedicated to helping oil refineries and chemical plants achieve excellence in energy efficiency. In addition to consulting projects for companies such as ExxonMobil, Phillips66, LyondellBasell and Sasol, Alan provides training courses in pinch analysis and energy management. He also runs courses in communication skills, engineering ethics and professional excellence, and was the 2010 Chair of the South Texas Section of AIChE. Dr. Rossiter was born and raised in Rhodesia (now Zimbabwe) and received his B.A., M.Eng. and Ph.D., all in chemical engineering, from the University of Cambridge, England. He has more than 30 years of process engineering and management experience and more than 70 publications, including the books *Waste Minimization Through Process Design* (McGraw-Hill, 1995), *Professional Excellence: Beyond Technical Competence* (AIChE-Wiley, 2008) and, more recently, *Energy Management and Efficiency for the Process Industries* (AIChE-Wiley, 2015).

Robert Salvin

Robert Salvin is a chemical engineer with over 40 years of experience in the chemical industry. He has been associated for 35 of those years with LyondellBasell and its predecessor companies, Lyondell and ARCO Chemical. Throughout his career, Salvin has focused primarily on corporate development, with responsibility for economic evaluation guidelines and methodology for the company worldwide. He has an MBA in finance with degrees from Drexel University.

Gary Sawyer

Gary Sawyer, P.E., has over 30 years of experience in the chemical industry, most of which has supported business and R&D decision analysis with process design, economic evaluations, and competitive technology assessments. He was employed by Lyondell Chemical (formerly ARCO Chemical), and by Union Carbide prior to that. He is now a consultant practicing as Process Evaluations LLC. He holds a B.S. and M.S. degree in chemical engineering from Rensselaer Polytechnic Institute, and he serves as an Industrial Consultant for the University of Pennsylvania.

Jeffery Seay

Dr. Jeffrey Seay is Associate Professor of Chemical and Materials Engineering at the University of Kentucky College of Engineering Paducah Extended Campus Program. Dr. Seay joined the University of Kentucky in 2008 after a 12-year career as a process engineer in the chemical industry. His research interests include the integration of sustainable biomass supply chains with thermochemical modeling of

biomass utilization processes as well as the application of appropriate technology to the production of biofuels in underdeveloped regions. Dr. Seay is the current Chair of the American Institute of Chemical Engineers (AIChE) Sustainable Engineering Forum (SEF) and past Vice-Chair and Education Committee Chair for the SEF. In the last several years, he has served on the organizing committee for several international sustainability-focused conferences.

Dr. Seay leads the University of Kentucky Appropriate Technology and Sustainability (UKATS) research group at the University of Kentucky Paducah Extended Campus. UKATS is focused on developing sustainable, renewable energy solutions for underdeveloped regions, particularly sub-Saharan Africa. His group has collaborated with the African Center for Renewable Energy and Sustainable Technology (ACREST) in Cameroon to develop a sustainable process for producing biodiesel from locally available resources. In addition, his group is working to develop metrics for evaluating the impacts of renewable energy processes in developing regions. Dr. Seay is a past faculty advisor to two US EPA-funded People, Prosperity and the Planet projects focused on sustainable biofuel. Dr. Seay's outreach activities include hosting local high school students who are interested in participating in sustainability-focused research projects. More than 20 students from 5 area high schools have participated over the last 5 years.

Adrian Sepeda

Adrian Sepeda has a broad background that spans more than 33 years in the chemical industry. After managing process safety, risk management and accident investigations for Occidental Chemical Corporation's worldwide operations, he retired from OxyChem as the Director of Risk Management in 2002. He then started his own process safety and risk management consulting firm, A. L. Sepeda Consulting Inc. He has serviced national and international clients that include large corporations as well as small businesses. He "retired" again and closed his business in 2013. Adrian now accepts small process safety– and risk management–related projects and teaching requests.

Dan Smith

Dan Smith is a Sr. R&D Advisor with Albemarle Corporation and Manager of Albemarle's Chemical Reactivity and Engineering Fundamentals group. He has extensive experience in process development, process design, process simulation and process evaluation, which has included work on Albemarle commercial products such as alpha olefins, linear alcohols, flame retardants, and organometallic catalysts. For 20 years, he has consulted on pressure relief and related process safety issues. Dan trains engineers at Albemarle Corporation on pressure relief design, and has been active with the AIChE Design Institute for Emergency Relief Systems (DIERS) Users Group since 2004. Since he joined Albemarle's Core Technology group in 2003, his focus has been to develop a comprehensive reactive hazard evaluation program for the whole company, and he has been instrumental in establishing several other process safety practices and procedures within Albemarle. Dan graduated from the University of Arkansas with a B.S. degree in Chemical Engineering in 1985.

Néstor Sposito

Néstor Sposito joined CCPS in 2011 after 32 years with Dow Argentina. He is actively involved in the leadership of NFPA and the United Nations Environmental Program's APPEL Process. Néstor has BS degrees in Chemistry and Chemical Engineering and an MS in Hygiene and Safety Engineering.

S. Greg Starks

S. Greg Starks, Regional Sales Manager for HTRI in the USA and Canada, graduated with a BS in Mechanical Engineering from Texas A&M University, College Station, Texas, USA. While working at the Shuttle Support Thermal Control Systems Analysis Group of Rockwell International, Houston, Texas, he performed thermal analyses for the space shuttle and developed geometry models for the shuttle and space station. From 1994–1999, Starks was employed at HTRI developing calculation engines for their software as well as a quality control database to track program changes. He then moved to Austin, Texas, to work as the Software Engineering Manager for Tanisys Technology, Inc., a supplier of automated test equipment for semiconductor memory technologies. When he rejoined HTRI, Starks was responsible for enhancements to the Xist calculation engine. He now leads sales efforts in the United States and Canada and assists with HTRI's training initiatives.

Byron Sun

Byron has over 27 years of experience in the chemical industry, including 9 years as a chemical engineer, 6 years in production management and 12 years as a safety, health and environment professional. Byron worked for China Petrochemical Company (now SINOPEC) for 9 years and for DuPont Company for 15 years. From 2004 through 2012, he was Safety, Health and Environment Manager for DuPont China. In 2012, Byron became a full-time safety consultant and joined CCPS as a staff consultant.

Byron received a diploma from Shanghai Science and Technology University and obtained a Master's degree from Tongji University.

Remi Trottier

Remi Trottier is a research scientist in solids processing at The Dow Chemical Company. He has more than 20 years of industrial experience in particle characterization. He has written numerous papers on particle characterization and has taught short courses.

Thomas Troxel

Thomas Troxel is a Vice President at Jenike & Johanson Inc., a world-renowned engineering consulting firm specializing in the storage, flow and processing of powder and bulk solids. He has been involved in many projects related to flow properties testing, modeling, blending, pneumatic conveying and fluidization.

Erdem Ural

Dr. Erdem Ural is a well-known combustible dust expert with over 25 years of experience working on research, litigation, insurance, protection, testing and regulatory aspects of combustible dust problems. He has published numerous papers on the subject and is author of the "Explosion Prevention and Protection" chapter of the National Fire Protection Association (NFPA) *Handbook of Fire Protection*. Dr. Ural taught as an adjunct professor of Fire Protection Engineering at the Worcester Polytechnic Institute. He currently serves on the editorial boards of two technical journals and on several NFPA combustible dust hazard committees, and he chairs the ASTM International committee responsible for combustible dust hazard standards.

Jenny Wang

Jenny Wang is currently a CCPS staff consultant and instructor. From 2009 to 2015, she was the Asia process safety manager at Air Products. Prior to that, she had 15 years' experience in process and process safety in DuPont and Bayer Material Science, with various responsibilities of process engineering, PHA, risk analysis, incident investigation, PSM auditing, etc. Jenny has a BS degree in Refined Chemical Engineering and an MS degree in Applied Chemistry. Her projects include: process safety training program, translation of CCPS products, and Asia CCPS conferences.

Christianto Wibowo

Christianto Wibowo is a principal engineer at ClearWaterBay Technology, Inc. He has over 15 years of experience managing consulting projects on the development of crystallization and solid-liquid separation processes. He is a senior member of AIChE and is actively involved in the Process Development Division.

Fred Williams

Fred Williams, B.S., PE, is a Senior Project Management Consultant with The Pegasus Organization. Mr. Williams is an experienced Project Manager and Professional Engineer with a B.S. in Civil Engineering from the Georgia Institute of Technology. His clients have included chemical and pharmaceutical companies as well as energy and electric and gas utility organizations. Project areas have included work management, engineering, auditing, procedure development, supply chain management and process development. He has been an instructor for the Pennsylvania State University's Project Management Certificate Program. Fred's greatest strength is the way in which he provides guidance in applying project management tools and techniques in a non-threatening manner.

John Williams

John Williams, PE, is a practicing engineer in the process industries with over 30 years of experience in project development, cost estimating and financial analysis. His deep experience spans the chemical, metals, refining, biotech and pharmaceutical industries. In his engineering practice, he specializes in conceptualization, technical and economic analysis, process optimization, plant design and plant retrofits.

Theodore Williams

Dr. Theodore "Ted" Williams has developed detailed cost estimation techniques for capital projects and operations over more than a decade at EPS, a leading engineering design firm. In that time, he has worked closely with clients in the energy sector performing operations analysis, design, and valuations for oil refining, petrochemical, biofuels, and power generating facilities.

Dr. Williams' technical expertise includes cost estimating, aerodynamics, computational fluid systems, finite element method, product development and design optimization. While continuing his work in industry, he also served as an Adjunct Assistant Professor in the Aerospace and Mechanical Engineering Department of the University of Notre Dame, where he taught aerodynamics theory and mechanical engineering design. He holds a PhD and an MS in Aerospace and Mechanical Engineering from Notre Dame and a BA in Physics from Wabash College.

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