Plan to attend this practical mixing course for process engineers and scientists...

The Art and Science of Industrial Mixing
April 14–16, 2015
Chicago, Illinois

- Demystify mixing processes!
- Participate in problem-solving sessions and demonstrations where you observe good and bad mixing
- Learn how to avoid the most common mistakes in mixing
- Gain a working knowledge of mixing fundamentals and equipment
- Identify how to achieve measurable and reproducible mixing results
- Understand the components of typical mixing equipment, including impellers, motors, shafts, and seals

Please share this brochure with colleagues who may benefit from attending this course.

ENROLL ONLINE TODAY!
The Art and Science of Industrial Mixing
April 14–16, 2015 in Chicago, Illinois

Practical Ideas for Real Problems
While some of mixing is still an art, much of today’s knowledge is backed by real science and engineering. This introductory course will:
• Take the mystery out of fluid mixing
• Give you practical tools to tackle real problems
• Help you achieve measurable and reproducible results
• Understand the relationship between your process and mixing

Once you understand how and why mixers work, you will be able to correctly identify ways to improve your mixing. This course will get you moving immediately in the right direction.

Explore Important Concepts
You will learn what it takes to achieve good mixing and how to apply practical ideas to your processes. During the course, you will examine:
• The fundamental relationships for:
  – impeller power
  – pumping capacity
  – blend time
• Shear rate
• Flow patterns
• Scale-up methods using geometric similarity
• Different fluid mixing applications:
  – liquid blending
  – solids suspension
  – powder addition
  – gas-liquid dispersion
  – liquid-liquid mixing
• How and when to use different types of impellers
• Relationships for determining, establishing, quantifying, and achieving process requirements
• The basics of mechanical design for mixers
• Typical components of mixing equipment, including tanks, motors, drives, seals, shafts, and impellers and their function

Upon completion of this course you will be prepared to:
• Apply mixing fundamentals to your process applications
• Understand the importance of flow patterns
• Evaluate and quantify mixer performance for new or existing mixers
• Calculate mixer power and other operating characteristics
• Perform geometrically similar scale-up calculations
• Identify ways to improve your mixing intensive processes

This practical course will be especially valuable to those who are new to the field of mixing or those with past experience who need a practical update. Engineers and scientists who must convert process and product objectives into practical results will learn how. This course will be immediately useful to those who are involved in:
• Day-to-day mixing applications
• Process improvement
• Solving process or equipment problems
• Processes for new products
• New equipment installations
• Retrofits and replacements
• Expansions

Increase Your Mixing Knowledge
The course format combines lectures, demonstrations, and problem-solving sessions. Not only will you learn about fluid mixing, you will have the opportunity during the course to observe good and bad mixing through demonstrations with water and flow followers in a transparent tank. Examples of computer model results will help you understand the flow patterns that provide good mixing. Both physical models and computer animations will show the important dynamics and parameters of fluid mixing.

Your Instructor
David S. Dickey, PhD, has been an independent consultant with MixTech, Inc., in Coppell, Texas since 1998. Before he began consulting, he had more than 23 years of experience with process equipment manufacturers, including 16 years working directly with manufacturers of liquid mixing equipment. He has also engineered dry-solids mixing equipment, pilot plant reactors, static mixers, heat exchangers, pumps, distillation, and other process equipment. His experience includes new product and process development, scale-up, application engineering, manufacturing, and sales. He has written and/or co-authored more than 30 publications on the practical and technical aspects of engineering, equipment, and design for mixers. He holds a BS degree in chemical engineering from the University of Illinois and MS and PhD degrees in chemical engineering from Purdue University. In 2005, Dr. Dickey received the North American Mixing Forum Award for Excellence and Sustained Contributions to Mixing Research and Practice.

Technical discussions and calculations will demonstrate how to:
• Calculate impeller power
• Evaluate volume specific power and torque
• Estimate mixing blend time
• Understand dimensionless groups
• Perform geometrically similar scale-up

The interactive format of the course will provide ample opportunity for you to ask specific questions about your processes and problems. The course instructor can draw on his years of experience in many different areas to help answer your questions. When you complete the course you will have the practical knowledge necessary to tackle and solve most of your mixing problems.

Please bring a scientific calculator for use during the problem-solving sessions of the course.
Course Outline

Welcome and Introduction
Elaine M. Bower, FAIChe
Program Director
Department of Engineering
Professional Development
University of Wisconsin–Madison

Mixing Terminology and Concepts
• Processes
• Equipment
• Technology
• Flow, shear, and pumping capacity

Mixing Impellers
• General purpose
• Special purpose
• Different uses

Impeller Power
• Power measurements
• Dimensionless numbers
• Power correlations
• Viscosity effects
• Torque

Essentials of Mixer Design
• Quantity
• Difficulty
• Intensity
• Liquid blending
• Blending applications

Mixer Performance Calculations
• Problem set
• Solution

Flow Patterns
• Axial, radial, and rotational flow
• Computer models of fluid velocity
• Radial, mixed, and axial flow impellers
• Viscosity effects
• Tank geometry effects

Liquid-Liquid Mixing
• Design for blending applications
• Blend time estimation
• Immiscible liquid dispersion
• Drop size and tip speed
• High-shear dispersers

Mixer Demonstration
• Mixer performance
• Effect of baffles
• Different impellers
• Performance comparisons

Solid-Liquid Mixing
• Solids suspension applications
• Levels of suspension
• Dry solids incorporation
• High-shear dispersers

Gas-Liquid Dispersion
• Dispersion applications
• Degrees of dispersion
• Dispersion mechanisms
• Impellers for gas dispersion
• Mass transfer

Heat Transfer
• Heat transfer applications
• Types of heat transfer
• Correlations and approximations

Static Mixers
• Mixer types
• Mixing characteristics

Scale-Up
• Geometric similarity
• Scale-up rules

Mixer Scale-Up Calculations
• Problem set
• Solution

Overview of Mixing Equipment
• Equipment components
• Similarities with all mixers

Tanks for Mixers
• Tank dimensions and characteristics
• Mixer mounting

Motors
• Electric motors
• Motor enclosures
• Explosion-proof motors

Mixer Drives
• Drive features
• Gears, bearings, and belts

Shaft Seals
• Lip seals
• Stuffing boxes
• Mechanical seals

Mixer Shafts
• Design for strength
• Design for critical speed

Mixing Impellers
• Practical design features
• Materials of construction

Summary and Review

Course Schedule
Registration and course will be held at
The Hilton Garden Inn–Chicago
O’Hare Airport
2930 South River Road
Des Plaines (Chicago), IL

Day 1
8:00 a.m. to 8:15 a.m.  Registration
8:15 a.m. to 4:30 p.m.  Class

Day 2
8:00 a.m. to 4:30 p.m.  Class

Day 3
8:00 a.m. to 12:00 p.m. Class

The daily schedule will include
midmorning and midafternoon
refreshment breaks and lunch at noon
on Day 1 and Day 2.

ENROLL ONLINE TODAY! Or visit our website.
Four Easy Ways to Enroll

Phone: 800-462-0876 or 608-262-1299 (TDD 265-2370)

Fax: 800-442-4214 or 608-262-3448

Email: The Pyle Center
Attn: Engineering Registration
702 Langdon Street
Madison, Wisconsin 53706

Internet: epd.engr.wisc.edu/webR023

ENROLL ONLINE TODAY!

Course Information

❑ Please enroll me in The Art and Science of Industrial Mixing
Course #R023 April 14–16, 2015 in Chicago, Illinois Fee: $1795
❑ Team Discount: $1650 per person when two or more enroll from the same organization at the same time
❑ I cannot attend at this time. Please send me brochures for future courses.

Limited Enrollment

Personal Information (Please print clearly.)

Name ________________________________________________
Title _________________________________________________
Company ______________________________________________
Address _______________________________________________
City/State/Zip __________________________________________
Phone (______) __________________ Fax (______) ____________
E-mail ________________________________________________

Additional Enrollees

Name ________________________________________________
Title _________________________________________________
E-mail ________________________________________________

Billing Information

❑ Bill my company ❑ P.O. or check enclosed (Payable in U.S. funds to UW – Madison)
❑ MasterCard ❑ Visa ❑ American Express

Cardholder's Name _____________________________ Expires __________
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Future Courses

For information about the following courses, contact Elaine Bower, Program Director, at 800-462-0876, or e-mail her at bower@engr.wisc.edu.

Successful Liquid Mixing Scale-up Methods
February 10–12, 2015
Course #R035
Pilot Plant and Laboratory Safety
February 23–25, 2015
Course #R146
Spray Technology for Chemical and Petrochemical Applications
February 26, 2015
Course #R147
Dryer Technology
April 28–29, 2015
Course #R024
Atomization and Spray Technology: Focus on Spray Drying
April 30, 2015
Course #R025

Need to Know More?

Call toll free 800-462-0876 and ask for

Program Director: Elaine M. Bower
bower@engr.wisc.edu

Program Associate: Theresa Rodger
rodger@epd.engr.wisc.edu

or e-mail custserv@epd.engr.wisc.edu

General Information

Fee of $1795 Covers Course notebook, break refreshments, lunches, and certificate. We do not publish proceedings. Course materials are distributed only to participants.

Cancellation If you cannot attend, please notify us by April 7, 2015, and we will refund your fee. Because this course has limited enrollment, cancellations received after April 7 and no-shows are subject to the full course fee of $1795. You may enroll a substitute at any time before the course starts.

Location and Accommodations This course will be held at the Hilton Garden Inn Chicago O’Hare, 2930 South River Road, Des Plaines (Chicago), IL 60018. We have reserved a block of guest rooms (rates starting at $134) at the Hilton Garden Inn Chicago O’Hare. Reserve a room online at epd.engr.wisc.edu/lodgingR023 or call 847-296-8900 and indicate that you will be attending this course under group code UOW. Room requests made after March 23 will be subject to availability. Other fees and restrictions may apply.

Earn Continuing Education Credits

By participating in this course, you will earn 20 Professional Development Hours (PDH) or 2.0 Continuing Education Units (CEU).

On-site Courses Save Time and Money!

Engineering Professional Development can deliver The Art and Science of Industrial Mixing
• At a location of your choice
• At your convenience
• At reduced per-person cost
• Tailored to your needs

To inquire about this course or other courses we can bring to your site, call 800-462-0876 and ask for Program Director Elaine Bower. Or see epd.engr.wisc.edu/onsite

UW# _____________________________

From mailer panel.