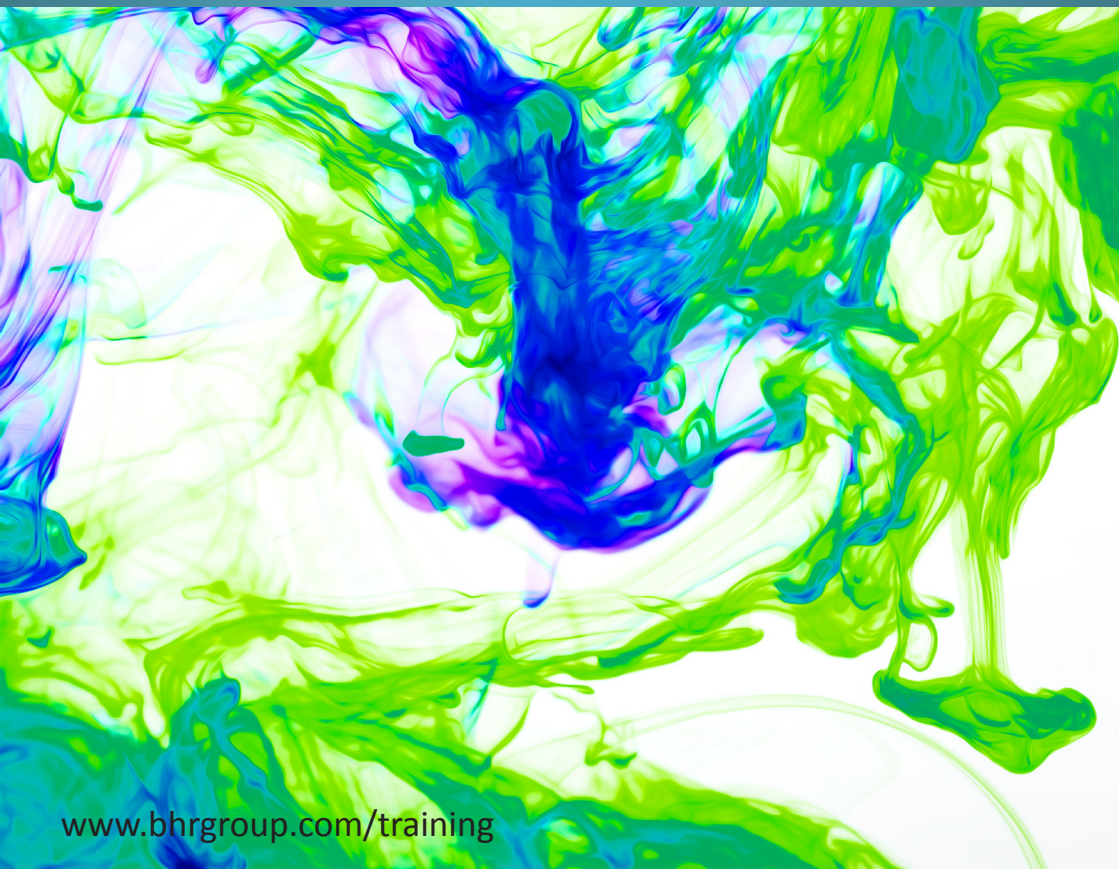
BHR Group
EXPERTS IN FLUID ENGINEERING

COURSES

Improving Mixing Processes for Industrial Applications



www.bhrgroup.com/training

ABOUT THE COURSE

Improving Mixing Processes

Background to the Course

The course will communicate principles of fluid mixing, provide recommendations for process design and scale-up and enable participants to apply these to their mixing processes/problems. Additionally the course will discuss specifications for the optimal selection and operation of mixing equipment.

Course Outline

Mixing is fundamental to process efficiency and product quality:

- Flexibility in operation (multiple products from one plant; variable batch sizes).
- Product consistency and repeatability.
- Success in scale-up/scale-down.

These mixing-related concerns require a good understanding of the underlying mechanisms and principles which will be covered in this course. A comprehensive set of lecture notes will be provided in PDF format on a memory stick.

Who should attend

The course is designed for experienced engineers and graduates, scientists and fluid engineering managers from the chemical, process or related industries (biochemical, pharmaceutical, personal care) who are involved in product or process development, design, operation or research.

Course Leader

Dr. Nigel Heywood is a Chartered Chemical Engineer & Fellow of the Institution of Chemical Engineers with a PhD from the University of Wales. He researched multiphase pipeflow at Toronto University, and has worked at Warren Spring Laboratory, AEA Technology and Aspen Technology. He is a senior BHR consultant in slurry handling and the author of over 200 articles and reports and a book “Slurry Handling: Design of Solid-Liquid Systems”.

Course Tutors

Dr Mick Dawson has a PhD in Chemical Engineering and is BHR’s Engineering Director. His areas of expertise include process mixing, inline mixing, gas-liquid mixing and mass transfer.

Mr David Brown has a B. Eng in Chemical Engineering and is Technical Director at BHR Group. He is an authority on experimental methods and solid-liquid mixing, contributing to the Handbook of Industrial Mixing.

Dr Gustavo Padron is a Senior Consultant in Chemical Engineering at BHR, specialising in liquid-liquid and gas-liquid mixing processes and the design, commissioning, execution and analysis of experimental projects related to mixing processes.

Learning Objectives

On completion of the course, you will appreciate how to:

- Understand the fundamentals of mixer design
- Scale up mixing systems
- Troubleshoot mixing systems
- Optimise processes.

COURSE PROGRAMME

Day 1

Introduction
Objectives and layout of course. Importance of mixing in industrial processes, consequences of failures in mixing processes, energy savings and social benefits, examples of capital and operating cost savings.

Mixer types & associated equipment
Different types of mixers (top, submerged and bottom entry mixers, static mixers, jet mixed systems and associated equipment), flow patterns, general guide to impeller selection, mechanical design.

Mixing concepts
Process requirements, dimensionless groups, flow regimes (laminar, turbulent, transitional), power requirements for mixing processes, rules for scale-up and scale-down.

Liquid blending
Mechanisms of blending; blending regimes; blending liquids of low-medium viscosity (turbulent and transitional regimes); scale-up & down; blending high viscosity liquids (laminar regime); blending liquids of different properties (including video demonstrations); CSTRs; blending with jets.

Reactive mixing
Effect of mixing on multiple reactions, micro and meso mixing models, effect of process parameters on reaction productivity, optimisation and scaling of reactive systems to increase productivity and reduce waste in the reactor.

Liquid-liquid dispersions
Phase continuity, deformation and break-up of drops (including video demonstrations), coalescence phenomena, impeller selection, mass transfer in liquid-liquid dispersions.

Tutorial:Example calculations, case studies

Tour of labs & pilot plants at BHR Group.

Day 2

Solid-liquid mixing
Solid suspension: mechanistic and empirical models for solid suspension, power requirements, scale-up and down, jet solid suspension; solids distribution: multiple impellers; solids draw-down.

In-line and high intensity mixing
Blending, gas-liquid mixing and liquid-liquid mixing using in-line equipment (static mixers, ejectors and rotor stator mixers).

Heat transfer
Introduction to concepts related to heat transfer in mixing equipment.

Industrial Workshop/Questions and discussion of case studies from Course Attendees.

Gas-liquid mixing
Gas-liquid mixing design guidelines for low-to-medium viscosity liquids; power requirements and effect of scale on gas dispersion; hold-up and mass transfer; scale-up and down; multiple impellers.

Computational fluid dynamics (CFD)
How and why CFD is used to solve single and multiphase mixing and reaction problems.

What previous attendees say about this course:

"A good overview of mixing relevant to my job. Good level of theory covered" **Pfizer**

"Very informative, very confident and approachable lecturers - I will recommend this to more of my colleagues" **Mixing Solutions Ltd**

"Very well-structured course" **Cranfield University**

VENUE

The Course will take place at BHR Group.

Address

BHR Group, The Fluid Engineering Centre,
Cranfield, Bedfordshire MK43 0AJ

Accommodation

Delegates are responsible for their own accommodation (if required). A list of accommodation options can be supplied if required.

Course Fees

Course fees include the cost of tuition, course notes (on USB), lunches and refreshments during the course. There is a 10% early bird discount available for bookings made more than 4 weeks before the course starts

By early bird cut-off	£720 +VAT
After early bird cut-off	£800 +VAT
Web-based Attendance	£400 +VAT

For the third and further delegates from the same organisation, a 50% discount is available*. FMP members are eligible for a further £100 discount on the published prices.

Delegates with any special requirements should contact the course organiser as soon as possible.

*Not available in conjunction with any other offers.

HOW TO BOOK

Booking for this course should be completed through our secure online Booking system.

Log on to our secure booking site at: www.bhrgroup.com/training and complete the application process as directed.

You will receive an automatic email confirmation of your booking within 24 hours.

Other payment options:

- Cheque made payable to VirtualPiE Limited and mailed to the course organiser at the address below.
- Bank transfer paid to our account at:
  Barclays Bank
  Account number: 33034771
  Sort code: 20-23-55
  IBAN: GB30 BARC 2023 5533 0347 71
  SWIFT BIC: BARCGB22

For online booking queries and for all other enquiries relating to the course please contact:

Nigel Heywood
Course Organiser

BHR Group, The Fluid Engineering Centre
Cranfield, Bedfordshire MK43 0AJ

T: +44 (0)330 119 1987
F: +44 (0)1234 750074
E: nheywood@bhrgroup.co.uk

Terms and conditions of booking

Payment in full should accompany your booking. Fees must be paid in full no later than 15 working days before the course commences. Failure to pay may result in attendance being refused.

Cancellations made up to 21 days prior to the course date will be subject to a £100 administration fee. NO REFUNDS will be given for cancellations made less than 21 days prior to the course. Replacement candidates are welcome at any time.

Registrations are accepted on the understanding that the printed programme is given in good faith, but this may have to be re-scheduled or the speakers changed for reasons outside our control. BHR Group reserves the right to cancel or postpone the course, in which case fees will be refunded in full. In the event of cancellation, BHR Group will not be held liable for delegates travel or accommodation expenses.