

# Slurry Handling: Pumping & Pipeline Design

18th- 19th October 2017



# ABOUT THE COURSE

## Slurry Handling: Pumping & Pipeline Design

### Course Outline

This course aims to provide an understanding of the hydraulics of slurry flow in pipes. It focuses on how an effective slurry pipeline system can be best achieved through appropriate assessment of relevant slurry physical properties, pipe sizing, and pump selection and sizing.

### Who should Attend

The course will be of interest to process, chemical, mechanical and civil engineers who wish to understand better the requirements to design a slurry pipeline system. Little or no prior understanding of pipeline design for slurry flows is needed. Participants are welcome to bring any specific application they may have, now or in the short term for discussion.

The topics covered are applicable across a wide range of industries, such as mining/minerals processing, bulk and fine chemicals, nuclear waste handling, sewage sludge and other effluent/waste solid/liquid operations across the process industry sectors.

### Learning Objectives

On completion of the course, you will appreciate the characteristics of the flow of both settling and “non-settling” slurry in pipes of different orientation and will have an understanding of:

- How to measure the rheological properties of “non-settling” slurries.
- How frictional pressure losses are estimated for “non-settling” slurry (laminar and turbulent flow) and settling slurry flowing in circular pipes and pipe fittings.
- How to select and size appropriate pumps for slurry transfers.
- The importance of designing a system which minimises wear in pipework, pumps and fittings and the various types of isolation valves used in slurry pipework.
- How slurry storage tanks can be designed using different agitator types, diameters, speeds, etc. for different types of slurry.

### Course Lecturers

**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”.

**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.

**Mr Phivos Ioannou** has an M.Eng in Mechanical Engineering and an MSc in Computational Modelling and is currently conducting research for his PhD in Aerospace Sciences from Cranfield University. He is an engineering consultant in modelling and simulation at BHR.



# COURSE PROGRAMME

## Day 1

### Laboratory Measurement of Slurry Physical Properties

Knowledge of slurry physical properties is important for the optimum selection and design of process equipment. Measurement of flow curve/viscosity and other physical properties such as concentration, density, particle size distribution and settling rates.

### Pipeline Design for Non-settling Slurries

Estimation of frictional pressure drop/flow rate relationships for pipeline flow in laminar, transitional and turbulent flow of Newtonian and non-Newtonian slurries.

### Pipeline Design for Settling Slurries

Calculation of pressure drop/flow rate relationships and deposition velocity for settling slurries in horizontal pipes, covering both existing empirical correlations and the two-layer model approach. Also, approaches to vertical pipeflow.

### Pipe Clearing Methods and Systems

Several alternative methods, including pigging, can be used to clean pipework, recover valuable product, minimise effluent streams and switch cleanly from one product to another.

## Day 2

### Frictional Pressure Loss in Fittings

Calculation of frictional pressure losses for a wide variety of pipe fittings. Including elbows, bends, tees, sharp/gradual expansions and contractions, and some valve types. Estimation of losses apply to both Newtonian and non-Newtonian slurries in either laminar or turbulent flow.

### Slurry and Paste Pump Types

A wide variety of pump types are reviewed.

### Slurry Pump Selection and Sizing

Various methods for selecting a generic pump type based on the key slurry properties and operating parameters, and methods for derating pumps for Newtonian slurries and settling slurries.

### Slurry Valve Types

Review of generic types of slurry valves with their operating ranges, advantages and limitations.

### Wear in Slurry Transfer Systems

Wear mechanisms, wear tests and minimising wear by the correct selection of materials and operating conditions.

### Slurry Storage Vessel Design and Operation

An overview of the various theories for slurry tank and agitator design.

## What previous attendees say about this course:

- "Well organised, good venue. The course definitely met my expectations and I feel I have learned a lot" PQ Silicas UK Ltd
- "The course material is very good and will form a good reference text for the future" Sellafield Ltd, UK
- "The course helped me to identify critical parameters / data for slurry handling design purposes" Corbion Group, Netherlands

# 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.

Early Bird Rate (Before 22nd September 2017)	£720 +VAT
Full Delegate Rate	£800 +VAT
Web- based attendance	£400 +VAT

For the third and further delegates from the same organisation, a 50% discount is available\*.

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

# How to Book

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

Visit [www.bhrgroup.com/training](http://www.bhrgroup.com/training), select the event you wish to register for and complete the booking 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:

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## 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 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.

\*Not available in conjunction with any other offers.