

It is known that offshore activity for the petroleum industry emphasizes subsea completions with full wellstream flow in much longer flowlines. Thus, an improved understanding of multiphase flow in wells, flowlines, and risers is of vital importance. **This course gives you that understanding!**

Fundamentals of two-phase flow in piping systems encountered in the production and transportation of oil and gas is the course's focus. The completed and current research projects conducted at the Tulsa University Fluid Flow Project (TUFFP) permits teaching the latest techniques for designing multiphase flow systems.

### This course features ...

- An appropriate balance will be maintained between lectures and problem solving, and between theory and application.
- Problem-solving sessions are dispersed throughout the course to enhance the understanding of variables unique to two-phase flow.
- Computer algorithms are presented so that you will be able to develop your own programs upon completion of the course.
- You will receive the SPE monograph on "Multiphase Flow in Wells" and an extensive workshop manual.
- A "get acquainted" reception will be held Monday at the end of class
- A tour of TU's North Campus Multiphase Flow and Flow Assurance Experimental Test Facilities.
- A scientific calculator will be provided

### This course is designed for ...

Systems Engineers, Process Engineers, Operations Engineers, Facilities Engineers, Reservoir Engineers, Production Engineers, Petroleum Engineers, Flow Assurance Engineers, Technical Consultants, Chemical & Mechanical Engineers, and anyone else who handles multiphase flow systems.

**Course Pre-Requisites:** A familiarity with basic fluid mechanics and fluid properties is necessary. You should also be familiar with hydrocarbon systems vapor-liquid equilibrium and computer programming. No previous experience in two-phase flow is required.

### DATE, TIME AND LOCATION

**May 11-15, 2015 • Tulsa, Oklahoma**

Doubletree Hotel, 6110 S. Yale, 918-495-1000

The short course is scheduled from 8:30 a.m. to 5:00 p.m.

Monday-Thursday and from 8:30 a.m. to noon on Friday.

**HOTEL RESERVATIONS:** A block of sleeping rooms has been reserved at the hotel for participants attending this course needing overnight accommodations. Contact the hotel directly, and specify you are with The University of Tulsa course. To receive the discounted group rate, reservations must be made before April 13, 2015.

## Instructors

**Dr. Cem Sarica**, F.H. "Mick" Merelli/Cimarex Energy Professor of Petroleum Engineering at The University of Tulsa (TU) holds a Ph.D. in Petroleum Engineering from TU. His current research interests are multiphase flow in pipes, oil and gas production, and flow assurance. He has authored several publications on these subjects. Since receiving his Ph.D. degree, he has worked for Istanbul Technical University (ITU) as an Assistant Professor of Petroleum Engineering, TU as the Associate Director of Tulsa University Fluid Flow Projects (TUFFP), and The Pennsylvania State University (PSU) as Associate Professor of Petroleum and Natural Gas Engineering in the Energy and Geo-Environmental Engineering Department. He is currently serving as the director of TUFFP, Tulsa University Paraffin Deposition Projects (TUPDP) and Tulsa University Horizontal Well Artificial Lift Projects (TUHWALP). He has taught several courses in multiphase flow in pipes, flow assurance and oil and gas production at ITU, PSU, and TU.

**Dr. James P. Brill**, Professor Emeritus and Research Professor of Petroleum Engineering at The University of Tulsa (TU), is a recognized authority on behavior prediction and applications for multiphase flow in pipes and paraffin deposition. Since receiving a Ph.D. degree in Petroleum Engineering from the University of Texas, he has worked for Chevron Oilfield Research Company and Amoco Production Company's Research Center, in addition to TU. He has numerous publications on multiphase flow and other areas of Petroleum Engineering and is coauthor of the *SPE Monograph on Multiphase Flow in Wells* that serves as the primary text for the short course. At TU, he has been actively engaged in teaching, research, and consulting in multiphase flow, and is the founder and director emeritus of TUFFP and TUPDP.

**"This course offers the attendee a unique opportunity to learn the fundamentals of multiphase flow technology from the industry experts who develop the technology."**

*R. Sutton, Sr. Technical Consultant, Marathon Oil*

**"I learned many useful tools and insights about multiphase flow that will help in my job."**

*R. Russell, Sr. Project Engineer, Baker Hughes, Inc.*

**"This was a very thorough course that covers multiphase flow correlations and models and how they work."**

*J. Damiano, Engineer I, EOG Resources*

**"As I was not familiar with the multiphase flow modeling, I was able to follow the explanations because the contents start from the fundamentals."**

*R. Hirose, Reservoir Engineer, INPEX Corporation*

**"The course is very well organized and I have a much deeper understanding now of multiphase flow. The course clarifies the theories behind software interface."**

*S. Cai, SGS Upstream Services*

## Course Outline

### Principles of Two-Phase Flow

- Single-Phase Flow Review
  - Conservation laws
  - Mechanical energy balance equation
  - Heat balance equation
  - Evaluation of friction losses
- Two-Phase Flow Introduction
  - Definition of basic variables
  - Two-phase flow pressure gradient equation
  - Flow patterns
  - Computing algorithms

### PVT Properties

- Mass Transfer Models
  - Black oil model
  - Compositional model
- Density of Oil, Water, Gas
- Viscosity of Oil, Water, Gas, Emulsions
- Surface Tension

### Flow in Wells

- Flow Pattern Prediction Modeling
- Pressure Loss and Holdup Prediction – Models and Correlations
- Evaluation of Pressure Loss Methods

### Flow in Pipelines

- Flow Pattern Prediction Modeling
- Pressure Loss and Holdup Prediction – Models and Correlations
- Evaluation of Methods
- Effects of Hilly Terrain
- Slug Flow Modeling

### Flow Through Restrictions

- Basic Equations
- Critical vs. Subcritical Flow
- Critical Flow Correlations
- Subcritical Flow Correlations

### Unified Modeling

- Model Development
- Model Evaluation

### Flow Assurance

- Wax Deposition
  - Deposition Modeling
  - Prevention and Remediation
- Severe Slugging
  - Phenomena
  - Mechanisms
  - Elimination Methods

“Brill and Sarica’s knowledge in multiphase flow is unsurpassed.”  
D. Dimattia, Process Eng. Advisor, ExxonMobil

“An excellent short course providing the background to problem solving techniques to use state of the art models to resolve your multiphase flow issues and understand the limits of the solutions.”

K. Leigh, Sr. Process Engineer, ChevronTexaco

“This course shows the pros and cons of many different models used in 2-phase flow calculations, so we as engineers know not to blindly follow the answers programs give us.”

J. B. Huff, Engineer I, EOG Resources

## Enrollment Information

To enroll, complete and return the attached enrollment form with your payment to: The University of Tulsa, Continuing Engineering Education, 800 South Tucker Drive, Tulsa, OK, 74104-3189, USA

or fax to: 918-631-2154

or call: 918-631-3088

or Email: [cese@utulsa.edu](mailto:cese@utulsa.edu)

or Online: [www.cese.utulsa.edu](http://www.cese.utulsa.edu) (credit card payments only)

Confirmation of enrollment will be sent to you by email prior to the course.

**SEMINAR FEE:** The seminar fee covers the cost of all sessions, handout materials, textbook, electronic workshop manual, guided tour of TU’s experimental facilities, reception and daily refreshments. The fee is to be paid in net U.S. dollars.

**MEMBER COMPANY DISCOUNT:** Available to those companies enrolled in TUFFP (Tulsa University Fluid Flow Projects) and TUPDP (Tulsa University Paraffin Deposition Projects).

**GROUP DISCOUNT:** Available to groups of two or more attending from the same company location.

**EARLY ENROLLMENT:** Sign-up for the short course before April 13, 2015 to receive this discounted rate.

All paid seminar fees will be refunded in the unlikely event the course is canceled. Those who cancel ten working days or less prior to the seminar will receive a refund less an administrative fee of \$125.

Refunds will not be granted after class has begun or for nonattendance. Substitutions are permitted at any time.

## What is TUFFP?

The Tulsa University Fluid Flow Projects (TUFFP) is a cooperative industry-university research group supported by more than 18 oil and gas production, service companies and government agencies from 10 countries. The group was formed January 1, 1973, to conduct applied research on fluid flow problems encountered by the member firms. Research is supported by \$1,000,000 annual membership fees. Most of the current research projects involve experimental studies of multiphase flow in pipes. Short courses on the design of two-phase flow in piping systems for oil and gas production and transportation are among the services offered by TUFFP to member and non-member firms.

## Registration Form

Please enroll the following in the May 11-15, 2015 - Tulsa, Oklahoma offering of **FLUID FLOW PROJECTS: “TWO-PHASE FLOW IN PIPES” Short Course.**

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Zip \_\_\_\_\_ Country \_\_\_\_\_

Phone ( \_\_\_\_\_ ) \_\_\_\_\_

Email \_\_\_\_\_

Enroll on-line! [www.cese.utulsa.edu](http://www.cese.utulsa.edu)

## Tuition Fee Schedule (price in net U.S. dollars)

### TUFFP & TUPDP Member Companies:

- \$2,595 per person - early enrollment discount (available until April 13, 2015)
- \$2,595 per person - group discount
- \$2,795 per person - regular tuition

### Non-Member Companies:

- \$2,995 per person - early enrollment discount (available until April 13, 2015)
- \$2,995 per person - group discount
- \$3,295 per person - regular tuition

### Method of Payment:

- Check enclosed. Make payable to The University of Tulsa, CESE
- Charge my credit card.
  - VISA  MasterCard  Discover  Am. Exp.

Card Number \_\_\_\_\_

Expiration Date \_\_\_\_\_

Name on Card \_\_\_\_\_

Billing Address \_\_\_\_\_

### Contact us at:

The University of Tulsa, CESE  
800 South Tucker Drive  
Tulsa, OK 74104-3189 USA

**FAX:** 918-631-2154

**CALL:** 918-631-3088

**EMAIL:** [cese@utulsa.edu](mailto:cese@utulsa.edu)



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Announces the 40th offering of

# FluidFlow Projects: Two-Phase Flow in Pipes

**A State-of-the-Art Short Course**

**May 11-15, 2015**  
**Tulsa, Oklahoma**

Instructors:

**Dr. Cem Sarica**

**Dr. James P. Brill**