

# *Improved Oil Recovery Technologies Certificate*

**PROGRAM SYLLABUS**

# *Improved Oil Recovery Technologies Certificate*

*If you are a technical professional working in the design and field implementation phases or thermal recovery operations of enhanced oil recovery for conventional and unconventional reservoirs, this certificate is designed for you.*

Take three, four-week courses and a seminar series taught by top academic instructors from the Faculty of Engineering at the University of Alberta. With classes Friday afternoons and on Saturdays you can learn while you work, advancing your career without time away from your job.

**1**

**ENHANCED OIL RECOVERY  
TECHNOLOGIES**

**2**

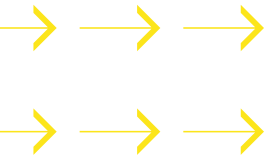
**THERMAL RECOVERY METHODS**

**3**

**UNCONVENTIONAL OIL AND GAS  
RECOVERY TECHNIQUES**

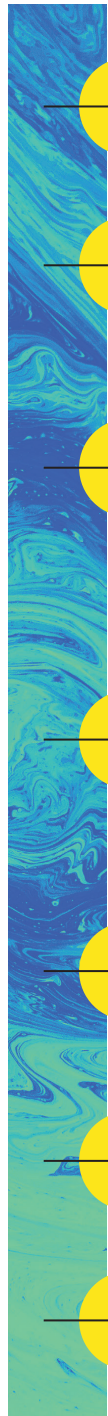


**THE RESPECTFUL LAND USE SERIES**



# Certificate Outcomes

***By completing this certificate,  
you will have the ability to:***



Determine the main reservoir characteristics to establish a base for further implementations of advanced recovery techniques.

Understand the basic mechanisms of conventional and unconventional EOR and thermal recovery methods.

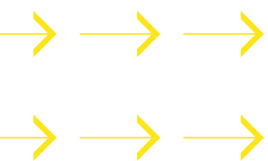
Select candidate reservoirs for water flooding, chemical flooding (polymer flooding, surfactant flooding, alkaline flooding), gas injection (immiscible and miscible gas flooding) operations and design and develop field implementation programs.

Select candidate reservoirs and design field implementation for thermal recovery operations including In-situ combustion, steam flooding, cyclic steam stimulation, steam/ solvent injection and steam-assisted gravity drainage (SAGD).

Understand the basics of hydraulic fracturing principles to be applied in unconventional (tight gas/oil, shale gas/oil) reservoirs.

Select candidate reservoir for water and gas based injection operations for further development of unconventional reservoirs.

Appreciate and respect land use in relation to treaty and/or land agreements with Indigenous nations.



# Meet Your Instructors



## **Tayfun Babadagli** PHD, PENG

Dr. Babadagli is a professor in the Civil and Environmental Engineering Department, School of Mining and Petroleum Engineering, at the University of Alberta, where he holds an NSERC-Industrial Research Chair in Unconventional Oil Recovery. He previously served on the faculty at Istanbul Technical University, Turkey, and Sultan Qaboos University, Oman. Babadagli holds BS and MS degrees from Istanbul Technical University and MS and PhD degrees from the University of Southern California, all in petroleum engineering.

Dr. Babadagli has provided consultancy services, short courses, and delivered talks to industry, universities, and research centers in more than thirty countries. Babadagli has authored more than 480 technical papers, of which more than 260 appearing in refereed journals, three book chapters, more than 50 technical reports, and he holds one patent.

He is currently a member of the JPT Editorial Committee and has served on numerous other SPE educational and research related committees as well as conference/workshop/forum programming and organizing committees. He is also the recipient of the 2017 SPE International Reservoir Description and Dynamics Award. In 2020, Dr. Babadagli was selected as a recipient of SPE and AIME Honorary Membership.

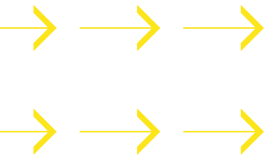


## **Huazhou Li** PHD, PENG

Dr. Li is an Associate Professor in Petroleum Engineering at the University of Alberta. He holds a BSc degree and an MSc degree, both in Petroleum Engineering, from the China University of Petroleum (East China), and a PhD degree in Petroleum Systems Engineering from the University of Regina.

His research focuses on improving phase-behavior modeling of complex reservoir fluids and developing novel enhanced oil/gas recovery techniques. He has published one book entitled "Multiphase Equilibria of Complex Reservoir Fluids" and authored more than 100 peer-reviewed journal papers and SPE conference papers. He now serves as an associate editor for Geofluids.

He received the Regional Distinguished Achievement Award for Petroleum Engineering Faculty from the Society of Petroleum Engineers (SPE) in 2020, the Petro-Canada Young Innovator Award from the University of Alberta in 2018, and the Outstanding Technical Editor Award from SPE Journal in 2016, 2019, and 2021. He is a member of SPE and American Chemical Society (ACS).



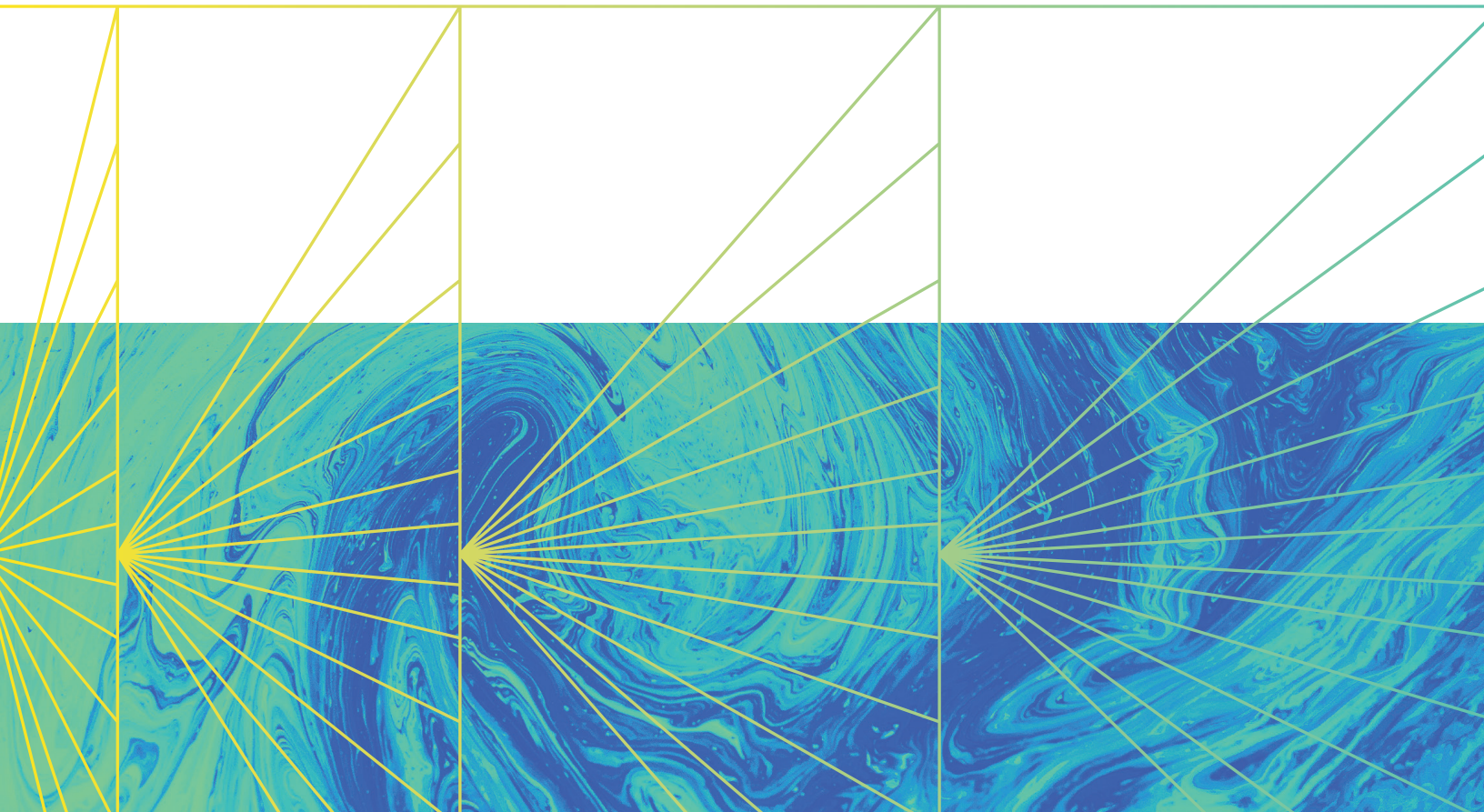
# Meet Your Instructors



## **Jessica Vandenberghe** MSc, PEng

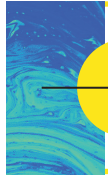
Jessica is an Industrial Professor - Indigenous Engineering and Assistant Dean (Community and Culture) with Engineering at Alberta where she oversees a wide portfolio that contributes to the development of well rounded and ethically minded engineering students who will ultimately help to build strong and vibrant communities within Canada.

She has worked in the oilsands, mining, regulatory, infrastructure, and consulting industries. She holds a B.Sc. in Chemical Engineering Computer Process Control Co-op and a M.Sc. in Chemical and Mining Engineering, both from the University of Alberta. Her career has taken her to communities large and small around the nation and she has sat on many Boards and Councils with stakeholders, such as federal, provincial and municipal governments, as a representative of First Nations, Metis Settlements and Metis Nations, as well as academic institutions and private industry. As a mother of two and an Indigenous female engineer, she is passionate about diversity, equity, and inclusion, along with Truth and Reconciliation.



# 1

# Enhanced Oil Recovery Technologies



**Tayfun Babadagli** PHD, PENG

MAR 2022 | FRIDAYS 4-6 PM | SATURDAYS 9 AM - 4 PM

This course is designed to provide an extensive coverage of enhanced oil recovery methods. After covering the theory of displacement processes in porous media (waterflooding in specific), class exercises will be given. We will discuss improved waterflooding using chemicals. Field examples of different types of applications, as well as a pilot design will be provided. The course also covers new EOR technologies including the use of nano-materials.

## **Week 1** MARCH 4-5, 2022

Introduction and basic concepts in multiphase flow in porous media. Natural drive mechanisms. Why EOR? Microscopic, macroscopic, and volumetric sweep efficiency. Concept of capillary number. Definition and measurement of residual oil saturation. General classification of enhanced oil recovery methods. Screening criteria.

## **Week 2** MARCH 11-12, 2022

Waterflooding. Residual oil. Secondary and tertiary recovery. Recovery mechanisms. Fractional flow. Recovery factor calculations. Chemical methods (polymer, surfactant and alkali flooding). Types of surfactants and chemical structure. Ternary diagrams. Types of polymers and their use in the oil industry. Surfactant selection for wettability alteration. Laboratory techniques and examples. Field examples.

## **Week 3** MARCH 18-19, 2022

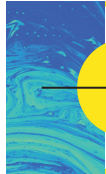
Immiscible/miscible gas injection. Concept of miscibility. Ternary diagrams. Equation of states. CO<sub>2</sub> and N<sub>2</sub> injection. WAG process. Laboratory techniques and examples. First contact miscibility. Multi-contact miscibility. MMP definitions. Slim tube experiments. Field examples.

## **Week 4** MARCH 25-26, 2022

EOR applications in heterogeneous and naturally fractured reservoirs. Gravity drainage mechanism, capillary imbibition recovery. Laboratory techniques and examples. Field examples. New trends in EOR. Use of nano materials in EOR applications (wettability alteration during waterflooding and thermal methods, foam generation during CO<sub>2</sub> injection).

# 2

# Thermal Recovery Methods



**Tayfun Babadagli** PHD, PENG

APRIL 2022 | FRIDAYS 4-6 PM | SATURDAYS 9 AM - 4 PM

This course will cover, extensively, the elements of thermal recovery techniques for heavy oil recovery. We will review the basics and laboratory scale understanding of steam and air injection techniques. You will learn how to select the right techniques for different reservoir types and geological environments using field case examples. Performance prediction techniques will be discussed as well.

## **Week 1** APRIL 1-2, 2022

Introduction and basic concepts in multiphase flow in porous media (relative permeability, capillary pressure, wettability, interfacial tension). Thermal vs non-thermal techniques. What is heavy-oil and bitumen? Thermal methods. Viscosity reduction. Steam injection (cyclic and flooding). Properties of steam.

## **Week 2** APRIL 8-9, 2022

Estimation of thermal recovery potential: Marx-Langenheim, Myhill-Stegemeir and other methods. Heat losses through injection well and formation during steam injection. Field examples. Laboratory to field thermal methods assessment. Process mechanics.

## **Week 3** APRIL 15-16, 2022

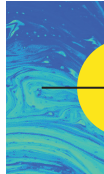
Steam pilot design. Examples of steam injection pilots. Field examples (Cold Lake, Duri, California, Middle East experiences). Air injection concepts. Basics of in-situ combustion. Performance estimation methods. What is THAI? Advantages-disadvantages and pitfalls. Field examples.

## **Week 4** APRIL 22-23, 2022

Heavy-oil and bitumen recovery from sands (SAGD) and naturally fractured reservoirs. Gravity drainage mechanism, capillary imbibition recovery. Field examples. Heavy-oil and bitumen recovery from oil-shales and carbonates. Electrical and microwave heating. Efficiency improvement using new technologies/material (solvents, CO<sub>2</sub>, surfactants, nano-fluids, nano-metals).

# 3

## Unconventional Oil and Gas Recovery Techniques



**Huazhou Li** PHD, PENG

OCTOBER 2022 | FRIDAYS 4-6 PM | SATURDAYS 9 AM - 4 PM

This course will introduce the fundamental mechanisms and recent developments of the various techniques used for stimulating and recovering unconventional oil and gas resources. We will consider unconventional reservoirs such as tight gas reservoirs, tight oil reservoirs, shale gas reservoirs, and shale oil reservoirs. The following recovery techniques will be covered: primary recovery techniques, multistage hydraulic fracturing stimulations, gas injection methods, and chemical injection methods. There will be a special focus on CO<sub>2</sub> injection methods, which can be used to enhance hydrocarbon recovery as well as permanently sequester CO<sub>2</sub> in the depleted reservoirs. Examples will be provided to demonstrate how to apply these recovery techniques on a field scale.

### **Week 1** OCTOBER 7-8, 2022

Introduction to tight gas/oil recovery techniques. Geological considerations. Petrophysical properties. Rock-fluid interactions. Well stimulation techniques.

### **Week 2** OCTOBER 14-15, 2022

Improved recovery techniques of tight gas/oil reservoirs. Enhanced oil/gas recovery techniques. Screening criteria. Design and evaluation procedure. Field examples.

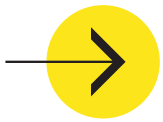
### **Week 3** OCTOBER 21-22, 2022

Introduction to shale gas/oil recovery techniques. Geology. Petrophysical properties. Rock-fluid interactions. Well stimulation techniques.

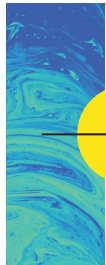
### **Week 4** OCTOBER 28-29, 2022

Improved recovery techniques of shale gas/oil reservoirs. Enhanced oil/gas recovery techniques. Screening criteria. Design and evaluation procedure. Field examples.





# The Respectful Land Use Series



**Jessica Vandenberghe** MSc, PEng

**DATES:** TBA

**NOTE:** This seminar series does not need to be repeated if you take more Petroleum Certificates in the future.

Participants will participate in three seminars on the importance of land use in all land development and resource exploitation, developing a foundational appreciation of, and respect for, land use in relation to treaty and/or land agreements with Indigenous nations.

## **Seminar 1** INTRODUCTION TO TRUTH AND RECONCILIATION

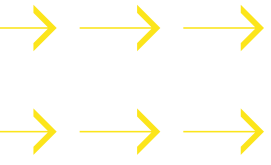
This one-hour seminar will be provided by a trained facilitator of Indigenous descent and will explore the history of Canada through the Indigenous lens of experiences and incidents that occurred, touching on the results and impacts of the Indian Act, Human Rights, and data that demonstrates that Indigenous people continue to be subject to oppressive policy, inherent racism, prejudice and stereotypes.

## **Seminar 2** UNDERSTANDING INDIGENOUS WORLDVIEW TOWARDS LAND SPIRIT AND MAKING THE CONNECTION TO INDIGENOUS COMMUNITIES AND LAND OWNERSHIP

This is a one-hour seminar, supplemented with reading, reflection and an assignment. It will guide participants towards understanding the differences between Settler and Indigenous perspectives towards land. It will also touch upon the governance laid out by the Indian Act around reserve lands, land ownership, and build an understanding of why reserves and Metis Settlements are different from municipalities and counties.

## **Seminar 3** HOW PROFESSIONAL ENGINEERS HAVE A RESPONSIBILITY TO ANSWER THE CALLS TO ACTION IN THEIR PROJECT WORK AND ETHICAL BEHAVIOUR

This one-hour seminar will be offered by a trained Indigenous Professional Engineer facilitator and discuss the Professional Engineer's ethical obligations and why equity, diversity, inclusion and decolonization are foundational to risk management, project management, decision making, and design work. Essential to meeting these ethical obligations is the deep understanding of Truth and Reconciliation and the Calls to Action in order to provide unbiased perspectives when part of project teams and engaging with ethnically diverse communities.



# Certificate Details

## **Prerequisites:**

A post-secondary degree or diploma in engineering, science or related field

## **Investment:**

\$6000 + GST  
Paid in three installments

## **Engineering at Alberta**

We are one of the top five engineering schools in Canada, with more than 4,400 undergraduate students and 1,200 graduate students. Our Petroleum Engineering program ranks as one of the Top 10 Petroleum Engineering programs in the world.

Now we are offering new programs for the working professional. This is a place that uncovers the unknown. Where ideas take the stage and possibility runs the show. We train people to embrace curiosity, providing state-of-the-art facilities, award-winning faculty and support.

### **Enroll**



[ONLINE UALBERTA.CA/ENGINEERING/PROGRAMS/  
CERTIFICATES-IN-PETROLEUM-ENGINEERING](https://online.ualberta.ca/engineering/programs/certificates-in-petroleum-engineering)

[QUESTIONS? DR. ERGUN KURU - EKURU@UALBERTA.CA](mailto:DR. ERGUN KURU - EKURU@UALBERTA.CA)

**INTERESTED IN ARRANGING A CUSTOM IN-PERSON OR  
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