DHRTC Summer School, Week 32 – Technical University of Denmark, Lyngby

Preliminary Programme

	Sunday 05/08 Accommodation at Hotel Postgarden	Monday 06/08 DTU (101, room S09) Mature Fields	Tuesday 07/08 DTU (101, room S09) Corrosion and scale	Wednesday 08/08 Field trip, Stevns Klint Geology	Thursday 09/08 DTU (101, room S09) Chemistry in mature fields	Friday 10/08 DTU (101, room S01) Characterization of petroleum mixtures and EOR	Satuday 11/08 DTU (101, room S09) Geophysics	Sunday 12/08 Departure for Esbjerg
08.00								
08.45		Welcome						
09.00-11.00		Challenges, development, Management *Total*	Chemical thermodynamics and salt solutions - background *Karen Feilberg*		Chemistry in Mature Fields Wettability, interfacial tension and surface tension at the molecular level *Theis Sølling*	Petroleum mixtures: - Where are the fluids of interest stored? - Sampling the fluids - How does the reservoir fluid behave under pressure, temperature - Categories of the fluids *Klaus Potsch*	Introduction to Geophysics and Geostatistics *Klaus Mosegaard* *Thomas Hansen*	
11.00-12.30		Challenges, development, Management *Total*	- Corrosion mechanisms - Occurrence and types of corrosion in the mature fields in DUC area, monitoring of corrosion - Mitigation methods *Rajan Ambat*	Field trip to Stevns Klint *Peter Frykman*	Instrumentation and methods for studies of surface chemistry *Theis Sølling*	Petroleum mixtures: - Phase behavior of the fluids Production schemes - Production problems - Black oil approach - Compositional approach Discussion: - What do we need to know? *Klaus Potsch*	Geophysical modeling. Theory and exercises. *Klaus Mosegaard* *Thomas Hansen*	
12.30-13.30		Lunch (Cantina in 101)	Lunch (Cantina in 101)		Lunch (Cantina in 101)	Lunch (Cantina in 101)	Lunch (Cantina in 101)	
13.30-15.00		Challenges, development, Management *Total*	Scale types and occurrence in north sea wells, monitoring *Karen Feilberg*		Chemical traces and tracer tests. General mechanisms of production chemicals in mature fields *Theis Sølling* Presentation on Dynamics of Liquid-Liquid Interfaces: application to reservoir fluid production and surface treatment *Simon Ivar Andersen*	Enhanced Oil Recovery: - Why do we need EOR - What methods for EOR exists - EOR problems Discussion: - What do we need to know? *Alexander Shapiro*	Geostatistics. Theory and exercises. *Klaus Mosegaard* *Thomas Hansen*	
15.00-16.30		Challenges, development, Management *Total*	- Chemistry of barium and strontium scales - Calcium carbonate and iron carbonate scales - Modelling and mitigation, chemistry of scale prevention *Kaj Thomsen* *Philip Fosbøl*		Digital rock physics: Applications of CT scanning *Theis Sølling*	Enhanced Oil Recovery: Exercises/discussion Exercises with the thermodynamic software *Alexander Shapiro* *Klaus Potsch*	Putting it all together: Creating a reservoir model from geophysics and geostatistics. *Klaus Mosegaard* *Thomas Hansen*	

DHRTC Summer School, Week 33 – Aalborg University - Esbjerg

Preliminary Programme

	Sunday 12/08 Arrival and accommodation at Danhostel Esbjerg	Monday 13/08 **Aalborg University (Esbjerg) C1 – room 117**	Tuesday 14/08 **Aalborg University (Esbjerg) C1 – room 117** **Monitoring and Automation in offshore Oil & Gas exploitation and production**	Wednesday 15/08 **Excursion Esbjerg Port**	Thursday 16/08 **Aalborg University (Esbjerg) C1 – room 117** **Seismic acquisition, processing and interpretation. Petrophysical welllogs**	Friday 17/08 **Aalborg University (Esbjerg) C1 – room 117** **Assignment in groups**	Saturday 18/08 **Aalborg University (Esbjerg) C1 – room 117** **Assignment – Results and discussions**	Sunday 19/08 Departure and transport to CPH from Esbjerg
08.30								
08.45		Welcome	Topside process systems (facilities and operations) Process monitoring and control (topside separation, slugging flows in pipelines and risers, gas-lift production wells, injection water treatment, produced water treatment) *Zhen Yu*	Day at Port of Esbjerg: Oil and Gas companies and activities. *Jens Bo Holm-Nielsen et al., Rambøll, SEMCO and Total*				
09.00-10.45		1. General info of Oil and Gas EDU and R&D activities at AAU 2. Introduction on topside operations *Jens Bo Holm-Nielsen* *Jens Muff*			Reflection seismics: Theory , usability and pitfalls Reflectionseismics: How to do? *Ole Rønø Clausen* *NN*	Group work on assignment	Group work on assignment	
11.00-12.30		- Overview of Topside Gas/Oil/Water Separation Units - Process Design of Separation Train - Issues on Oil/Water Separation *Marco Maschietti*	Emerging & advanced real-time monitoring and control techniques (Oil-in-Water, TSS, dissolved-oxygen, microscopy tech, fluorescence tech, tomography tech, MIMO control, MPC control, robust control) *Zhen Yu*		Geological interpretation and use of Petrophysical well logs *Ole Rønø Clausen* *NN*	Group work on assignment	Group work on assignment	
12.30-13.30		Lunch (Cantina, building A, room 150)	Lunch (Cantina, building A, room 150)		Lunch (Cantina, building A, room 150)	Lunch (Cantina, building A, room 150)	Lunch (Cantina, building A, room 150)	
13.30-15.00		Potential Applications of Membrane Technologies within Oil & Gas Production Units *Jens Muff*	Robotics for offshore OG applications (inline robot, ROVs and drones) *Petar Løhndorf*		Chalkfields in the North Sea – examples *Ole Rønø Clausen)* *NN*	Group work on assignment	Presentation and discussions of results	
15.00-16.30		Production Chemistry – an overview of applications and challenges *Rudi Nielsen*	Lab testing pilot plants, advanced instruments and equipment *Simon Pedersen* *Stefan Jespersen*		Start up of case study assignment: Identify a chalk reservoir, and suggest well locations *Ole Rønø Clausen* *NN*	Group work on assignment	Presentation and discussions of results	

Course objectives

Week 32 (DTU)

General course objectives

The course gives the student an understanding of chalk in an oil and gas field perspective.

Learning objectives

- Chemical thermodynamics and salt solutions
- Occurences and types of corrosion in mature fields and corrosion mechanisms
- Mitigation methods
- Scale types and occurrence in North Sea wells and monitoring
- The background for chalk sedimentation and processes involved
- Physical properties of the chalk sedimentation
- Fractures and effects on flow
- The K/T boundary and what it tells about an important event in Earth's history
- Overview of the mechanisms behind the chemical processes taking place in an oil reservoir and the tools for addressing their importance
- The properties of petroleum fluids: what they consist of, how they behave under varying temperature and pressure, how their properties may be measured and modelled
- The modern methods of enhanced oil recovery: How we can produce more oil by application of the chemicals, or gases, or by thermal methods?
- Geophysics and geostatistics: geophysical modelling and creating a reservoir model from geophysics and geostatistics.

Day-to-day objectives:

Tuesday – Corrosion and scale (Karen Feilberg and Philip Fosbøl):
An overview of scale and corrosion types and mechanisms. An understanding of the mitigation techniques materials and the associated costs and basic understanding of the chemical and physical processes in in the wells. The scale session entails the concepts of scaling and electrolyte theory and the calculations involved in scaling determination and prediction. The learning objectives are to:

1. Describe the fundamental principles of the scaling phenomena
2. Relate theory of thermodynamics to scaling
3. Apply phase diagrams to the basic understanding of scaling
4. Perform scaling calculations and conclude on scenarios of process variables which control scaling

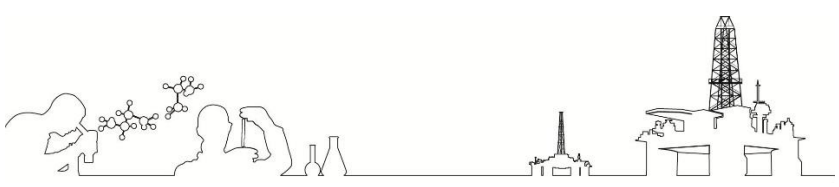
Wednesday – Stevns Klint (Peter Frykman):
The participants will learn about

1. The background for chalk sedimentation and processes involved
2. Physical properties of the chalk material
3. Fractures and effects on flow
4. What the K/T boundary tells about an important event in earth history

Thursday – Chemistry (Theis Sølling):
Chemistry is omnipresent also in the oil and gas section where the most complex mixture of chemicals imaginable – crude oil – is the product.

The objective is to give the participant and over view of the mechanisms behind the chemical processes the takes place in and oil reservoir and the tools for addressing their importance.

Friday – Petroleum mixtures (Alexander Shapiro):
At this day of the Summer school the participants will be introduced into the properties of petroleum fluids: what they consist of, how they behave under varying temperature and pressure, how their properties may be measured and modelled. In the second half of the day, an introduction to the modern



methods of enhanced oil recovery will be given: How we can produce more oil by application of the chemicals, or gases, or by thermal methods.

Saturday – Geophysics (Klaus Mosegaard):
In this introduction to geophysics and geostatistics we provide the background needed for combining complex geological information with geophysical data. From geophysics we have reflection seismic data, well log data, electromagnetic data etc., and from geological investigations we have obtained knowledge about rock types, layer sequences, folding and faulting. We will first introduce theory and methods for characterizing such information in a probabilistic form. Then we will present methods for integrating this information into one probabilistic model. All this will allow us to make predictions about geological conditions to be found at future borehole locations.

Our introduction to geophysics and geostatistics aims to provide the student with skills to describe available geo-information using statistical methods, understand and apply geostatistical simulation algorithms to describe and simulate geologically realistic structures, understand and quantify errors in geo-models, and to integrate geological and geophysical information.

Week 33 (Esbjerg)

AAU (Jens Bo Holm-Nielsen) and AU (Ole Rønø Clausen):

General course objectives

The course gives students from all fields of engineering an understanding of the technical, economical and environmental conditions governing the oil and gas industry in the North Sea. The complexity of the oil and gas industry and the need for a broad range of technical skills is illustrated and high tech solutions discussed. The participants will become familiar with the terminology of the various disciplines related to oil and gas production to a level that facilitates the specialization and project ideas for Master and Ph.D. levels. The course forms the basis for further studies in enhanced oil recovery technology at AAU, including thesis projects in all engineering fields. The jobs are mutual after finalizing the studies at the universities

The course will in addition contain lectures on the North Sea evolution, introduction to the software used, and a case study in group. The case study is to be completed by a short report and a presentation of the results. The groups will be put together so that a variety of competences are present in all groups.

Learning objectives

A student who has met the objectives of the course will be able to:

- Learn and perform how to operate and tackle problems in the Oil and Gas industry. Meeting the big players at the Port of Esbjerg
- perform a basic technological evaluation of production of oil and gas from a given discovery
- present the technological options for production of oil and gas at different water depths
- calculate the consequenses of different production scenarios on the project economy
- perform basic material and technology selection for oil and gas production from the given production conditions
- optimize and automatize the production profile with new high tech solutions and online monitoring at the oil & gas platforms
- evaluate the special economic, environmental and technological challenges and concerns related to offshore oil and gas production
- use seismic interpretation software integrated with well log interpretations to characterize the structural geometry, formation of and potential of an oilfield from the North Sea.
- characterize a HC reservoir using seismic and well log data.