

Course title and number PETE 689-1 Formation Damage: Mechanisms and Remediation
 Term (e.g., Fall 200X) Summer 2009
 Meeting times and location TR 9:35-12:25 PM. RICH 313

Course Description and Prerequisites

Formation damage can occur in oil and gas wells during drilling, completion, or even following chemical treatments. It adversely impact well performance and significantly affects the economics of damaged wells. It is essential to understand various mechanisms that cause formation damage before applying any chemical treatments. This course is designed to explain: (1) how to identify field problems, then (2) how to solve them. It is important to understand how cleaning fluids will interact with the formation brines, rock and oil. Improper design of chemical treatments can result in a new and more difficult type of damage to remove. This course will cover and explain in detail mechanisms of formation damage that can occur during drilling, completion, and following chemical treatments. Finally, the course will address chemical treatments to remove various types of damage. Field examples will be given to highlight the mechanism of damage, and the best method to remove it.

Learning Outcomes or Course Objectives

The main objective of this course is to highlight the importance of formation damage and how it impact well performance. Oil, gas and water supply wells are damaged during their life time. Various types of damage can occur during drilling, completion and production. Identification of damage type and location is the first step in designing chemical treatment to remove formation damage. Well completion, bottomhole conditions, and type of fluids in the wellbore should be also considered. Failure to consider these parameters will result in more damage than originally thought. Field cases will be discussed in the class to reinforce the importance of problem identification and fluid selection that takes into account downhole pumps and well tubulars.

Instructor Information

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 Office hours Monday and Wednesday: 10:20-11:10 and 11:30-12:20 PM
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Textbook and/or Resource Material

Several textbooks will be used, including, but not limited to:
 Reservoir Formation Damage, F. Civan, 2000
 Emulsions: Fundamentals and Applications in the Oil Industry, L.L. Schramm, 2000
 Technology for Cleaning Industrial Equipment, W. W. Frenier, 2001

Grading Policies

Homework	40%
Class Project	30%
Final Exam	30%

Course Topics, Calendar of Activities, Major Assignment Dates

Week	Topic	Required Reading
1	Introduction	Definitions, impact of well performance, skin damage, and how to measure it in the field
2	Clays and Feldspars	Structures and chemical composition of various clays and feldspars, types of clays and how they impact well performance
3	Fines Migration, Clay Swelling and Clay Stabilizers	Fines migration and permeability decline, coreflood experiment to determine critical salt concentration, impact of pH on migration and swelling of clays, cationic polymers as clay stabilizers
4	Damage due to Drilling and Completion Fluids and Injection Waters	Types of drilling and completion fluids, filter cake characteristics, and various methods to remove it, water blockage, surface tension of completion fluids, surfactants to reduce surface tension
5	Damage due to Perforation	How to perforate various wells, perforation and its impact on well performance, damage due to perforation
6	Formation Damage due to Organic Deposition	Asphaltenes, Waxes, and Naphtanantes, Mechanisms of Organic Deposition, Removal, and Mitigation. Damage due to suspended solids and bacteria
7	Formation Damage due to Inorganic Scale	Types of scales encountered in oilfield, Mechanisms of scale formation, Scale Removal Methods Radioactive Tracer Logs, and Scale Mitigation Treatments
8	Formation Damage due to EOR	Damage due to alkaline flooding, damage due to CO ₂ flooding, damage due to polymer flooding, damage due to steam flooding
9	Formation Damage due to Chemical Treatments	Damage due to scale squeeze treatment, damage due to mud acid treatments, damage due to additives
10	Damage Removal	Various chemical treatments available to remove various types of damage. Chemicals used in damage removal will be discusses, including acids, oxidizers, chelating agents, enzymes and combinations of these chemicals.

Other Pertinent Course Information

Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation

requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit <http://disability.tamu.edu>

Academic Integrity

For additional information please visit: <http://www.tamu.edu/aggiehonor>

"An Aggie does not lie, cheat, or steal, or tolerate those who do."