SPE Training Course: Strain-Based Casing Design for Thermal Applications

Course Summary

Description:
Casing in thermal applications is subject to unique design challenges that cannot be addressed with conventional methods. In conventional design, casing “fails” when thermally induced loads yield the pipe, but thermal wells often must operate under such conditions and industry experience demonstrates that wells can do so reliably. Designing a structure that remains stable requires knowledge of strain-based design: the distinction between strength and stiffness, the effects of variability in strength and stiffness, load path dependencies, post-yield material behavior, and strain localization. In this course, participants will learn to “think strain, not stress”.

Learning Objectives:
This course provides a detailed look at casing design considerations for thermally stimulated wells, with particular relevance to SAGD and CSS recovery methods. Practical application of design principles is demonstrated through a series of group exercises. Participants will leave with an increased understanding of design fundamentals for thermal wells and be able to evaluate the suitability of and required inputs for a design basis for casing in thermal applications.

Materials
The behavior of casing systems is highly dependent on material behaviors that are not captured by API casing specifications. Specifically, temperature- and rate-dependence of elastic and post-yield properties and cyclic behavior. The relevant aspects of post-yield steel properties and appropriate methods to measure those properties will be discussed in this section.

Thermal Casing Design
Conventional design equations found in API 5C3 are inadequate for predicting the structural performance of casing in thermal wells due to axial yielding and strain localization. Participants
will be instructed on design alternatives for assessing structural performance, analytical methods for estimating strain localization, relevant loads and load paths (cases), and guided through an example design case study.

**Casing Connections**

Connections are a key component of the casing string and are required to provide a gas tight seal over the life of the well. Participants will be provided with the key requirements for connections in thermal wells and an overview of the connection qualification process for thermal wells.

**Exercises**

The concepts provided in the lectures will be reinforced through a series of exercises.

**Learning Level** Intermediate to Advanced

**Course Length** 1 Day

**Why You Should Attend**

To gain a deeper understanding of the theoretical basis for thermal well casing design and how to evaluate and apply a strain based design for a thermal well.

**Who Should Attend**

This course is for anyone that would like to expand their knowledge and skill-set in strain-based design concepts and design methodologies, with particular application to intermediate casing. This may include:

(i) Current thermal well designers that wish to improve or refine the design bases they are currently using; and

(ii) Those with training or experience in conventional design that are new to thermal well design and integrity, either recent graduates or those coming into thermal projects from other applications.

**Special Requirement**

**CEU:** 0.8 CEUs (Continuing Education Units) will be awarded for this 1-day course.

**Special Requirements:**

None; however, knowledge of conventional casing design practices and basic understanding of the thermal well environment would benefit the participant.
Instructor

Dr. Trent Kaiser has extensive experience in analytical methods and technology development for the oil-and-gas industry. Throughout his professional career, he has developed analytical components of connection qualification programs and formulated methodologies to integrate those components with laboratory testing. Dr. Kaiser has broad experience in the areas of tubular pipe and connection design. His work on casing structures has included assessment of formation-induced deformations of casing strings, and development of algorithms to accurately characterize well deformations from casing inspection logs. Recently, he has led the development of advanced material characterization of steels for strain-based designs in thermal recovery operations and permafrost applications. Dr. Kaiser holds B.Sc. (1983), M.Sc. (1987) and Ph.D. (1991) degrees in Mechanical Engineering from the University of Alberta. He has authored numerous technical articles, and is listed on more than 20 patents. Dr. Kaiser has served as an SPE Distinguished Lecturer and as President of the Canadian Heavy Oil Association. He is also a member of ASME.

For more information, please contact trainingcourses@spe.org or call 1-403-930-5454.