Heavy Oil Production & Processing

Overview

LEVEL
Knowledge

PURPOSE
This course aims to acquire a comprehensive knowledge and practical know-how of the production and field processing of heavy crude oil.

LEARNING OBJECTIVES
Upon completion of the course, participants will be able to:
- describe heavy oil fundamental properties, main reservoir production mechanisms and the adapted techniques,
- explain the reasons for upgrading heavy crude oils, assess the various problems induced by unwanted compounds, master oil and water treatment processes, operations and related operating conditions,
- understand the role of different units in a heavy crude upgrading chain,
- acquire a good understanding of the operation of the units related to extra heavy crude oil processing.

WAYS AND MEANS
Highly interactive training course delivered by industry experts and adapted to participants’ experience.

LEARNING ASSESSMENT
Assessment by test at the end of the course.

PREREQUISITES
No prerequisites for this course.

Agenda

DRIVE MECHANISMS
Primary recovery. Secondary recovery: water flooding, gas injection, solvent displacement using naptha, DCO, DRU. Classic EOR methods: miscible gas injection, chemical flooding. Thermal EOR methods: Cyclic Steam Stimulation (CSS), Steam-Assisted Gravity Drainage (SAGD), In Situ Combustion (ISC), Toe-to-heel air injection.

WELL PERFORMANCE
Needs for artificial lift. Viscosity reduction: dilution/blending, heating, emulsification through the formation of an oil-in-water emulsion, pour point reduction by using Pour Point Depressant (PPD). Forecast production of heavy crudes including behavior of horizontal wells.

COMPLETION ADAPTED TO HEAVY OIL PRODUCTION
Cold production. Hot production: cyclic steam stimulation, steam assisted gravity drainage.

NEED FOR OIL FIELD PROCESSING - QUALITY REQUIREMENTS
CRUDE OIL TREATMENT
Crude stabilization (gas removal) by Multi Stage Separation (MSS): operating parameters (number of separation stages, pressures, heating and cooling needs...); influence on the quantity and quality (API grade) of the produced oil; foaming problems and main available solutions; associated gas recovery. Crude dehydration (water removal) and desalting: emulsion problems in heavy crude oil production and impact of well production techniques on surface facilities; asphaltens management in surface facilities; dehydration processes for heavy crude oils; heavy crude oil desalting. Acid crude sweetening (H₂S removal): principle of stripping, stripping of heavy crude oils. Diluent recovery unit, diluent recovery assessment and maximum recovery diluent. Asphaltens precipitation in storage.

PRODUCTION WATER TREATMENT
Main treatments. Operating principle and required performances. Comparison of the different available techniques. Selection criteria. Examples of production water treatment block flow diagrams.

INJECTION WATER TREATMENT
Reasons for water injection. Quality requirements and necessary treatments. Main operating conditions of each treatment and required performances. Examples of injection water treatment block flow diagrams.

UPGRADER PRINCIPLES & OBJECTIVES
Production, fluidification and transportation of extra heavy crude oils. Different ways to upgrade heavy crude oils. Overview of an upgrader, role and purposes of the different processes.

ATMOSPHERIC & VACUUM DISTILLATION
Upgrader distillation units: principles of distillation, capacity, process flowsheets. Atmospheric and vacuum distillation unit: operating conditions, material balance, energy consumption and heat recovery. Corrosion and corrosion prevention in atmospheric and vacuum distillation units.

UPGRADER HYDROTREATMENTS TO PROCESS NAPHTHA & DISTILLATE
Hydrotreatment chemical reactions and hydrogen consumption. Hydrotreatment processes: process flow diagram, operating conditions, products characteristics.

THERMAL CONVERSION UNITS: VISBREAKING & DELAYED COCKING
Heavy cuts thermal conversion processes. Visbreaking. Delayed coking process.

OTHER CONVERSION PROCESSES
Deasphalting units: vacuum residues structure and properties; deasphalting principles: different deasphalting solvents, overall flow sheet, operating conditions; integration of deasphating units in conversion schemes.

INTEGRATION OF UPGRADING PROCESS WITH SUBSURFACE & SURFACE PRODUCTION