

Extra Heavy Crude Oil Upgrading

5 days
Overview

UPGRADE-EN-P

LEVEL

Skilled

PURPOSE

This course provides a broad technical information on heavy crude upgrading and conversion processes.

LEARNING OBJECTIVES

Upon completion of the course, the participants will be able to:

know about various extra heavy crude oils and heavy cuts for processing,
understand the role of different units in a heavy crude upgrading plant,
acquire a good understanding of the operation of these units and the specific features related to extra heavy crude oil processing.

LEARNING ASSESSMENT

Quiz.

PREREQUISITES

To fulfill at least one of the following criteria:

to have 1 year's of proven professional experience in the refining industry,
or to be in the process of being moved to a position in a unit processing heavy oils.

Agenda

CRUDE OIL PROPERTIES

Main physical and chemical properties and standard tests of crude oils.
Extra heavy crude properties in contrast to classical crude oils.

0.5 d

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.

0.5 d

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, tower and equipment characteristics.
Crude oil desalting unit: purpose, operating conditions, specific solutions to process heavy crude oils.
Corrosion and corrosion prevention in atmospheric and vacuum distillation units.

0.75 d

THERMAL CONVERSION UNITS: VISBREAKING & DELAYED COKING

Heavy cuts thermal conversion processes.
Visbreaking: feed and products, product properties, process flow diagram, operating conditions; specific equipment: furnace, soaker, separation section, stability of heavy cracked fuel oils.
Delayed coking:

1 d

General description of coking processes: chemical reactions, process performances.
Delayed coking process description: feed and products, material balance, product properties; process flow diagram, operating conditions; technology of furnace and coke drums; coke types and users; operation of a delayed coking unit: coking cycle, decoking cycle and switch management, coke handling.
Others coking processes: fluid coking, flexicoking.
Integration of flexicoking units in upgrading schemes of heavy crudes.

UPGRADER HYDROTREATMENTS TO PROCESS NAPHTHA & DISTILLATE

0.5 d

Origin of feeds and related characteristics.
Hydrotreatment chemical reactions and hydrogen consumption.
Hydrotreatment catalysts: composition, role and mode of action.
Hydrotreatment processes: process flow diagram, operating conditions, products characteristics.

UPGRADER HYDROCRACKER (HCK) OR MILD HYDROCRACKER (MHC)

0.5 d

Main methods of cracking heavy cuts: thermal, catalytic and hydrocracking processes.
Specific hydrocracking chemical reactions: exothermicity, hydrogen consumption.
Hydrocracking catalysts: composition, main properties and poisons.
Mild hydrocracker (MHC) unit: process flow diagram, feed and products, material balance.

HYDROGEN MANUFACTURING PLANTS

0.5 d

Different processes for hydrogen production (SMR and POX).
Steam methane reforming (SMR): material balance, feed and products, preliminary desulfurization and sulfur trap, chemical reactions, catalysts, process scheme, operating conditions.
Steam reforming furnace and steam production. CO conversion (operating conditions, catalyst). Hydrogen purification (principle of a PSA unit, flow diagram and performances).
Gasification processes (POX, partial oxidation).
Feeds: heavy cuts, residues...
Gasification process principle, material balance, simplified process flow sheet and operating conditions.
Soot trapping and ash management. Gas washing and purification, CO conversion.

H₂S REMOVAL & SULFUR RECOVERY PROCESS

0.25 d

Overview of sulfur removal and recovery.
Amine units: process flow scheme and operating conditions, safety issues.
Sulfur recovery units: process principle, chemical reactions, thermal stage, catalytic stages, sulfur recovery, tail gas incineration; process scheme, operating conditions, sulfur yield.
Tail gas treatment: Sulfreen, Clauspol, SCOT; principles and operating conditions.

OTHER CONVERSION PROCESSES

0.5 d

Deasphalting units: vacuum residues structure and properties; deasphalting principles: different deasphalting solvents, overall flow sheet, operating conditions; integration of deasphalting units in conversion schemes.
Residue hydroconversion processes: examples of feed properties. Metals in catalytic hydroconversion processes, fixed bed technologies; ebullated bed technologies.