AXENS R2R™ PROCESS

OPERATIONS TRAINING

Objective: To provide an in-depth knowledge of the **R2R™** process and particularly the customer's unit. By the end of the course, the participants will have:

- A general understanding of the significance of the unit within the refinery scheme
- A broad technical understanding of the catalyst and the chemical reactions involved in the process
- A detailed knowledge of the Process Flow Diagram and Equipment
- A thorough knowledge of operating conditions and their impact on performances
- A good overview of the start-up and shut-down activities
  (NB: a detailed review of procedures is not included in the course).
- A sound knowledge of the main troubleshooting actions

Duration: The training course lasts 10 days. The duration can be tailored to the participants' level of understanding.

Attendance: This course is targeted to unit process engineers, unit technical managers, shift leaders, and board men. Suitably qualified or experienced outside operators may attend to enhance their process knowledge.

Program: The program below may be modified due to specific customer requirements, subject to an agreement between the customer and AXENS.

AXENS' OPERATIONS TRAINING PROGRAM

R2R™ process

Day 1

1. **Introduction(0.25 day)**
   - R2R function
   - R2R evolution
2. **Process Objectives (0.25 day)**
   - Cracking general characteristics
   - Unit objectives and capacity
   - Unit Block Flow Diagram
   - Feed Specifications
   - Unit duty
   - Product specifications
3. **Chemistry and Catalyst (0.5 day)**
   - Main chemical reactions
   - Catalyst

Day 2

4. **Heat & Carbon Balance (0.5 day)**
   - Rules of thumb
   - Coke yield
   - Heat balance
5. **Catalyst Circulation (0.5 day)**
   - Catalyst Circulation Factors
   - Fluidization principle
   - Pressure balance
   - Unit pressure control*

Day 3

6. **R2R: Process Description (0.25 day)**
   - Process Flow Diagrams
   - Mechanical drawing: general arrangement
   - R2R & Flue Gas Pictures
7. **R2R: equipment 1 (0.75 day)**
   - Riser & Disengager
   - Regenerators
   - Cyclones
   - Catalyst stripper
   - Catalyst slide valves
   - Gas distribution rings
   - Coking in R2R units

Day 4

8- **R2R operating parameters and effects (0.75 day)**
   - Summary of variables
   - Feed rate
   - Feed temperature
   - Riser Outlet Temperature (ROT)
   - Catalyst quality
   - Feed quality
   - Recycles (in feed, MTC…)
   - Air balance
   - Regenerators pressure
   - Reactor pressure

9- **Main Frac: Process Description (0.25 day)**
   - Unit function
   - Process Flow Diagrams
   - Piping & Instrumentation Diagrams (PIDs)

Day 5

10- **Main Frac: Equipment, Operating Parameters and Effects**
   - Columns
   - Wet Gas Compressor
   - Slurry Filter System

Day 6

11- **Analysis of Operating Conditions (0.5 day)**
   - Monitoring R2R operational data
   - Heat and mass balance
   - Catalyst bed levels
   - Pressure balance and fluidization
   - Cyclone inlet velocity
   - Yields
   - Catalyst collection efficiency

12- **R2R Technology Features (0.5 day)**
   - Refractory
   - Main air blower
   - Assisted check valve
   - Torch oil sprayer
   - Air heater

Day 7

13- **Catalyst Handling**
   - Description
   - Operation
   - Catalyst draw off

14- **Flue Gas Treatment**
   - Revision
   - CO boiler & Waste Heat Boiler
   - Electrostatic Precipitator
   - Economizer

Day 8 & 9

15- **Initial Start-Up (2 days)**
   - Summary of operations for the complete unit
   - Initial start-up
   - Normal start-up
   - Shut-down operations
   - Restart after a shut-down

Day 10

16- **Normal Start-up, Shut-down and Emergencies Operation (0.5 day)**
   - Normal start-up
   - Normal shut-down
   - Emergencies

17- **Troubleshooting (0.5 day)**
   - Catalyst circulation problems
   - High catalyst losses
   - High regenerator temperatures
   - Afterburning
   - Low regenerator temperatures
   - Poor quality of regeneration
   - Coking of transfer line to main fractionators
   - Air blower limitations
   - Refractory ageing

18- **Health, Safety and Environment**

19- **Quiz**