CONCEPT

Process Plant Troubleshooting: Whole-Unit Diagnosis, Plant Balances and Upset Control

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Introduction:

Process plant troubleshooting often stalls at the first plausible cause: a column is declared flooded, a controller is retuned or a feed rate is cut, and the real fault returns on the next shift. This Core Concept course trains engineers, panel operators and shift supervisors to diagnose whole units systematically, moving from symptom definition through DCS trend review, mass and energy balance closure and hypothesis testing to a verified fix. Refinery, gas and petrochemical cases build to a Unit Troubleshooting Playbook covering fault trees, data checks, operating windows and change control for one unit.

Course Objectives:

- Apply a structured define, gather, hypothesise, test, fix and verify sequence to unit upsets and record the evidence at each step
- Locate faults by closing mass, component and energy balances around sections of a process unit and flagging instrument errors
- Read P&IDs, cause and effect charts and control loop behaviour on DCS trends to separate process faults from control and measurement faults
- Diagnose distillation, separator, heat train, reactor, furnace, foaming and hydrate problems from their operating signatures
- Judge excursions against operating envelopes and integrity operating windows, rationalise bad actor alarms and decide when a problem needs formal root cause analysis
- Control temporary changes made during troubleshooting through management of change and compile a Unit Troubleshooting Playbook

Target Audience:

- Process and technical support engineering staff responsible for unit performance, test runs and upset investigation
- Control room panel operating staff responsible for running units on the DCS and responding to alarms and upsets
- Shift supervision staff responsible for unit line-ups, shift handover and first response to operating problems
- Operations engineering staff responsible for operating envelopes, standing instructions and temporary operating changes
- Production planning and optimisation staff who rely on unit capacity and product quality holding to plan

Course Outline:

Day 1: Structured Troubleshooting Method and Unit Symptom Definition

- Six-Step Troubleshooting Sequence: Define, Gather Data, Hypothesise, Test, Fix and Verify
- Symptom Statement Writing: What Changed, Where, When and by How Much
- Expected Behaviour Baselines from Design Data, Test Runs and Last Good Operation
- Half-Splitting and Divide-and-Conquer Isolation Across a Process Unit
- Troubleshooting Log Sheet and Evidence Record for Shift Teams

Day 2: Plant Data, Balances and Control Loop Diagnosis

- DCS Trend Overlay, Time Alignment and Rate-of-Change Reading
- Unit Mass Balance Closure and Instrument Error Screening
- Component and Energy Balance Checks Around Columns, Reactors and Heat Trains
- P&ID and Cause and Effect Chart Tracing During an Upset
- Control Loop Signatures: Valve Saturation, Oscillation, Cascade Breaks and Transmitter Drift

Day 3: Separation and Heat Transfer Unit Problems

- Distillation Flooding, Weeping and Entrainment from Column Pressure Drop and Temperature Profiles
- Tower Foaming Indicators and Antifoam Trial Planning
- Separator and Knock-Out Drum Liquid Carry-Over and Level Instrument Errors
- Preheat Train Fouling Trend from Duty and Outlet Temperature Loss
- Hydrate Formation Conditions, Line Blockage Signs and Inhibitor Dosing Checks

Day 4: Reactor and Furnace Faults, Operating Windows and Alarm Floods

- Reactor Temperature Profile, Catalyst Deactivation and Pressure Drop Diagnosis
- Fired Heater Draft, Excess Air and Flame Impingement Symptoms at Unit Level
- Operating Envelopes and Integrity Operating Window Excursion Response
- Alarm Flood Review and Bad Actor Rationalisation Using ISA-18.2 and EEMUA 191
- Escalation Criteria from Shift Troubleshooting to Formal Root Cause Analysis

Day 5: Refinery, Gas and Petrochemical Case Work and the Unit Troubleshooting Playbook

- Case Study: Crude Column Overhead Off-Specification After a Feed Switch
- Case Study: Gas Plant Separator Carry-Over and Downstream Unit Upset
- Case Study: Petrochemical Reactor Hot Spot and Furnace Firing Limit
- Management of Change for Temporary Set Point, Bypass and Line-Up Changes
- Unit Troubleshooting Playbook Drafting and Peer Challenge

Skills You Will Gain:

- Structured Fault Isolation
- Plant Data Trend Interpretation
- Mass and Energy Balance Reconciliation
- Control Loop Fault Diagnosis
- Column and Separator Diagnostics
- Operating Window Management
- Alarm Rationalisation
- Temporary Change Control

Why Attend This Course:

- Work through refinery, gas and petrochemical upset cases and defend each diagnosis with trend and balance evidence
- Stop repeat upsets caused by treating symptoms, retuning loops or cutting rates before the real cause is found
- Give panel operators, supervisors and engineers one shared troubleshooting language for shift handover and escalation
- Take back a Unit Troubleshooting Playbook with fault trees, data checks, operating window limits and change control steps for one unit

Conclusion:

Whole-unit troubleshooting depends on method as much as process knowledge. The course starts with a structured fault-finding sequence and clear symptom statements, adds DCS trend reading, balance closure and control loop diagnosis, then applies them to column, separator, heat train, hydrate, reactor and furnace problems. Operating windows, alarm floods and escalation to formal analysis follow, and the final day uses refinery, gas and petrochemical cases, with temporary changes held under management of change, to produce each participant's Unit Troubleshooting Playbook.