CONCEPT

Pneumatic Conveying and Bulk Solids Handling: Silo Flow, Feeders and Slurry Transport

31 May – 4 June 2027
Barcelona - Eixample district four-star



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Introduction:

Pneumatic conveying lines that block, silos that rathole or flood, feeders that surge and slurry pipelines that sand up cost bulk handling plants throughput, product quality and maintenance hours, yet the cause usually lies in how the particulate solid behaves rather than in the machine. This Core Concept course gives engineers and supervisors the methods to characterise bulk solids, diagnose silo and hopper flow, set conveying velocities for dilute phase, dense phase and slurry systems, and control wear and dust hazards. Participants produce a Bulk Solids Conveying Troubleshooting and Improvement Plan for one line at their own site.

Course Objectives:

- Characterise a bulk solid from particle size, bulk density, moisture, abrasiveness and flowability test data and predict how it will store and convey
- Identify mass flow and funnel flow in silos and hoppers and correct arching and ratholing through outlet, wall and feeder changes
- Select feeders, mechanical conveyors and flow aids that match the material and the required discharge rate
- Set air velocity, solids loading and air supply for dilute phase and dense phase pneumatic conveying and estimate line pressure drop
- Estimate deposition critical velocity for settling slurries and choose pumps, pipe linings and operating limits that control wear
- Diagnose blockages, throughput loss and dust explosion exposure on a handling line and plan corrective actions

Target Audience:

- Process engineers responsible for the capacity and reliability of powder, granule and slurry handling lines
- Mechanical engineers responsible for conveyors, feeders, rotary valves, blowers and slurry pipework
- Operations supervisors who run silo discharge, loading and conveying on shift
- Maintenance planners and technicians who clear blockages and repair worn bends, liners and valves
- Plant safety staff who assess combustible dust and bulk storage hazards

Course Outline:

Day 1: Bulk Solid Properties, Flowability and Current-State Assessment

- Bulk Solid Classification: Powders, Granules, Lumps, Cohesive and Free-Flowing Materials
- Material Data Sheet: Particle Size Distribution, Bulk Density, Moisture and Abrasiveness
- Angle of Repose Testing by Tilting Box, Fixed Cone and Rotating Cylinder Methods
- Shear Cell Flow Function and Wall Friction Test Interpretation
- Handling Line Current-State Survey: Throughput Record, Downtime and Blockage Log

Day 2: Silo and Hopper Flow, Feeders and Mechanical Conveyors

- Mass Flow Versus Funnel Flow Patterns and Hopper Wall Angle Selection
- Arching, Bridging and Ratholing Mechanisms with Outlet Size Checks
- Screw, Belt, Vibratory and Rotary Feeder Selection for Controlled Discharge
- Belt Conveyor, Screw Conveyor, Drag Chain and Bucket Elevator Overview
- Flow Aid Selection: Air Blasters, Vibrators, Acoustic Cleaners and Aeration Pads

Day 3: Pneumatic Conveying System Design and Operation

- Dilute Phase Versus Dense Phase Conveying and the Conveying Phase Diagram
- Saltation Velocity, Minimum Pickup Velocity and Solids Loading Ratio Settings
- Line Pressure Drop Estimation Across Horizontal Runs, Risers and Bends
- Conveying Air Supply: Positive Displacement Blowers, Compressors and Vacuum Exhausters
- Rotary Airlock Valves, Blow Tanks and Diverter Valves with Air Leakage Checks

Day 4: Slurry Transport, Wear, Attrition and Dust Hazards

- Settling and Non-Settling Slurries with Deposition Critical Velocity Estimation
- Slurry Pumping Duty: Centrifugal Slurry Pumps Versus Diaphragm Pumps for High Concentration
- Bend Erosion, Wear-Resistant Pipe Linings and Particle Attrition Control
- Combustible Dust Hazard Overview: Dust Explosion Pentagon and Dust Hazard Analysis
- Explosion Prevention and Protection: Wetting, Inerting, Deflagration Venting, Suppression and Containment

Day 5: Troubleshooting Walkthrough and Improvement Plan

- Inspection Walkthrough: Silo Discharge and Feeder Audited Against a Flow Checklist
- Pneumatic Line Blockage Diagnosis from Pressure Trend and Air Flow Records
- Throughput Loss Root Cause Tree for Conveying and Slurry Lines
- Line Rerating Options: Stepped Pipework, Velocity Profile and Air Supply Changes
- Bulk Solids Conveying Troubleshooting and Improvement Plan Build and Peer Review

Skills You Will Gain:

- Bulk Solid Characterisation
- Silo Flow Pattern Diagnosis
- Feeder and Conveyor Selection
- Conveying Velocity Setting
- Pneumatic Line Pressure Drop Estimation
- Slurry Deposition Control
- Wear and Attrition Control
- Combustible Dust Hazard Assessment

Why Attend This Course:

- Return with a Bulk Solids Conveying Troubleshooting and Improvement Plan for a real line at your own site
- Cut repeat blockages and silo hang-ups by tracing them to material properties and velocity settings rather than clearing them by hand
- Talk to equipment vendors and design contractors with the test data and calculations needed to challenge a proposal
- Compare conveying practice with peers from cement, mining, chemicals, food, plastics and power plants

Conclusion:

Bulk solids move reliably when the material is characterised, the silo is designed for the right flow pattern, the feeder controls discharge and the conveying line runs at velocities that neither drop out solids nor wear through bends. The course moves from material testing, through silo, hopper and feeder behaviour, to pneumatic and slurry conveying, wear and dust hazards. The final day applies an inspection walkthrough and blockage diagnosis to build the Bulk Solids Conveying Troubleshooting and Improvement Plan for site use.