MERCURY

Gas Pipeline Design & Analysis

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Introduction:

The Gas Pipeline Design and Analysis course provides a structured understanding of the technical, safety, and economic aspects of pipeline systems. This course guides participants through best practices in pipeline routing, material selection, and pressure management in natural gas transport. It emphasizes industry standards and regulatory compliance to ensure environmental protection and operational safety.

Drawing on real-world case studies, it offers insight into pipeline failure modes and mitigation strategies. Learners will gain skills in hydraulic modeling to optimize pipeline performance. This Gas Pipeline Design and Analysis program equips engineers and project managers with tools to evaluate pipeline capacity, maintenance planning, and cost estimation. It fosters a mindset combining theoretical principles and practical design tasks.

Targeted Groups:

This Gas Pipeline Design and Analysis training targets professionals seeking specialized knowledge and skills:

- Pipeline engineers looking to refine system design techniques.
- Process engineers transitioning to gas transport and distribution.
- Project managers oversee pipeline construction and operation.
- Maintenance supervisors focused on pipeline integrity.
- Regulators and safety officers ensure compliance.
- Energy consultants advising on gas infrastructure.
- Technical sales personnel working with pipeline equipment.
- Graduate students pursuing careers in pipeline engineering.

Course Objectives:

Participants will achieve the following objectives by completing the Gas Pipeline Design and Analysis course:

- Understand fundamentals of gas flow equations and hydraulic analysis.
- Apply routing strategies to minimize cost and environmental impact.
- Evaluate material selection based on pressure, corrosion, and stress.
- Demonstrate competence in pressure drop and compressor station design.
- Interpret pipeline codes and standards to ensure compliance.
- Design pipeline maintenance plans using risk assessment techniques.
- Analyze failure scenarios and implement mitigation measures.
- Develop accurate cost estimates and economic feasibility studies.
- Use hydraulic modeling tools to simulate pipeline performance.
- Communicate technical findings effectively to multidisciplinary teams.
- Plan integrity inspections align with regulatory expectations.
- Optimize pipeline network layout for capacity and system reliability.
- Measure performance metrics to support continuous improvement.

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Targeted Competencies:

Participants will gain the following competencies during the Gas Pipeline Design and Analysis program:

- Proficient in hydraulic modeling for pressure and flow calculations.
- Skilled at conducting route surveys and terrain analysis.
- Competent in assessing material compatibility and welding quality.
- Experienced in applying industry standards and safety codes.
- Able to size pipelines and select compressor equipment efficiently.
- Adept at performing cost-benefit and lifecycle analyses.
- Capable of planning inspection and maintenance schedules.
- Ready to detect and evaluate failure risks and implement controls.
- Efficient in presenting design proposals to stakeholders.
- Prepared to assess operational data and recommend optimizations.

Course Content:

Unit 1: Gas Pipeline Fundamentals:

- Overview of natural gas composition and transport principles.
- Introduction to pipeline types: gathering, transmission, distribution.
- Gas flow behavior: laminar vs turbulent regimes.
- Pressure, density, and temperature relationships in pipelines.
- Key pipeline performance indicators and metrics.
- Fundamentals of the compressor station role.
- Material properties: steel grades, coatings, corrosion resistance.

Unit 2: Hydraulic Analysis & Flow Modeling:

- Gas flow equations: Darcy-Weisbach, Panhandle A/B, AGA methods.
- Friction factor and roughness coefficient determination.
- Pressure drop calculation for steady-state flow.
- Capacity estimation and sizing for pipelines.
- Modeling compressor station effects on pressure.
- Pipeline simulation software overview and demonstration.
- Calibration of models using field data.
- Validation of model results and sensitivity analysis.

Unit 3: Route Selection & Environmental Considerations:

- Conducting route surveys and GIS mapping.
- Terrain evaluation: slopes, water crossings, urban zones.
- Balancing the shortest route vs environmental constraints.
- Assessing land use, wildlife habitats, and protected zones.
- Designing for seismic and geohazard resiliency.
- Public awareness and stakeholder engagement.
- Regulatory permitting process overview.
- Drafting route alignment and right-of-way plans.

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Unit 4: Materials, Welding & Construction Techniques:

- Selecting pipe materials based on pressure and corrosion.
- Coating and cathodic protection systems.
- Welding procedures and quality control measures.
- Non-destructive testing NDT methods in pipelines.
- Construction best practices: trenching, backfilling.
- Safety protocols and site risk management.
- Commissioning pipeline systems and leak testing.
- Inspection techniques during and after construction.

Unit 5: Integrity Management & Economic Analysis:

- Integrity management framework and risk ranking.
- Inspection tools: pigging, inline inspection, and field surveys.
- Failure mode analysis: corrosion, fatigue, ground shift.
- Preventive and predictive maintenance strategies.
- Economic evaluation: capex, opex, lifecycle cost.
- Feasibility study structure and cash flow modeling.
- Remediation planning and contingency budgeting.
- Performance monitoring: SCADA and telemetry data use.
- Course wrap-up: integrating design, safety, and cost.

Final Insights & Key Takeaways:

Participants will leave with a full-spectrum understanding of both theoretical principles and real-world applications in gas pipeline engineering. They will be equipped to design efficient and compliant pipeline networks, anticipate operational risks, and drive cost-effective outcomes. Graduates will confidently interpret industry standards and employ best practices in hydraulic modeling, material selection, and integrity management. This course sets a foundation for continuous improvement in gas pipeline infrastructure projects.