

■ Contents of Each Session ■

1. Orientation

- Chiyoda in brief
- Chiyoda's engineering training in variety
- Objectives, contents and time table of this training program

2. Introduction to LNG

- Basic knowledge of LNG:
Related technical terminology, composition of natural gas/LNG/pipeline gas, transportation and storage of LNG, etc.
- Worldwide LNG trade
- LNG value chain:
Gas production, liquefaction plants, LNG tankers, LNG receiving terminals and power generating facilities, gas/electricity consumers, etc.
- Pipeline gas value chain:
Gas production, gas compression plants, gas pipelines, pipeline transportation distance, power generating facilities, etc.

3. LNG Technology/Liquefaction Process

- Outline of LNG plants:
Block flow of LNG plants, trend of LNG plant capacity per train, natural gas usage, LNG market, key process of LNG plants, gas treating facilities, etc.
- Refrigeration Cycle
- Liquefaction Process:
Introduction of licensors for various liquefaction process
- Main Refrigerant Compressors
- Turbines (Gas Turbines and Steam Turbines)
- Main Cryogenic Heat Exchangers (MCHE)
- LNG Storage and Loading:
Storage tanks and LNG tankers
- LNG Receiving Terminal and Power Station:
Process flow of LNG receiving terminals, power generation trend utilizing LNG fuel, etc.

4. P&ID (Piping and Instrument Diagram)

- What is P&ID
- Work Steps of P&ID Development
- Design Information on P&ID:
Equipment/piping/instruments, operation and control, safety, maintainability, etc.

5. Process Safety

- Process Safety Analysis:
Why do we need to analyze the safety?, process safety evaluation procedure, definitions of hazard and risk
- Hazard Evaluation Techniques:
Identification of potential hazards, typical process safety analysis for new plant, etc.
- HAZOP (Hazard and Operability Studies)'s objectives, scopes, and procedures
- HAZOP Case Study Workshop

6. Instrument Technology

- What is Instrumentation:
Instrument key functions of LNG plants, etc.
- Functions of Instrumentation:
Typical flow control of instrumentation, DCS (Distributed Control System), SIS (Safety Instrumented System), and ESD (Emergency Shut Down), etc.
- Field Instruments:
Pressure gauges, temperature gauges, flowmeters, level gauges, control valves, analyzers, etc.
- Introduction of Instrumentation Related Troubles

7. Material Technology

- Definitions, types, and principles of corrosion
- Typical Examples of Corrosion Problems and Countermeasures in LNG Plants:
CO₂ corrosion, sulfide stress cracking, hydrogen induced cracking, amine/SCC corrosion, low temperature embrittlement, mercury attack, seawater corrosion, external corrosion of carbon steel, external stress corrosion cracking (ESCC) of stainless steel
- Non-Destructive Inspections of Plants:
PT (Penetrant Test), MT (Magnetic particle Test), UT (Ultrasonic Test), RT (Radiographic Test), ET (Eddy current Test)
- Introduction of Material/Corrosion Related Troubles at Existing Facilities

8. Advanced Technology

- Failure Mechanism
- Vibration:
Types of vibration and their potential causes, basic theory of vibration, relevant specification and criteria
- Water Hammer, pulsation:
What are water hammer and pulsation?
- Thermal Fatigue:
Introduction of thermal fatigue caused problems and their countermeasures
- Erosion/Corrosion:
Introduction of erosion/corrosion caused problems and their countermeasures

9. RCA (Root Cause Analysis)

- What is RCA? Basic of RCA
- RCA' s objectives and technique
- RCA Case Study Workshop (Workshop based on sample cases):
Fault tree analysis, group discussion, presentation, comments

10. Wrap Up

- Questions and answers throughout 4-day session
- General comment by the lecturer(s)