■ 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)