LNG Plants – Technical operations (Part I)

Juan Manuel Martín Ordax
Introduction

An LNG production plant is designed with two objectives: meet the production target set in the objectives and satisfy the emission and environmental regulations.

It is important to understand the design limitations and the interaction among units for plant operation.

Focus on the process parameters and typical pitfalls that operators may encounter in day-to-day operation.
LNG plant normal operation

Typical LNG production plant:
LNG plant normal operation

Slug catcher: is a critical unit that safeguards the LNG production plant against surge in flow and pressure swing from upstream oil and gas production wells.
LNG plant normal operation

Typical vessel slug catcher
LNG plant normal operation

Typical finger type slug catcher
LNG plant normal operation

Condensate stabilization unit: The function is to process the condensate from the slug catchers and to remove the light components to meet the export condensate specification.
LNG plant normal operation

Condensate stabilization unit:
LNG plant normal operation

Acid gas removal unit (AGRU): Function is removal of the acid gases to meet the specifications for the LNG liquefaction plant.
LNG plant normal operation

For sulfur recovery unit in an LNG plant a straight-through process is the most common due to its simplicity and lower costs.
LNG plant normal operation

Tail gas treating unit: It consists of two sections: hydrogenation section and the tail gas treating section
LNG plant normal operation

Tail gas treating unit: Typical tail gas treating and hydrogenation unit.
LNG plant normal operation

Molecular sieve unit: Designed to meet the product specifications on water and mercaptans (RSH) content. The main items that should be checked in this unit:

- Mercaptans buildup
- Regeneration gas temperature
- Flow rate
- Flow channeling
- Oxygen
- Inlet separator
- Bed fouling
- Dehydration bed failure
- High pressure drop in bed
- Moisture analyzer probes locations
- Even distribution across the bed
- Feed by-pass
- Degradation of molecular sieve
- Change in inlet conditions
- Retrograde condensation
LNG plant normal operation

NGL recovery unit: The function is to remove the C2⁺ or C3⁺ hydrocarbons from the feed gas, producing an NGL product and a lean gas feed to the LNG plant.
LNG plant normal operation

Liquefaction unit.
LNG plant normal operation

Liquefaction unit

• The LNG production throughput is controlled by the refrigeration from the mixed refrigerant system.

• The operation of the mixed refrigeration train is based on controlling the MR system refrigeration output by adjusting the vapor inventory and mixed refrigerant composition. The propane system refrigeration is designed to provide cooling to the mixed refrigerant, the feed gas, and the condenser of the scrub column.

• LNG production turndown is achieved by venting lighter components at the HP and MR separator.
**LNG plant normal operation**

**LNG Storage tanks**

The function of LNG storage tanks is to store the LNG product under a stable pressure. The operating pressure of the storage tank must stay within the design limits of the storage tank.

Typical LNG Storage Tank Design and Operating Pressures are:

<table>
<thead>
<tr>
<th>Description</th>
<th>Pressure (KPag)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Design Pressure</td>
<td>30</td>
</tr>
<tr>
<td>Vacuum Design Pressure</td>
<td>-1.5</td>
</tr>
<tr>
<td>Normal Operating Pressure</td>
<td>10</td>
</tr>
<tr>
<td>Minimum Operating Pressure</td>
<td>2.5</td>
</tr>
<tr>
<td>Maximum Operating Pressure</td>
<td>25</td>
</tr>
</tbody>
</table>
General startup sequence

A successful startup requires planning and organization and experienced and knowledgeable staff.

A well-executed startup program requires a collaborated effort among contractors, licensors, equipment suppliers, and the plant owner.

The startup program typically consists of the following phases:

- Preparation and planning
- Precommissioning and operational testing
- Commissioning
- Startup and initial operation
- Performance and acceptance test.