DESCRIPTION OF THE LNG TERMINAL AND ITS MANAGEMENT

1) INTRODUCTION

The Panigaglia Terminal is owned by GNL Italia; it was built between 1967 and 1970 and was commissioned in 1971. In its original configuration, the facility was designed to receive natural gas from Libya, making it interchangeable with the lightest gas extracted in Italian fields, facilitating its entry into the national grid. With the end of imports from Libya, the plant was adjusted to meet the typical standards of regasification plants and was used for the regasification of LNG from various different origins.

In 1980, following the termination of contractual relations with Libya, the plant worked at a reduced capacity until 1987 when a decision was made to restructure the facility. This restructuring, which lasted from 1987 to 1991, was followed by a second set of upgrade works carried out between 1995 and 1997 in which the two LNG storage tanks were modified, transforming them from single to double containment tanks.

2) DESCRIPTION OF THE TERMINAL

The regasification process at the Panigaglia plant uses "submerged combustion" vaporizers which heat and vaporize the LNG using heat produced by the combustion of part of the Natural Gas produced. This type of heating system is less expensive in terms of investment; however it is more expensive form an operational perspective than the more common systems that rely on heat exchange between the liquefied gas and sea water. However, the system was adopted because of the specific environmental constraints affecting the stretch of sea where there the plant is located.

The facility, which extends over an area of 317,300 m^2, is located in the Bay of Panigaglia, along the coast that links La Spezia with Portovenere. The facility consists of the following:

- the plant itself, which occupies an area of approximately 45,000 m^2, consisting mainly of two LNG storage tanks, vaporization plants, the pier for LNG carriers to berth and auxiliary systems;
- a number of buildings used primarily as offices, maintenance workshops with the relevant equipment and warehouses;
- green areas established following the first restructuring phase, in order to comply with environmental standards;
- a woodland area, surrounding the facility.

The plant consists of the following sections:

- receiving;
- storage;
- regasification;
- Boil-off Gas (BOG) recovery;
- final gas correction;
- auxiliary systems;
- control and safety systems.

The following are the main operations of the Terminal: Annexes to this chapter show scale drawings of the plant location and layout and a diagram of the pier.

2.1) Receiving

The receiving section consists of the berthing area for LNG carriers, the unloading arms and the transfer line.

The berthing area is located at the end of a 500-metre long pier which, once the relevant checks have been completed, allows LNG carriers with a capacity of up to 65,000-70,000 m^3 of LNG to berth. The sea surrounding the head of the pier is about 10 metres deep and is used exclusively for the manoeuvring and berthing of LNG carriers. The pier has four mooring bollards, each of which is equipped with quick release mooring hooks, and two fenders to protect the Ship, which are equidistant from the unloading arms and have a centre to centre distance of approximately 70 metres.

To unload the cargo, the right-hand side of the pier is equipped with three unloading arms, two for liquid (12 inches in diameter), each with a normal maximum flow of 2,000 m^3/h, and one, located in the centre, to return the vapour to the ship (8 inches in diameter and a maximum flow of 12,000 Nm^3/h). However, the unloading flow rate depends on the production of vapours (Boil-Off Gas) that develop during the unloading operation which are recovered by the specific section for handling boil-off gas.

The vapour returned is to the Ship, as required, by a vapour return blower with a capacity of about 12,000 Nm^3/h.

The LNG from the carrier is transferred to two storage tanks through a 24-inch transfer line connecting the unloading arms to the tanks.

2.2) Storage

The storage section consists of two tanks, each with a geometric capacity of 50,000 m^3, an operating capacity of approximately 44,000 m^3, and submersed pumps for the movement of LNG.

The tanks are made up of two coaxial, vertical cylindrical containers. The self-supporting inner container is made of 9%Ni steel and is designed to store the LNG while the outer container (added as part of the second restructuring phase) is made of prestressed reinforced concrete and has the dual function of supporting and protecting the insulating material placed around the inner container and, in the event of an emergency, containing any loss of LNG. Each tank is also installed inside a containment basin.

The LNG is stored in the tanks at a temperature of approximately -160 °C and at a pressure slightly higher than atmospheric pressure (350 mmH_2O rel).

Each storage tank is equipped with three submerged pumps, two with a capacity of 500 m^3/h of LNG each, and the third with a capacity of 170 m^3/h of LNG.

2.3) Regasification

The regasification section consists of pumps for the movement and pressurization of the LNG and of submerged combustion vaporizers.

The LNG extracted from the storage tanks by means of the submerged pumps is pressurised initially to approximately 22 bar by the primary pumps (three in operation plus one in reserve) and, subsequently, to about 75 bar by the secondary pumps (three in operation plus one in reserve) and is then sent to the vaporizers. Each pump, both primary and secondary, has a maximum capacity of approximately 250 m^3/h of LNG.

The LNG is regasified by means of submerged combustion vaporizers (three* in operation and one in reserve), each of which has a maximum rated capacity of approximately 250 m^3/h of LNG.

The heat required to vaporize the LNG is produced by the combustion of natural gas (fuel-gas) taken downstream of the vaporizer.

2.4) Boil-Off Gas (BOG) Recovery

The BOG recovery system at the Panigaglia facility consists of three cryogenic compressors, one with a capacity of 2,000 kg/h and two with a capacity of 8,000 kg/h each, the absorption column and its feed pumps. The smaller compressor is used for the continuous recovery of the vapours generated by the heat entering the plant during normal operations and outside of unloading periods; the two larger compressors are used for the recovery of the BOG produced during unloading. Recovery takes place in the absorption column by condensing the vapours with subcooled LNG.

2.5) Final gas correction

The purpose of correcting the final gas is to maintain the Wobbe Index of the gas sent to the pipeline at a value of less than 52.33 MJ/Sm^3 in order to meet the quality specifications of the transport network and thus ensuring the interchangeability of regasified LNG with other natural gas normally transported through the network. The correction is made by adding air or nitrogen enriched air to keep the oxygen concentration to below 0.6% (mole). Non-compliance of the natural gas sent through the network with the quality requirements will automatically lock the system.

The final gas correction section consists of two air compression trains and a battery of membrane units that enrich the nitrogen content. Each train is equipped with a screw compressor connected in series with a reciprocating compressor and is capable of compressing air to the pressure of the pipeline with a maximum capacity of 4,300 Nm^3/h.

2.6) Auxiliary systems

This section includes all of the activities that support the main process and without which the facility could not function. The most important activities are as follows: the electrical substation and its transmission lines for the supply of power and the transformation of electricity at the plant; fresh water and sea water systems for the disposal of the heat generated by compressors; instrument air systems for the

* *With regard to Thermal Years 2009-10 and 2010-11, the number **three** should be replaced with **two.***

implementation of pneumatic controls; the station for measuring the quantity and quality of the gas in the methane pipeline and the fire protection system.

2.7) Control and security system

The LNG regasification plant is monitored and remotely controlled from the Centralised Control Room by means of an automatic system. This system is divided into two subsystems:

- Distributed Control System (DCS) whose functions include the acquisition, processing and regulation of the process parameters and the supervision of the plant;
- Programmable logic-based automation and blocking system (PLC) which governs the start-up, stopping and blocking of the equipment sequences as well as activating automatic safety procedures in the event of emergency.

3) CAPACITY OF THE PLANT AND THE CRITERIA FOR DETERMINING ITS CAPACITY

The regasification capacity of the Panigaglia Terminal is determined by considering the following values:

1. the receiving capacity;
2. the vaporization capacity.

3.1) Receiving Capacity

The receiving capacity of the plant during one month of operations (the "reference period", conventionally fixed at 30 days) is determined by taking into account:

a) the maximum possible number of Unloading slots;
b) the LNG unloading capacity.

3.2) Vaporization Capacity

The vaporization capacity of Panigaglia Terminal is determined by considering the following parameters:

- ✓ the pumping system;
- ✓ the vaporization system.

The capacity of the pumping system is influenced by the quality of LNG unloaded and the working pressure of the methane pipelines connected, while the capacity of the vaporization system is determined by referring to the capacity of each of the four ** submerged combustion vaporizers.

It follows, therefore, that the vaporization capacity coincides with the capacity of the vaporization system.

** *With regard to Thermal Years 2009-2010 and 2010-2011, the number **four** should be replaced with **three.***

3.3) Plant Regasification Capacity

The regasification capacity of the plant is determined in relation to the number of potential unloading slots at the terminal and the capacity, expressed in LNG volume, which can be delivered to the Terminal itself.

Taking into consideration the duration of the mooring, unloading and unmooring of a LNG carrier at the pier, which does not allow more than one landing every two days, the maximum number of possible slots on an annual basis is equal to half the operational days of the Terminal in each Thermal Year, rounded down to the nearest integer.

Given the necessary safety operating margins of a regasification terminal, the facility allows a maximum guaranteed capacity of 17,500 m^3/g *** of LNG. Therefore, the annual capacity of the terminal is equal to 17,500 m^3_{liq} *** multiplied by the number of days that the terminal operated in each Thermal Year.

*** *With regard to Thermal Years 2009-2010 and 2010-2011, the value of* ***17,500 m^3_{liq}*** *should be replaced with* ***12,000 m^3_{liq}***