

## **Appendix 3 MEASURING, METERING, QUALITY**

This appendix is an operational appendix which applies without prejudice to the provisions of the Framework contract.

The terms beginning with a capital letter in this appendix have the meaning given in the definitions of the Framework contract.

### **1 METHODOLOGY OF MEASUREMENTS PERFORMED IN THE LOADING PORT**

At the Operator's request, the Shipper shall provide it with the following information:

- detailed description of the LNG sampling and vaporisation method and characteristics of the equipment used;
- detailed description of the chromatographic method used to analyze the LNG main components (hydrocarbons and nitrogen), including the calibration and characteristics of the equipment used;
- detailed description of the chromatographic method used to analyze the LNG sulphur-based components (H<sub>2</sub>S, COS, mercaptans, total sulphur), including the calibration and characteristics of the equipment used;
- detailed description of the method used to detect mercury in LNG, including the calibration and characteristics of the equipment used;
- detailed description of the method used to detect oxygen in LNG, including the calibration and characteristics of the equipment used;
- traceability of reference standard products used for measurements, with certificates.

### **2 MEASUREMENTS PERFORMED ON THE CARGO AT THE TERMINAL**

#### **2.1 CARGO MEASUREMENT OPERATIONS**

Two Cargo measurement operations are carried out onboard the Vessel by the Operator and the Shipper, before and after the Cargo Transfer respectively:

- Cargo measurement before the Cargo Transfer after the issuing of the notice of readiness and before gas and liquid crossfeed valves are opened;
- Cargo measurement after the Cargo Transfer after the liquid manifold is drained and the gas and liquid manifold valves are closed.

These operations involve carrying out gauging, temperature and ceiling pressure measurements in the Vessel's tanks. A quantity certificate, incorporated in the Cargo Report as per form provided in article 7 of this appendix, including the results of these measurements, is drawn up and signed by the Shipper and the Operator on completion of each Cargo Transfer.

If the piping filling state is different before and after the Cargo Transfer, the corresponding Cargo volume variation must be taken into account in calculating the Quantity Transferred. For this purpose, the Shipper shall provide the Operator with a calculation of the manifold volumes it intends to use and the procedure for cooling and draining these manifolds.

If the Shipper operates the Vessel's machinery on Natural Gas when it is connected to the gas arm, the energy consumed is then either determined by the gas meter of the Vessel's machinery if applicable, or by a set quantity of gas taken of 0.10% applied to the total Quantity Transferred, not corrected with the quantity of energy sent back under gaseous form (return gas):

$$Q_{\text{mach}} = 0.001 \times V \times d \times H_m.$$

This set quantity of gas taken off is also applied in the event of a failure or a malfunction of the existing gas meter, or in the absence of reading index of the gas meter during Cargo measurement.

If the Shipper is not present, and unless otherwise notified on its part, the Captain shall be authorised to represent the Shipper for all Cargo measurements, and in particular in signing the quantity certificate.

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### 2.2 GAUGING AND CALCULATION OF THE LNG VOLUME TRANSFERRED

The gauging procedures must comply with the recommendations of the current version of the *LNG Custody Transfer Handbook* of the International Group of Liquefied Natural Gas Importers (GIIGNL). The primary and secondary measuring systems are of capacity type, float type and/or microwave type (radars) and/or laser type (LIDAR); they must comply with the recommendations of the standard ISO 18132.

The LNG volume transferred, expressed in cubic meters, is determined by the difference between the volumes of LNG contained in the Vessel's tanks before and after the Cargo Transfer. Each of the Vessel tanks must be fitted with two (2) gauging systems, a main system dedicated to Cargo measurement operations and a spare system. The maximum permissible error in the main gauging system must not exceed plus or minus 5 mm. The primary and secondary gauging systems will be identified during the Cargo measurement operations before the Cargo Transfer, without modification during the Cargo Transfer. In the event of a failure of the main gauging system, the spare system is used; if its maximum permissible error exceeds plus or minus 5 mm, especially on an old Vessel, the Shipper and the Operator shall agree on a maximum permissible error greater than plus or minus 5 mm.

The total uncertainty in measuring the LNG volume transferred as a result of the gauging system measuring uncertainty, gauge tables and correction tables associated with each of the Vessel's tanks must be less than 0.3%, in accordance with the European Union Law n°2011/17/UE, transposed into French law by the Order of 07/11/2011 ("Arrêté") and the Decree n°2016-769 of 09/06/2016.

In case the Vessel's cargo lines used for the Cargo Transfer have not the same filling state during gauging before and after Cargo Transfer:

- if the Vessel's cargo lines are full before Cargo Transfer and empty after Cargo Transfer, the volume of LNG measured before Cargo Transfer is increased by the volume of the cargo lines;
- if the Vessel's cargo lines are empty before Cargo Transfer and full after Cargo Transfer, the volume of LNG measured after Cargo Transfer is increased by the volume of the cargo lines.

The volume of the cargo lines is usually provided by the Vessel's tables: this value is used to increase the volume measured in the tanks. If the volume of the cargo lines is unknown or if the Vessel is not able to provide the relevant tables, a fixed increase of 75 m<sup>3</sup> of LNG is applied.

### 2.3 DETERMINING THE LNG TEMPERATURE AND GAS PHASE TEMPERATURE

Each of the Vessel's tanks must be fitted with temperature sensors located such that at any time at least one sensor is located in the liquid and one in the gas phase, the other sensors being uniformly distributed over the tank height. Only the measurements in the tanks concerned by the Cargo Transfer are taken into account. The LNG temperature before the Cargo Transfer is determined as the arithmetic mean of all the measurements of the temperature sensors immersed in the liquid. The gas phase temperature after the Cargo Transfer is determined as the arithmetic mean of all the measurements of temperature sensors located above the liquid phase. The total uncertainty on the temperature, including uncertainty on the different devices of the temperature measuring system, must be less than the value given in the following table, in accordance with the recommendations of the standard ISO 8310.

	total uncertainty of the measuring chain
LNG (liquid phase < -145°C)	± 0.2 °C
Natural Gas (gas phase > -145°C)	± 1.5 °C

### 2.4 DETERMINING THE PRESSURE IN THE VESSEL'S TANKS

The measuring procedures must comply with the recommendations of the current version of the *LNG Custody Transfer Handbook* of the GIIGNL.

Each of the Vessel's tanks must have at least one pressure sensor in contact with the gas phase. Only the measurements in the tanks concerned by the Cargo Transfer are taken into account. The average pressure in the tanks is determined before and after the Cargo Transfer as the arithmetic mean of the measurements read in each tank. The required accuracy of the absolute pressure measuring system is specified ± 10 mbar or ± 1% of the full-scale of the sensors, going from 800 mbar to 1400 mbar.

### **3 MEASUREMENTS PERFORMED IN THE TERMINAL**

#### **3.1 LNG SAMPLING AND RETURN GAS SAMPLING**

LNG in-line sampling: The Operator uses a so-called "in line" discontinuous sampling method, as defined in the LNG European standard EN 12838 and the standard ISO 8943 (2007), which makes it possible to:

- continuously sample and vaporise LNG under nominal transfer rate (i.e. not including the start and end of Cargo Transfer); sampling is performed by means of a Pitot tube isolated by maintaining it under vacuum conditions or by re-circulating LNG located in the centre of the transfer pipe, after the transfer arms; the transfer line, which meets the standard ISO 8943, maintains the LNG sub-cooled until it is vaporised in an electric vaporizer, by Joule effect, at regulated temperature;
- transfer the vaporised gas at stabilized pressure and flow rate to a chromatograph via suitable and identified piping; and
- perform chromatographical analysis at regular intervals (at least three (3) times an hour).

LNG cylinder sampling: In parallel with in-line sampling, LNG in the gaseous state is sampled in cylinders. The systems for sampling and transferring the evaporated gas to the sampling cylinders are the same as for in-line sampling. For each Cargo Transfer, three (3) samples (one for the Shipper, one for the Operator and one for an independent laboratory) are taken simultaneously and in parallel in cylinders when half of the Cargo has been transferred, and kept sealed by the Operator for two (2) weeks after the Cargo Transfer; at the end of this period, the sampling cylinders are purged and inerted. At the express request of the Shipper, and on an exceptional basis, the Operator shall make reasonable efforts to keep the sample cylinders for a longer period. The cylinder samples are only analyzed at the Shipper's explicit request and expense, and only applies to the measurement of major components.

If the Cargo Transfer is a Specific Service (gassing up, cooling down) or consists in a specific operation such as the Unloading or the Reloading of a heel of a limited quantity of LNG, there is no LNG cylinder sampling except in case of express request from the Shipper.

Sampling of return gas: The return gas sent back by the Terminal to the Vessel or by the Vessel to the Terminal is sampled directly in the return gas pipe with a so-called "in line" discontinuous sampling method, under nominal transfer rate (i.e. not including the start and end of Cargo Transfer); it is transferred to a chromatograph for analysis at regular intervals (at least three times an hour).

If the LNG sampling line (vaporiser and cane harvesting) is out making the analysis impossible, the Shipper and the Operator shall agree on a method to estimate the LNG transferred, e.g.:

- LNG aging study (in the case of Unloading), or
- compositional average of the last three (3) cargoes of the same LNG delivered previously.

In the event of a failure of the return gas sampling line or of the chromatograph dedicated to the analysis of this return gas, the Shipper and the Operator jointly agree to use the empirical method recommended by the latest version of the LNG Custody Transfer Handbook from GIIGNL in order to determine the average molar composition of the return gas.

#### **3.2 ANALYSIS OF COMPONENTS, CALIBRATION AND CHECKING OF CHROMATOGRAPHS**

##### **3.2.1 ANALYSIS OF THE MAIN COMPONENTS OF LNG AND RETURN GAS**

The main components of LNG and return gas are analyzed by chromatography in gaseous phase in accordance with the standard ISO 6974 (part 5). An analysis is performed at least three (3) times an hour and the analysis results are validated and standardized. The composition of the LNG and return gas is determined, for each component, as the arithmetic mean of the analysis results obtained under nominal Cargo Transfer conditions (i.e. not including the start and end of the Cargo Transfer).

If the chromatograph is unserviceable after first third of the Cargo Transfer under steady state conditions, the chromatographic analysis carried out during this first third shall be used for Cargo measurement.

If the chromatograph is unserviceable or jittering during the first third of the Cargo Transfer under steady state conditions, three (3) samples in cylinder with a double ogive shall be taken in parallel at regular intervals; a cylinder of each of the samples shall then be chromatographically analyzed as soon as the chromatograph is operational again and calibrated in accordance with the procedures in force.

### 3.2.2 CALIBRATION AND CHECKING OF THE ANALYSIS CHROMATOGRAPHS OF MAIN COMPONENTS

Outside the Cargo Transfer phases, the chromatographs are permanently swept with vector gas. The chromatograph in the gaseous phase is calibrated by carrying out at least five (5) consecutive analyses with a reference gaseous mixture in accordance with the current standard ISO 6141, the last three (3) analyses being kept to determine the new response factors of each component of this gas. This calibration is performed every year, or following a check having revealed a non-conformity, or after a maintenance action having required the instrument to be stopped. The chromatographs are checked in use with a standard gas certified COFRAC (or equivalent), at least once a quarter or before each calibration.

### 3.2.3 ANALYSIS OF TRACE ELEMENTS

Sulphur-based compounds are analyzed in accordance with the standard ISO 19739. The methods described in this standard may be tailored according to the measuring instruments available and the recommendations of the suppliers of such instruments.

When equipment checking for traces elements contained in LNG is faulty after the first third of the Cargo Transfer under steady state conditions, the analysis results obtained during this first third shall be the ones used for Cargo measurement.

If the equipment checking for trace elements is unserviceable during the first third of the Cargo Transfer under steady state conditions:

- in the case of an Unloading, the reference values considered are those obtained during Loading or, in the absence of data at Loading, the ones obtained during the latest unloadings of the same LNG already delivered at the Terminal,
- in the case of a Reloading, the reference values considered are the weighted average of the values of the unloaded LNG used for the Reloading.

## 3.3 DETERMINATION OF THE GROSS HEATING VALUE (GHV), WOBBE INDEX AND THE DENSITY

The GHV and volumetric Wobbe Index are established for a real gas in accordance with the method recommended by the current standard ISO 6976, the reference conditions of which are as follows:

- volumetric measuring conditions: 0°C and 1,01325 bar absolute (so-called "normal" conditions);
- combustion conditions: 0°C and 1,01325 bar absolute.

The mass GHV calculations are established in accordance with the same ISO standard and under the same reference combustion conditions.

The LNG density is calculated in accordance with the revised KLOSEK MC KINLEY method (published in December 1980 in *Technical note 1030 – National Bureau of Standards* and described in the *GIIGNL LNG Custody Transfer Handbook*, taking into account:

- the mean temperature of the transferred LNG,
- the LNG mean composition determined during the Cargo Transfer,
- the molar mass of each component as defined in the current standard ISO 6976,
- the molar volume of each component and the correction factors K1 and K2 as described in *Technical note 1030 – National Bureau of Standards*, published in December 1980.

## **4 DETERMINING THE TRANSFERRED QUANTITY**

The Quantity Unloaded is calculated in accordance with the following formula:

$$E = [(V \times d \times H_m) - Q_r - Q_{mach}] / 3600$$

The Quantity Reloaded is calculated in accordance with the following formula:

$$E = [(V \times d \times H_m) - Q_r + Q_{mach}] / 3600$$

where E is the Quantity Transferred, expressed in MWh (Megawatt-hour),

V is the LNG volume transferred, expressed in m<sup>3</sup> (cubic meters), measured and calculated in accordance with article 2.1 of this appendix,

d is the density of LNG samples, kg/m<sup>3</sup> (kilograms per cubic meters of LNG), calculated in accordance with article 3.1 of this appendix,

H<sub>m</sub> is the LNG mass GHV, expressed in MJ/kg, determined from the mean measurement of the LNG content in accordance with article 3.1 of this appendix,

Q<sub>mach</sub> is the quantity of energy used by the Vessel to operate its machinery during the Cargo Transfer,

Q<sub>r</sub> is the quantity of energy sent back by the Terminal to the Vessel during Unloading, or by the Vessel to the Terminal during Reloading, expressed in MJ and calculated as follows:

$$Q_r = V \times \{273.15 / (273.15 + T)\} \times \{p / 1013.25\} \times H_v$$

where T is the gas return temperature, expressed in °C (degrees Celsius), measured at the end of the Unloading or at the beginning of the Reloading and calculated in accordance with article 2.1 of this appendix;

p is the mean pressure in the Vessel's tanks at the end of the Unloading or at the beginning of the Reloading, expressed in mbar (millibar), measured and calculated in accordance with article 2.1 of this appendix;

H<sub>v</sub> is the volumetric GHV of the return gas, expressed in MJ/m<sup>3</sup>, determined from the mean measurement of the Natural Gas content in accordance with article 3.1 of this appendix.

The calculation methods for the transferred energy are described in a technical note ("LNG cargo transfer - Calculation methods and rounding-offs") that is made available to the Shipper and its subcontractors on the Operator's website.

## **5 RECTIFICATION, VERIFICATION AND USE OF THE MEASUREMENTS CARRIED OUT ON THE TERMINAL**

### **5.1 OPERATOR MEASURING INSTRUMENT AND RECTIFICATION**

If any component of these equipment stops or malfunctions, or if a component of these equipment is found not to comply with the current statutory standards, the Operator shall perform a rectification for the period beginning from the date of the latest verification in which the component in question was found to be in conformity and ending on the date the conformity of the said component was re-established. The Operator shall inform the Shipper of the rectification performed. Subject to compliance with its confidentiality obligations, the Operator shall provide the items justifying this rectification at Shipper's request.

### **5.2 VERIFICATION AND CORRECTION OF MEASUREMENTS AT THE SHIPPER'S REQUEST**

The Shipper is entitled to attend the measurements carried out on the Terminal. It is entitled to ask for any component or set of components of the Cargo Measuring Equipment and Gas Measuring Equipment to be checked, either by the Operator, or by an expert designated by joint agreement.

If the check shows that the accuracy of the component or set of components checked leads to an uncertainty of one percent (1%) or less in the calculation of the Quantity Transferred, and provided that the accuracy of the Vessel's measuring devices complies with article 2 of this appendix, the measurements shall not be corrected and the verification costs shall be borne by the Shipper.

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If the check shows an uncertainty strictly greater than 1% in the calculation of the Quantity Transferred, and if no other agreement is reached between the Operator and the Shipper, the Quantities Transferred shall be corrected for half of the period between the day the check was carried out and the day the latest calibration was carried out by the Operator.

### 5.3 USE OF THE MEASUREMENTS BY THE OPERATOR

The Operator can freely use the measurements performed in the frame of the Contract, to the extent of its confidentiality obligations. The Operator provides these measurements to the Shipper at his request, insofar as they are directly used for the calculation of the Quantity Transferred and Daily Send-Out.

## 6 UNITS AND ROUND OFFS

### 6.1 UNITS AND ROUND OFFS

The calculations and associated round offs are performed in International Units as defined in the standard ISO 8000-1. The calculation methods for the transferred energy and the round offs rules are described in a technical note ("LNG cargo transfer - Calculation methods and rounding-offs") that is made available to the Shipper and its subcontractors on the Operator's website.

The following table shows the round offs to be applied to the calculation results that are displayed in the Cargo Report (see article 7 of this appendix):

<b>Grandeur</b>	<b>Unit</b>	<b>Round off (read-out)</b>
Volume (apart from gross and net transferred LNG)	m <sup>3</sup> (cubic meter)	0.001
Gross and net transferred volume of LNG	m <sup>3</sup> (cubic meter)	0.1
LNG and gas return temperatures	°C (degree Celsius)	0.1
Pressure in Vessel's tanks	mbar (millibar)	1
LNG and gas return composition	Molecular %	0.001
Mass of LNG	kg (kilogram)	0.1
Mass GHV	MJ/kg (Megajoule per kilogram) or kWh/kg (kilowatt-hour per kilogram)	0.01
Volumetric GHV	MJ/m <sup>3</sup> (Megajoule per cubic meter) or kWh/m <sup>3</sup> (kilowatt-hour per cubic meter)	0.01
Wobbe Index	MJ/m <sup>3</sup> (Megajoule per cubic meter) or kWh/m <sup>3</sup> (kilowatt-hour per cubic meter)	0.01
Density	kg/m <sup>3</sup> (kilogram per cubic meter )	0.1
Quantity of energy returned to the Vessel or to the Terminal	MJ (Megajoule) or kWh (kilowatt-hour)	1
Quantity of energy transferred	MJ (Megajoule) or kWh (kilowatt-hour)	1

Any quantity of energy expressed in MWh (Megawatt-hour) is round offs to three (3) meaningful decimals and any quantity of energy expressed in kWh (Kilowatt-hour) is round offs to zero (0) meaningful decimals, as per the following rules:

- o a non-meaningful decimal which equals to zero (0), one (1), two (2), three (3) or four (4) does not raise the meaningful decimal;
- o a non-meaningful decimal which equals to five (5), six (6), seven (7), eight (8) or nine (9) raise the meaningful decimal.

In case of dispute, the quantity of energy expressed in MWh (Megawatt-hour) only is contractual.

## 6.2 UNIT CONVERSION

A quantity of energy expressed in kWh (Kilowatt-hour) at 25°C (GHV) is converted in a quantity of energy expressed in MWh (Megawatt-hour) at 0°C (GHV) by multiplying this quantity of energy by 1.0026, in accordance with the recommendations of the standard NF ISO 13443, and by dividing the result by one thousand (1000).

A quantity of energy expressed in MWh (Megawatt-hour) at 0°C (GHV) is converted in a quantity of energy expressed in kWh (Kilowatt-hour) at 25°C PCS by multiplying this quantity of energy by one thousand (1000), and by dividing the result by 1.0026, in accordance with the recommendations of the standard NF ISO 13443.

A quantity of energy expressed in Wh (Watt-hour) is converted in a quantity of energy expressed in J (joule) by multiplying this quantity of energy by one three thousand and six hundred (3600).

A quantity of energy expressed in Btu (British Thermal Unit) is converted in a quantity of energy expressed in J (joule) by multiplying this quantity of energy by 1055.056.

## 7 CARGO REPORT AND CERTIFICATES

### 7.1 LOADING CERTIFICATE

Upon departure from the Loading Port, the Shipper shall send the Operator a Loading Certificate providing the LNG characteristics measured at Loading and those expected at Unloading. This certificate shall be sent by e-mail both to the Terminal and to the Operator's operational representative, which are listed in Specific Conditions.

The Shipper must make sure that the methods used for determining the LNG characteristics measured at Loading comply with applicable international standards (ISO, GPA, CEN, ASTM). The Operator may require that the Shipper have these characteristics validated by an independent auditing company. Any fees arising from this shall be borne by the Shipper.

The Loading Certificate indicates:

- the Shipper's name;
- the Vessel's name;
- the journey number;
- the name of the Loading Port (and the name of the wharf if necessary);
- the port of origin of the Cargo if different from the Loading Port;
- the Loading date;
- the LNG destination;
- the Cargo reference number;
- the mean composition of the loaded LNG as a molecular % and its impurity content:
  - the total sulphur in mg(S)/m<sup>3</sup>(n)
  - sulphur in the H<sub>2</sub>S in mg(S)/m<sup>3</sup>(n)
  - sulphur in H<sub>2</sub>S+COS in mg(S)/m<sup>3</sup>(n)
  - mercaptans in mg(S)/m<sup>3</sup>(n)
  - carbon dioxide in ppm
  - mercury in ng/m<sup>3</sup>(n)
  - the oxygen content in ppmv
  - the hydrocarbon dew point temperature in °C
- the total volume before and after Loading;
- the mean temperature of the loaded LNG;
- the tank pressure after Loading.



7.2 CARGO REPORT

After the Cargo Transfer, a Cargo Report is drawn up by the Operator and sent to the Shipper as per form provided hereafter. The Cargo Report consists of a certificate of quality and a certificate of quantity, with the energy quantities expressed at the reference temperature of 0°C and 25°C. For clarification, nominations on the Transmission System are made at the reference temperature of 25°C.

One single original copy of the Cargo Report is issued by the Operator.



Terminal Méthanier  
Montoir-de-Bretagne  
Zone Portuaire - BP 35  
44550 MONTOIR-DE-BRETAGNE

**RAPPORT DE CARGAISON: Certificat de Qualité**  
*CARGO REPORT: Certificate of Quality*

Date de l'opération / Transfer date : *jj/mm/aaaa*  
Type d'opération / Transfer operation : **DECHARGEMENT / Unloading**  
Nom du navire / Vessel Name : **LNG Carrier Name**

Références ELENGY		Références Company	
N° d'escale	xxxxx	N° de cargaison	yyyyy
Ship Call Number		Cargo Number	

Tous les calculs sont effectués conformément au contrat d'accès aux terminaux exploités par Elengy, dans les conditions de référence suivantes : [PCS à 0°C ; V(0°C ; 101325 Pa)]. All calculations are made according to Elengy-operated LNG terminals access contract, with the following reference conditions: [GHV at 0°C ; V(0°C ; 101325 Pa)].

Analyse / Analysis	GNL / LNG	Gaz retour Return gas	
Azote / Nitrogen (N <sub>2</sub> )	x.xxx	x.xxx	% mol.
Méthane / Methane (CH <sub>4</sub> )	xx.xxx	xx.xxx	% mol.
Ethane / Ethane (C <sub>2</sub> H <sub>6</sub> )	x.xxx	x.xxx	% mol.
Propane / Propane (C <sub>3</sub> H <sub>8</sub> )	x.xxx	x.xxx	% mol.
Iso Butane / Iso butane (iC <sub>4</sub> H <sub>10</sub> )	x.xxx	x.xxx	% mol.
Normal Butane / n butane (nC <sub>4</sub> H <sub>10</sub> )	x.xxx	x.xxx	% mol.
Néo Pentane / neo pentane (neoC <sub>5</sub> H <sub>12</sub> )	x.xxx	x.xxx	% mol.
Iso Pentane / iso pentane (iC <sub>5</sub> H <sub>12</sub> )	x.xxx	x.xxx	% mol.
Normal Pentane / n pentane (nC <sub>5</sub> H <sub>12</sub> )	x.xxx	x.xxx	% mol.
Hexanes plus / Hexanes plus (C <sub>6</sub> H <sub>14</sub> )	x.xxx	x.xxx	% mol.
Dioxyde de carbone / carbon dioxide (CO <sub>2</sub> )	x.xxx	x.xxx	% mol.

Impuretés / Trace elements	GNL / LNG	
Sulfure d'hydrogène / Hydrogen sulfide (H <sub>2</sub> S)	x.x	mg(S)/m <sup>3</sup> (n)
Mercaptans / Mercaptans (RSH)	x.x	mg(S)/m <sup>3</sup> (n)
Oxy sulfure de carbone + Sulfure d'hydrogène (COS + H <sub>2</sub> S)	x.x	mg(S)/m <sup>3</sup> (n)
Soufre total / Total sulfure (S)	x.x	mg(S)/m <sup>3</sup> (n)

Caractéristiques sous forme gaz / Characteristics in gas state [0°C ; 101325 Pa]	GNL / LNG	Gaz retour Return gas	
PCS massique / GHV (mass)	xx.xx	xx.xx	kWh/kg
PCS volumique / GHV (volumetric)	xx.xx	xx.xx	kWh/m <sup>3</sup> (n)
Indice de Wobbe / Wobbe index	xx.xx	xx.xx	kWh/m <sup>3</sup> (n)
Masse volumique / Density	xx.xx	xx.xx	kg/m <sup>3</sup> (n)
Densité / Relative density	xx.xx	xx.xx	-
Indice de méthane / Methane number (méthode PKI)	xx		

Caractéristiques sous forme liquide / Characteristics in liquid state	GNL / LNG	Gaz retour Return gas	
Température	-xxx.x	@ -160.0	°C
PCS volumique / GHV (volumetric)	xxxx.xx	xxxx.xx	kWh/m <sup>3</sup> <sub>LNG</sub>
Masse volumique / Density	xxx.x	xxx.x	kg/m <sup>3</sup> <sub>LNG</sub>
Coefficient d'expansion / Expansion factor	xxx.x	xxx.x	-





Terminal Méthanier  
 Montoir-de-Bretagne  
 Zone Portuaire - BP 35  
 44550 MONTOIR-DE-BRETAGNE

**RAPPORT DE CARGAISON: Certificat de Quantité**  
*CARGO REPORT: Certificate of Quantity*

**Date de l'opération / Transfer date :**                    *jj/mm/aaaa*  
**Type d'opération / Transfer operation :**            **DECHARGEMENT / Unloading**  
**Nom du navire / Vessel Name :**                        **LNG Carrier Name**

Références ELENGY		Références ENGIE	
N° d'escale <i>Ship Call Number</i>	XXXXX	N° de cargaison <i>Cargo Number</i>	YYYYY

**Reconnaissance de cargaison / Custody Transfer Measurement**

[Données retenues pour l'établissement du bilan net / Data used for calculating the net transferred quantities]

	<b>Avant transfert</b> <i>Before transfer</i>	<b>Après transfert</b> <i>After transfer</i>	
Date et Heure / <i>Date and Time</i>	jj/mm/aaaa hh:mm	jj/mm/aaaa hh:mm	
Volume GNL / <i>LNG volume</i>	xxx xxx.xxx	xxx xxx.xxx	m <sup>3</sup> LNG
Température moyenne GNL <i>LNG average temperature</i>	-xxx.x		°C
Température moyenne phase gaz <i>Vapour phase average temperature</i>		-xxx.x	°C
Pression moyenne phase gaz <i>Vapour phase average pressure</i>		xxxx	mbar(abs)
Gaz consommé aux machines du navire <i>Gas consumed by vessel's engines</i>	xx xxx.x	kg (mesuré / measured)	
		m <sup>3</sup> (n) (mesuré / measured)	
		kWh (0,10% de la quantité brute de GNL transféré / 0.10% of gross transferred LNG quantity)	

**Bilan net des quantités transférées / Net transferred quantities**

	Volume / <i>Volume</i> m <sup>3</sup> GNL	Energie / <i>Energy</i> kWh @ 0°C	Masse / <i>Mass</i> kg
<b>GNL transféré brut / Gross transferred LNG</b>	xxx xxx.xxx	x xxx xxx xxx	xxx xxx xxx.x
- <b>Gaz retour / Return gas</b>	xxx.xxx	x xxx xxx	xxx xxx.x
- <b>Gaz consommé aux machines du navire</b> <i>Gas consumed by vessel's engines</i>	xxx.xxx	x xxx xxx	xxx xxx.x
<b>GNL transféré net</b> <i>Net transferred LNG</i>	xxx xxx.x	x xxx xxx xxx @ 0°C x xxx xxx xxx @ 25°C	xxx xxx.x

**ELENGY :**  
 Date / *date* :  
 Nom / *name* :  
 Tampon et signature / *Stamp and signature* :

**Company :**  
 Date / *date* :  
 Nom / *name* :  
 Tampon et signature / *Stamp and signature* :