

## APPROFONDIMENTO SULLA GESTIONE E MOVIMENTAZIONE DEI PRODOTTI E SOTTOPRODOTTI

### SMALL SCALE LNG PLANT

Monte Pallano 1-2 (MP1 and MP2) – Collesanto gas field


Status	Rev. n.	Data	Descrizione	Elaborato	Verificato	Approvato
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# 1. Prodotto LNG

## 1.1. Scheda di Sicurezza

<b>SAFETY DATA SHEET</b>		Page: 1 of 7
<b>Liquefied Natural Gas (LNG)</b>		Printed: 12/07/2018 Revision: 12/07/2018
<b>Product Category:</b>	Refrigerated gas	
<b>Intended Use:</b>	Industrial Use	
<b>Synonyms:</b>	(UN 1972), (Liquefied Natural Gas), (Methane Refrigerated Liquid), (Natural Gas Refrigerated Liquid)	
2. HAZARDS IDENTIFICATION		
<b>Flammable Gases, Category 1</b>		
<b>Gas Under Pressure, Refrigerated liquefied gas</b>		
		
<b>GHS Signal Word:</b>	<b>Danger</b>	
<b>GHS Hazard Phrases:</b>	H220 - Extremely flammable gas. H281 - Contains refrigerated gas; may cause cryogenic burns or injury. H261 - In contact with water releases flammable gases.	
<b>GHS Precaution Phrases:</b>	P202 - Do not handle until all safety precautions have been read and understood. P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking. P282 - Wear cold insulating gloves/face shield/eye protection.	
<b>GHS Response Phrases:</b>	P336 - Thaw frosted parts with lukewarm water. Do not rub affected areas. P315 - Get immediate medical advice/attention. P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely. P381 - Eliminate all ignition sources if safe to do so.	
<b>GHS Storage and Disposal Phrases:</b>	P403 - Store in well-ventilated place.	
<b>OSHA Regulatory Status:</b>	This material is classified as hazardous under OSHA regulations.	
<b>Inhalation:</b>	This material can act as a simple asphyxiant by displacement of air. Symptoms of asphyxia include headache, dizziness, rapid breathing, increased pulse, mood changes, tremors, cyanosis, muscular weakness, narcosis, numbness of the extremities, unconsciousness and death. The effects of asphyxiation may be more rapid during physical effort since oxygen consumption is increased.	
<b>Skin Contact:</b>	The vapors are not irritants, but direct contact of the eyes, skin with cold vapors or liquid may cause frostbite, burns, permanent ocular and skin lesions.	
<b>Eye Contact:</b>	The vapors are not irritants, but direct contact of the eyes, skin with cold vapors or liquid may cause frostbite, burns, permanent ocular and skin lesions.	
<b>Ingestion:</b>	Not a likely route of exposure. May be harmful if swallowed.	
<b>Medical Conditions Generally Aggravated By Exposure:</b>	People with pre-existing heart, lung or blood conditions may have an increased sensitivity to asphyxiation.	

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### 3. COMPOSITION/INFORMATION ON INGREDIENTS

CAS #	Hazardous Components (Chemical Name)	Concentration
74-82-8	Methane	99.5 %
7727-37-9	Nitrogen	0.5 %

### 4. FIRST AID MEASURES

**Emergency and First Aid Procedures:**

<b>In Case of Inhalation:</b>	If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing. If breathing is difficult, give oxygen or administer artificial respiration. Get medical aid if irritation develops and persists.
<b>In Case of Skin Contact:</b>	Liquefied gases may cause cryogenic burns or injury. Treat frostbitten skin by flushing or immersing affected area in lukewarm water. Do not rub affected area. Do not remove clothing that adheres due to freezing. After sensation has returned to the skin, keep skin warm, dry, and clean. If blistering occurs, apply a sterile dressing. Seek immediate medical attention.
<b>In Case of Eye Contact:</b>	For contact with the liquefied gas, remove contact lenses if present, hold eyes open and gently flush the affected eye(s) with lukewarm water. Get immediate medical advice/attention.
<b>In Case of Ingestion:</b>	Not a likely route of exposure. In the unlikely event of ingestion, obtain medical attention immediately.
<b>Signs and Symptoms Of Exposure:</b>	Light hydrocarbon gases are simple asphyxiant and can cause anesthetic effects at high concentrations. Symptoms of overexposure, which are reversible if exposure is stopped, can include shortness of breath, drowsiness, headaches, confusion, decreased coordination, visual disturbances and vomiting. Continued exposure can lead to hypoxia, rapid breathing, numbness, unconsciousness and death. The signs of frostbite are a change in the color of the skin to grey or white, followed later by blisters. The skin may become inflamed and painful.
<b>Note to Physician:</b>	Show this safety data sheet to the doctor in attendance. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of hydrocarbon solvents (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for the development of cardiac arrhythmias.

### 5. FIRE FIGHTING MEASURES

<b>Flash Pt:</b>	-136 C (-213 F) Method Used: Unknown
<b>Explosive Limits:</b>	LEL: 5% (V) at 25.0 C (77.0 F) UEL: 15% (V) at 25.0 C (77.0 F)
<b>Autoignition Pt:</b>	537 C (999 F)
<b>Suitable Extinguishing Media:</b>	Dry chemical (Purple-K) and carbon dioxide are the most effective types of extinguishing media. To suppress or contain, use water fog or high expansion foam.
<b>Unsuitable Extinguishing Media:</b>	Water is not a suitable agent for fighting a LNG fire directly because it causes expansion of the fire by increasing the rate of vaporization of the liquid to gas.
<b>Fire Fighting Instructions:</b>	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Flame-retardant clothing, gloves and proper eye protection need to be worn in any situation where there is the potential for LNG vapors to ignite accidentally. If safe to do so, try to remove ignition sources. Use non-sparking tools to shut off the gas. Do not try to extinguish the fire if the gas leak can't be stopped. If there is no risk to the surrounding area, let the fire burn itself out. If needed, use a combustible gas detector to establish a secure perimeter around the site.



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Spilled material may pool on the ground and flow toward lower points until the temperature rises above -100C (-148F). If the spill has not ignited, water spray can be used to direct flammable gas-air mixtures away from ignition sources. LNG vapors are heavier than air until the vapors reach -180F. During a significant spill the vapors generated may travel long distances to a distant ignition source.

**Flammable Properties and Hazards:**

Highly flammable, extremely cold liquid and gas. Forms explosive mixtures in air and with oxidizing agents.

A Rapid Phase Transition (RPT) can occur when there is a significant difference in temperature between the LNG and a warmer liquid; this reaction can cause instantaneous vaporization of the LNG. The sudden increase in total volume occupied by the LNG may generate a shock wave (sudden generation of overpressure but without combustion).

**Hazardous Combustion Products:**

High temperatures and fire conditions can result in the formation of carbon monoxide and carbon dioxide, Fireball forms if gas is ignited immediately after release.

### 6. ACCIDENTAL RELEASE MEASURES

**Protective Precautions, Protective Equipment and Emergency Procedures:**

Use proper personal protective equipment as indicated in Section 8.

**Environmental Precautions:**

Liquefied Natural Gas (LNG) will not pollute natural resources such as ground water, soil, wetlands, streams or beaches. It vaporizes quickly and completely, and because it is lighter than air, it does not contain any pollutants from the spill.

**Steps To Be Taken In Case Material Is Released Or Spilled:**

Remove all sources of ignition. Ensure adequate ventilation. Notify relevant authorities in accordance with applicable regulations. Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken.

### 7. HANDLING AND STORAGE

**Precautions To Be Taken in Handling:**

To be handled by trained personnel only, using equipment specifically designed for LNG and following approved standard operating procedures. Cold burns may occur during filling operations. Wear appropriate personal protective equipment (see section 8) and use good industrial hygiene. Gas can accumulate in confined spaces and limit available oxygen. Use only with adequate ventilation.

Take precautionary measures against static discharge. Electrostatic charge may accumulate and create a hazardous condition when handling this material. To avoid fire, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material.

Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, flame, sparks or other sources of ignition.

**Precautions To Be Taken in Storing:**

Store only in containers compatible for Liquefied Natural Gas storage. Post area with proper signage such as no smoking, no open flames, personal protective equipment requirements and cryogenic hazard. Use spark-proof tools and explosion proof equipment. Keep away from heat, sparks and flame.

**Other Precautions:**

Liquid methane tanks are equipped with pressure relief devices. Venting vapors may obscure visibility. If venting or leaking methane catches fire, do not extinguish flames. Flammable vapors may spread from leak creating an explosive reignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an approved explosion meter. Never touch live electrical parts.



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Avoid materials incompatible with cryogenic use; some metals such as carbon steel may fracture easily at low temperature. To prevent liquid or cold gas from being trapped in piping between valves, equip the piping with pressure relief devices. Use only transfer lines designed for cryogenic liquids. It is recommended to pipe all vents to the exterior of the building. Always store and use with adequate ventilation. Never work on a pressurized system. If a leak occurs, follow established procedures for isolation and blow down before attempting any repair. Never place a compressed gas cylinder where it may become part of an electrical circuit.

### 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

CAS #	Partial Chemical Name	OSHA TWA	ACGIH TWA	Other Limits
74-82-8	Methane	No data.	TLV: Simple asphyxiant ppm	No data.
7727-37-9	Nitrogen	No data.	TLV: Simple asphyxiant ppm	No data.

<b>Respiratory Equipment (Specify Type):</b>	A NIOSH approved, self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand, or other positive pressure mode, should be used in situations of oxygen deficiency (oxygen content less than 19.5 percent), unknown exposure concentrations, or situations that are immediately dangerous to life or health (IDLH). A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use.
<b>Eye Protection:</b>	The use of eye protection (such as splash goggles) that meets or exceeds ANSI Z.87.1 is recommended when there is potential liquid contact to the eye. Depending on conditions of use, a face shield may be necessary.
<b>Protective Gloves:</b>	Wear thermal insulating gloves and clothing when working with materials that present thermal hazards (hot or cold).
<b>Other Protective Clothing:</b>	Wear thermal insulating gloves and clothing when working with materials that present thermal hazards (hot or cold).
<b>Engineering Controls (Ventilation etc.):</b>	Provide adequate ventilation to maintain 19.5% oxygen, less than 1% methane (20% of LEL). Use a combustible gas indicator since LNG is odorless. If ventilation practices are not adequate to maintain airborne concentrations below exposure limits, additional engineering controls may be required.
<b>Work/Hygienic/Maintenance Practices:</b>	Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday. Suggestions provided in Section 8 for exposure control and specific types of protective equipment are based on readily available information. Specific situations may require consultation regarding industrial hygiene, safety or engineering professionals to ensure proper protection.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

<b>Physical States:</b>	<input type="checkbox"/> Gas <input checked="" type="checkbox"/> Liquid <input type="checkbox"/> Solid
<b>Appearance and Odor:</b>	Appearance: colorless. Odorless. Odor: Cryogenic liquid.
<b>pH:</b>	NA
<b>Freezing Point:</b>	-182 C (-296 F)
<b>Boiling Point:</b>	-162 C (-259 F)
<b>Flash Pt:</b>	-136 C (-213 F)    Method Used: Unknown
<b>Evaporation Rate:</b>	NA
<b>Flammability (solid, gas):</b>	If a source of ignition is present where the vapor exists at 5 - 15% concentration in air, the vapor will burn along the flame front towards the source of fuel.
<b>Explosive Limits:</b>	LEL: 5% (V)    at 25.0 C (77.0 F)    UEL: 15% (V)    at 25.0 C (77.0 F)
<b>Vapor Pressure (vs. Air or</b>	655.57 PSI

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mm Hg):  
 Vapor Density (vs. Air = 1): NA  
 Specific Gravity (Water = 1): NA  
 Density: 0.415 at -164 C (-263 F)  
 Solubility in Water: No data.  
 Saturated Vapor Concentration: NA  
 Octanol/Water Partition Coefficient: No data.  
 Percent Volatile: 100 % by volume.  
 Autoignition Pt: 537 C (999 F)  
 Decomposition Temperature: No data.  
 Viscosity: NA  
 Molecular Formula & Weight: CH<sub>4</sub> 16.042

### 10. STABILITY AND REACTIVITY

**Reactivity:** Stable under recommended storage conditions.  
**Stability:** Unstable [ ] Stable [ X ]  
**Conditions To Avoid - Instability:** Heat, flames and sparks. Air. Heat will increase pressure in the storage tank.  
**Incompatibility - Materials To Avoid:** Air. Oxygen, Strong oxidizing agents, halides, chlorinated compounds, fluorine.  
**Hazardous Decomposition or Byproducts:** High temperatures and fire conditions can result in the formation of carbon monoxide and carbon dioxide.  
**Possibility of Hazardous Reactions:** Will occur [ X ] Will not occur [ ]  
**Conditions To Avoid - Hazardous Reactions:** Keep away from source of: ignition, heat, high temperatures, flames, sparks, welding and static electricity.

### 11. TOXICOLOGICAL INFORMATION

**Toxicological Information:** Mutagenicity: Not expected.  
 Reproductive toxicity: Not expected. Hypoxia during pregnancy may have adverse effects on the developing fetus.  
  
 This material can act as a simple asphyxiant by displacement of air. Anesthetic effects at high concentrations. High concentrations may reduce the amount of oxygen available, especially in confined spaces.  
**Irritation or Corrosion:** May cause frostbite.  
**Symptoms related to Toxicological Characteristics:** The vapors are not irritants, but direct contact of the eyes, skin with cold vapors or liquid may cause frostbite, burns, permanent ocular and skin lesions. Even though non-toxic by inhalation, exposure to high concentrations may cause a depression of the nervous system (rapid respiration, dizziness, headaches), but without any long-term effects.  
**Chronic Toxicological Effects:** No data available.  
**Carcinogenicity:** NTP? No IARC Monographs? No OSHA Regulated? No





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Philippines ICCS: Yes; REACH: Yes - (P)

### Regulatory Information:

California Proposition 65: This material does not contain any chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the requirements of California Proposition 65.

EPA Reportable Quantity (CERCLA) (in pounds): EPA's petroleum exclusions apply to this material. (CERCLA 101(14)).

CERCLA/SARA Section 313 & 40 CFR 372: This material does not contain any chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372.

CERCLA/SARA Section 311/312 (Title III Hazard Categories):

Acute Health: Yes

Chronic Health: No

Fire Hazard: Yes

Pressure Hazard: Yes

Reaction Hazard: No

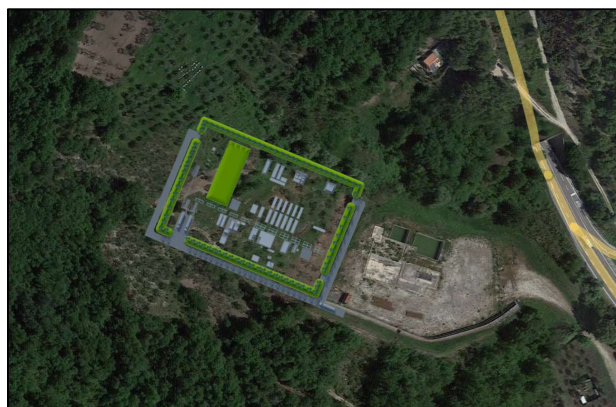
International Hazard Classification: Canada: This product has been classified in accordance with the hazard criteria of the Controlled Products Regulation (CPR) and the MSDS contains all the information required by the regulation.



## 1.2. Capacità di Produzione

Di seguito si riassumono le capacità dell'impianto Small Scale LNG in termini di capacità di produzione.

- Gas in ingresso: 268280Nm<sup>3</sup>/giorno
- GNL prodotto: 122,4 ton/giorno
- Funzionamento in continuo annuale: 8000 ore
- Capacità annua di produzione GNL: 40800 ton
- Capacità dello stoccaggio di GNL: 3000m<sup>3</sup> (pari a 11 giorni di produzione)
- Pensiline di caricamento di autocisterne: N° 2 pensiline di carico
- Numero di autocisterne giornaliere: 5 autocisterne al giorno su 3 turni di lavoro (volume di caricamento singola autocisterna di 50m<sup>3</sup>)



## 1.3. Modalità di Gestione

Una volta estratto il gas naturale e liquefatto tramite un processo di raffreddamento apposito, si avrà quindi una riduzione di volume di circa 600 volte inferiore rispetto allo stato gassoso. Questo processo garantirà una semplice veicolazione del prodotto sia via terra e sia via mare, rendendosi subito disponibile come combustibile per il trasporto dei veicoli e natanti.

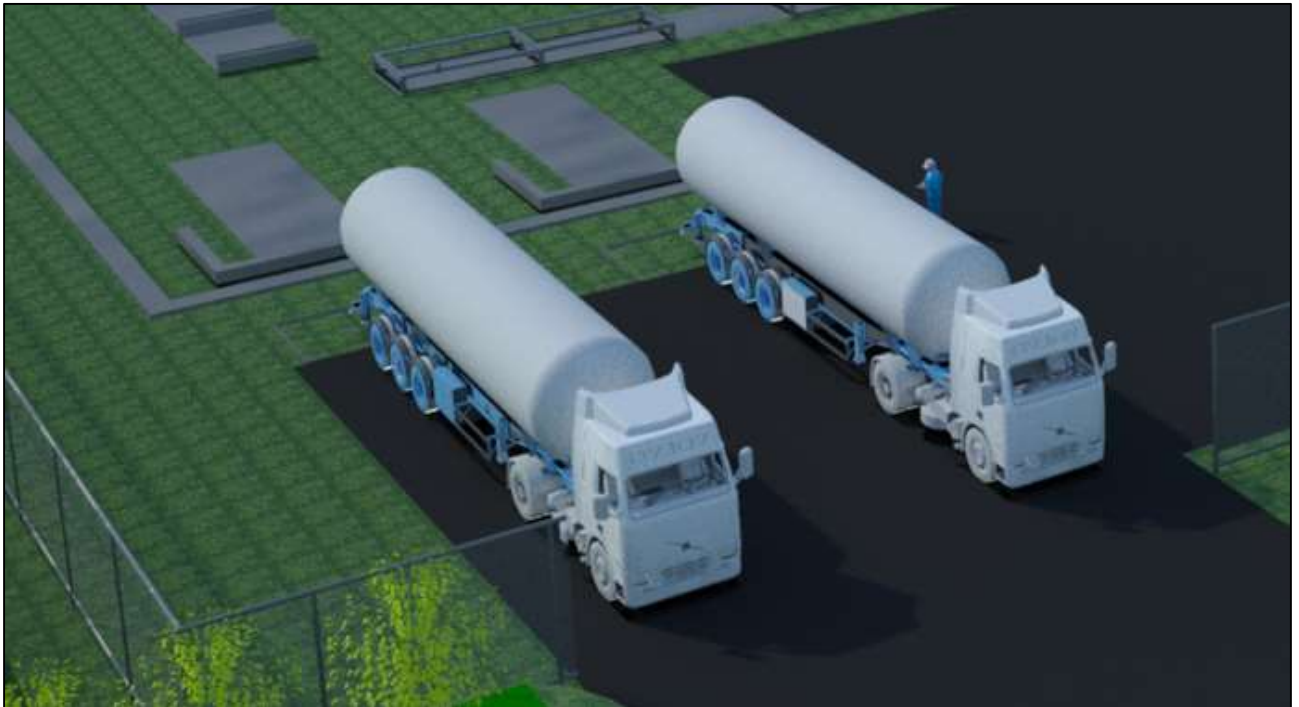
### 1.3.1. Stoccaggio

Per immagazzinare il gas naturale in modo sicuro e mantenerlo ad una temperatura di circa  $-160^{\circ}\text{C}$ , il sistema di stoccaggio è realizzato con materiali isolanti altamente efficaci che mantengono fuori il calore. Saranno formati da un serbatoio o più serbatoi semi-interrati e ricoperti da terra di riporto ricavata dagli scavi della stessa per l'alloggiamento degli stessi. La capacità totale sarà di 3000 m<sup>3</sup> pari a 11 giorni di produzione.



### 1.3.2. Pensiline di Carico

Il sistema carico del gas liquefatto ( 2 pensiline di carico) verrà gestito in modo da permettere il rifornimento sia delle autocisterne apposite e sia di ISO-Container.





### 1.3.2.1. Autocisterne o ISO-Container Criogenici


Possono essere utilizzate come deposito di carburante movimentabile e la quantità di prodotto trasferita è flessibile in quanto dipende dal numero di cisterne. Tra le cisterne mobili, si segnala la possibilità di utilizzare gli ISO container, che sono cisterne criogeniche mobili di dimensioni standard, pari a quelle di un container ISO (1 twenty-foot equivalent unit (TEU)) o un container doppio (2 twenty-foot equivalent unit TEU)<sup>2</sup>. Sono utilizzate come deposito di carburante portatile e la quantità di prodotto trasferita è flessibile in quanto dipende dal numero di cisterne. Possono essere caricate su una nave con le gru dedicate ai containers o possono essere caricate su autotreno in modalità Ro Ro (Roll-on/Roll-off). Sono intermodali come tutti i container ISO, possono quindi viaggiare tramite autotreno, treno o nave.

Il serbatoio è in pressione e può avere capacità approssimativa 40 mc.



## 2. Sottoprodotto CO<sub>2</sub>

### 2.1. Scheda di sicurezza

<b>SAFETY DATA SHEET</b>	
<b>1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER</b>	
<u>1.1 Product identifier</u>	
Product name	CARBON DIOXIDE
Synonyms	PRODUCT CODE: SG082
<u>1.2 Uses and uses advised against</u>	
Uses	DISPENSING GAS • INERT GAS • SHIELDING GAS
<u>1.4 Emergency telephone numbers</u>	
Emergency	1800 819 783 (24 hours)
<b>2. HAZARDS IDENTIFICATION</b>	
<u>2.1 Classification of the substance or mixture</u>	
CLASSIFIED AS HAZARDOUS ACCORDING TO SAFE WORK AUSTRALIA CRITERIA	
<b>Physical Hazards</b>	
Gases Under Pressure: Liquefied gas	
<b>Health Hazards</b>	
Not classified as a Health Hazard	
<b>Environmental Hazards</b>	
Not classified as an Environmental Hazard	
<u>2.2 GHS Label elements</u>	
Signal word	<b>WARNING</b>
Pictograms	
<b>Hazard statements</b>	
H280	Contains gas under pressure; may explode if heated.
<b>Prevention statements</b>	
None allocated.	
<b>Response statements</b>	
None allocated.	
<b>Storage statements</b>	
P410 + P403	Protect from sunlight. Store in a well-ventilated place.

PRODUCT NAME CARBON DIOXIDE

**Disposal statements**

None allocated.

**2.3 Other hazards**

Asphyxiant. Effects are proportional to oxygen displacement.

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### 3. COMPOSITION/ INFORMATION ON INGREDIENTS

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**3.1 Substances / Mixtures**

Ingredient	CAS Number	EC Number	Content (v/v)
CARBON DIOXIDE	124-38-9	204-696-9	99.9%

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### 4. FIRST AID MEASURES

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**4.1 Description of first aid measures**

<b>Eye</b>	Cold burns: Immediately flush with tepid water or with sterile saline solution. Hold eyelids apart and irrigate for 15 minutes. Seek medical attention.
<b>Inhalation</b>	If inhaled, remove from contaminated area. To protect rescuer, use an Air-line respirator or Self Contained Breathing Apparatus (SCBA). Apply artificial respiration if not breathing. Give oxygen if available. For advice, contact a Poisons Information Centre on 13 11 26 (Australia Wide) or a doctor.
<b>Skin</b>	Cold burns: Remove contaminated clothing and gently flush affected areas with warm water (30°C) for 15 minutes. It is recommended that warm water is applied to clothing before removing it so as to prevent further skin damage. Apply sterile dressing and treat as for a thermal burn. For large burns, immerse in warm water for 15 minutes. DO NOT apply any form of direct heat. Seek immediate medical attention.
<b>Ingestion</b>	Due to product form and application, ingestion is considered unlikely.
<b>First aid facilities</b>	None allocated.

**4.2 Most important symptoms and effects, both acute and delayed**

In high concentrations may cause asphyxiation. Direct contact with the liquefied material or escaping compressed gas may cause frostbite injury. Low concentrations of CO<sub>2</sub> cause increased respiration and headache.

**4.3 Immediate medical attention and special treatment needed**

Treat for asphyxia and cold burns.

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### 5. FIRE FIGHTING MEASURES

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**5.1 Extinguishing media**

Use water fog to cool containers from protected area.

**5.2 Special hazards arising from the substance or mixture**

Non flammable.

**5.3 Advice for firefighters**

Temperatures in a fire may cause liquid vessels and related equipment to rupture. Storage vessels may contain fine particle insulation materials or foam products which may be hazardous or release hazardous decomposition products in a fire. Cool vessels exposed to fire by applying water from a protected location. Do not approach vessels suspected of being hot. Evacuate area if unable to keep vessels cool.

**5.4 Hazchem code**

2T	
2	Fine Water Spray.
T	Wear full fire kit and breathing apparatus. Dilute spill and run-off.

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### 6. ACCIDENTAL RELEASE MEASURES

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**6.1 Personal precautions, protective equipment and emergency procedures**

If the cylinder is leaking, evacuate area of personnel. Inform manufacturer/supplier of leak. Use Personal Protective Equipment (PPE) as detailed in Section 8 of the SDS. Ventilate area where possible and eliminate ignition sources.

**6.2 Environmental precautions**

Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.



PRODUCT NAME CARBON DIOXIDE

**6.3 Methods of cleaning up**

Stop the flow of material, if this is without risk. If the leak is irreparable, move the cylinder to a safe and well ventilated area, and allow to discharge. Keep area evacuated and free from ignition sources until any leaked or spilled liquid has evaporated.

**6.4 Reference to other sections**

See Sections 8 and 13 for exposure controls and disposal.

**7. HANDLING AND STORAGE**

**7.1 Precautions for safe handling**

Before use carefully read the product label. Use of safe work practices are recommended to avoid eye or skin contact and inhalation. Observe good personal hygiene, including washing hands before eating. Prohibit eating, drinking and smoking in contaminated areas.

**7.2 Conditions for safe storage, including any incompatibilities**

Refer to vessel operating instructions. Do not store near incompatible substances, heat or ignition sources and foodstuffs. Portable liquid containers should be stored: upright, prevented from falling, in a secure area; below 65°C, in a dry, well ventilated area constructed of non-combustible material with firm level floor (preferably concrete), away from areas of heavy traffic and emergency exits.

**7.3 Specific end uses**

No information provided.

**8. EXPOSURE CONTROLS / PERSONAL PROTECTION**

**8.1 Control parameters**

Exposure standards

Ingredient	Reference	TWA		STEL	
		ppm	mg/m <sup>3</sup>	ppm	mg/m <sup>3</sup>
Carbon dioxide	SWA [AUS]	5000	9000	30000	54000
Carbon dioxide in coal mines	SWA [AUS]	12500	22500	30000	54000
Carbon dioxide in coal mines	SWA [Proposed]	5000	9000	30000	54000

**Biological limits**

No biological limit values have been entered for this product.

**8.2 Exposure controls**

**Engineering controls** Avoid inhalation. Use in well ventilated areas. Where an inhalation risk exists, mechanical extraction ventilation is recommended. Maintain vapour levels below the recommended exposure standard.

**PPE**

- Eye / Face Wear safety glasses.
- Hands Wear leather or insulated gloves.
- Body Wear coveralls.
- Respiratory Where an inhalation risk exists, wear Self Contained Breathing Apparatus (SCBA) or an Air-line respirator.



**9. PHYSICAL AND CHEMICAL PROPERTIES**

**9.1 Information on basic physical and chemical properties**

Appearance	COLOURLESS GAS
Odour	ODOURLESS
Flammability	NON FLAMMABLE
Flash point	NOT RELEVANT
Boiling point	NOT AVAILABLE
Melting point	NOT AVAILABLE
Evaporation rate	NOT APPLICABLE

**PRODUCT NAME CARBON DIOXIDE**
**9.1 Information on basic physical and chemical properties**

pH	NOT APPLICABLE
Vapour density	NOT AVAILABLE
Specific gravity	NOT APPLICABLE
Solubility (water)	0.759 cm <sup>3</sup> /cm <sup>3</sup>
Vapour pressure	6300 kPa @ 25°C (Approximately)
Upper explosion limit	NOT RELEVANT
Lower explosion limit	NOT RELEVANT
Partition coefficient	NOT AVAILABLE
Autoignition temperature	NOT AVAILABLE
Decomposition temperature	NOT AVAILABLE
Viscosity	NOT AVAILABLE
Explosive properties	NOT AVAILABLE
Oxidising properties	NOT AVAILABLE
Odour threshold	NOT AVAILABLE

**9.2 Other information**

% Volatiles	100 %
Critical pressure	7,380 kPa (Approximately)
Critical temperature	31°C (Approximately)
Cylinder pressure (when full)	6300 kPa @ 25°C (Approximately)
Density	1.53 (Air = 1)
Sublimation temperature	-78°C (Approximately)

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**10. STABILITY AND REACTIVITY**


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**10.1 Reactivity**

Carefully review all information provided in sections 10.2 to 10.6.

**10.2 Chemical stability**

Stable under recommended conditions of storage.

**10.3 Possibility of hazardous reactions**

Polymerization will not occur.

**10.4 Conditions to avoid**

Avoid contact with incompatible substances.

**10.5 Incompatible materials**

Moist carbon dioxide is corrosive, hence acid resistant materials are required (e.g. stainless steel). Certain properties of some plastics and rubbers may be affected by carbon dioxide (i.e. embrittlement, leaching of plasticisers, etc).

**10.6 Hazardous decomposition products**

May evolve toxic gases if heated to decomposition.

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**11. TOXICOLOGICAL INFORMATION**


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**11.1 Information on toxicological effects**

<b>Acute toxicity</b>	Based on available data, the classification criteria are not met. Low concentrations of carbon dioxide cause increased respiration and headache.
<b>Skin</b>	Not classified as a skin irritant. Contact with dry ice powder may cause frostbite injury or cold burns.
<b>Eye</b>	Not classified as an eye irritant. Contact with dry ice powder may cause frostbite injury or cold burns.
<b>Sensitisation</b>	Not classified as causing skin or respiratory sensitisation.
<b>Mutagenicity</b>	Not classified as a mutagen.
<b>Carcinogenicity</b>	Not classified as a carcinogen.
<b>Reproductive</b>	Not classified as a reproductive toxin.
<b>STOT - single exposure</b>	Asphyxiant. Effects are proportional to oxygen displacement. Over exposure may result in dizziness, drowsiness, weakness, fatigue, breathing difficulties and unconsciousness.
<b>STOT - repeated exposure</b>	Not classified as causing organ damage from repeated exposure.
<b>Aspiration</b>	Not classified as causing aspiration.



PRODUCT NAME CARBON DIOXIDE

## 12. ECOLOGICAL INFORMATION

### 12.1 Toxicity

No information provided.

### 12.2 Persistence and degradability

Not expected to be persistent in the aquatic environment.

### 12.3 Bioaccumulative potential

Bioaccumulation is not expected.

### 12.4 Mobility in soil

The substance is a gas, not applicable.

### 12.5 Other adverse effects

When discharged to the atmosphere, carbon dioxide may contribute to the greenhouse effect.

## 13. DISPOSAL CONSIDERATIONS

### 13.1 Waste treatment methods

**Waste disposal** Ensure all liquid and gas supply valves are shut. Notify the manufacturer that you will be returning the portable liquid container. Residual product will be disposed of under the manufacturer's supervision.

**Legislation** Dispose of in accordance with relevant local legislation.

## 14. TRANSPORT INFORMATION

CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE



	LAND TRANSPORT (ADG)	SEA TRANSPORT (IMDG / IMO)	AIR TRANSPORT (IATA / ICAO)
14.1 UN Number	1013	1013	1013
14.2 Proper Shipping Name	CARBON DIOXIDE	CARBON DIOXIDE	CARBON DIOXIDE
14.3 Transport hazard class	2.2	2.2	2.2
14.4 Packing Group	None allocated.	None allocated.	None allocated.

### 14.5 Environmental hazards

No information provided.

### 14.6 Special precautions for user

Hazchem code 2T  
 GTEPG 2C1  
 EmS F-C, S-V

**Other information** Transport on open top vehicles in accordance with Australian Code for the Transport of Dangerous Goods. Refer to Commonwealth, State and Territory Dangerous Goods Legislation which contain requirements which affect gas storage and transport.

## 15. REGULATORY INFORMATION

### 15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

**Poison schedule** A poison schedule number has not been allocated to this product using the criteria in the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).



**PRODUCT NAME**    **CARBON DIOXIDE**

**Classifications**        Safework Australia criteria is based on the Globally Harmonised System (GHS) of Classification and Labelling of Chemicals.

**Inventory listings**        **AUSTRALIA: AICS (Australian Inventory of Chemical Substances)**  
All components are listed on AICS, or are exempt.

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## 16. OTHER INFORMATION

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**Additional information**        The storage of significant quantities of gas cylinders must comply with AS4332 The storage and handling of gases in cylinders.

**APPLICATION METHOD:** Gas withdrawal: Gas regulator of suitable pressure and flow rating fitted to cylinder or manifold with low pressure gas distribution to equipment. Liquid withdrawal: may be used as liquid or vapourised for pressure regulated gas distribution.

**PERSONAL PROTECTIVE EQUIPMENT GUIDELINES:**

The recommendation for protective equipment contained within this report is provided as a guide only. Factors such as form of product, method of application, working environment, quantity used, product concentration and the availability of engineering controls should be considered before final selection of personal protective equipment is made.

**HEALTH EFFECTS FROM EXPOSURE:**

It should be noted that the effects from exposure to this product will depend on several factors including: form of product; frequency and duration of use; quantity used; effectiveness of control measures; protective equipment used and method of application. Given that it is impractical to prepare a report which would encompass all possible scenarios, it is anticipated that users will assess the risks and apply control methods where appropriate.

<b>Abbreviations</b>	<p>ACGIH        American Conference of Governmental Industrial Hygienists</p> <p>CAS #        Chemical Abstract Service number - used to uniquely identify chemical compounds</p> <p>CNS         Central Nervous System</p> <p>EC No.      EC No - European Community Number</p> <p>EMS         Emergency Schedules (Emergency Procedures for Ships Carrying Dangerous Goods)</p> <p>GHS         Globally Harmonized System</p> <p>GTEPG      Group Text Emergency Procedure Guide</p> <p>IARC         International Agency for Research on Cancer</p> <p>LC50         Lethal Concentration, 50% / Median Lethal Concentration</p> <p>LD50         Lethal Dose, 50% / Median Lethal Dose</p> <p>mg/m<sup>3</sup>       Milligrams per Cubic Metre</p> <p>OEL         Occupational Exposure Limit</p> <p>pH           relates to hydrogen ion concentration using a scale of 0 (high acidic) to 14 (highly alkaline).</p> <p>ppm         Parts Per Million</p> <p>STEL         Short-Term Exposure Limit</p> <p>STOT-RE     Specific target organ toxicity (repeated exposure)</p> <p>STOT-SE     Specific target organ toxicity (single exposure)</p> <p>SUSMP      Standard for the Uniform Scheduling of Medicines and Poisons</p> <p>SWA         Safe Work Australia</p> <p>TLV         Threshold Limit Value</p> <p>TWA         Time Weighted Average</p>
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## 2.2. Capacità di Produzione

Dall'unità di Addolcimento del Gas, attraverso le migliori tecnologie disponibili (BAT), si procederà al recupero della CO<sub>2</sub> come sottoprodotto pari a circa 3,68 ton/giorno. La CO<sub>2</sub> così recuperata potrà essere opportunamente valorizzata nel mercato industriale, imbottolata allo stato gassoso o liquido, evitandone l'immissione in atmosfera, in un quadro complessivo di riduzione delle emissioni di GHG.

- Portata massica: 153.2 Kg/h
- Portata volumetrica in condizioni Standard: 78.06 Nm<sup>3</sup>/h
- Pressione: 22 barg
- Temperatura -14.47 °C
- % mol CO<sub>2</sub>: 99,54%
- Funzionamento in continuo annuale: 8000 ore
- Capacità annua di produzione CO<sub>2</sub>: 1343,2 ton
- Capacità dello stoccaggio di CO<sub>2</sub>: 50 m<sup>3</sup> (pari a 13 giorni di produzione)
- Pensiline di caricamento: N° 2 pensiline di carico (1 per carico di CO<sub>2</sub> liquido + 1 per carico di CO<sub>2</sub> gassosa in bombole)
- Numero di autocisterne giornaliere: 1 autocisterna ogni 8 giorni circa.

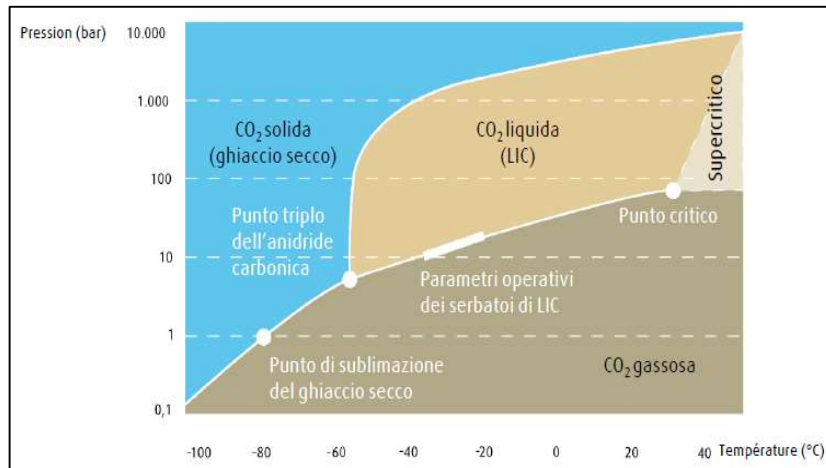
## 2.3. Modalità di Gestione

L'anidride carbonica è incombustibile, chimicamente stabile in condizioni atmosferiche e poco reattiva.

L'anidride carbonica sotto forma di gas in condizioni atmosferiche è circa 1,5 volte più pesante dell'aria. Per questa ragione la CO<sub>2</sub> scende prevalentemente verso il basso e si può raccogliere in pozzi, cantine o depressioni del terreno. Quando la circolazione dell'aria è scarsa, questi accumuli di CO<sub>2</sub> possono perdurare per molte ore.

Gli stati di aggregazione che dipendono dalla pressione e dalla temperatura richiedono una particolare attenzione:

- In condizioni atmosferiche la CO<sub>2</sub> è **gassosa**.
- A temperature comprese tra  $-56,6$  e  $+31,1^{\circ}\text{C}$  e pressioni di almeno 5,2 bar, la CO<sub>2</sub> può assumere la **forma liquida**. A pressione atmosferica (1 bar) l'anidride carbonica non può assumere la forma liquida.
- A temperature inferiori a  $-56,6^{\circ}\text{C}$  la CO<sub>2</sub> può assumere la **forma solida**.
- Tutti e tre gli stati di aggregazione sono possibili solo in corrispondenza del cosiddetto punto triplo ( $-56,6^{\circ}\text{C}$ , 5,2 bar).





### 2.3.1. Stoccaggio

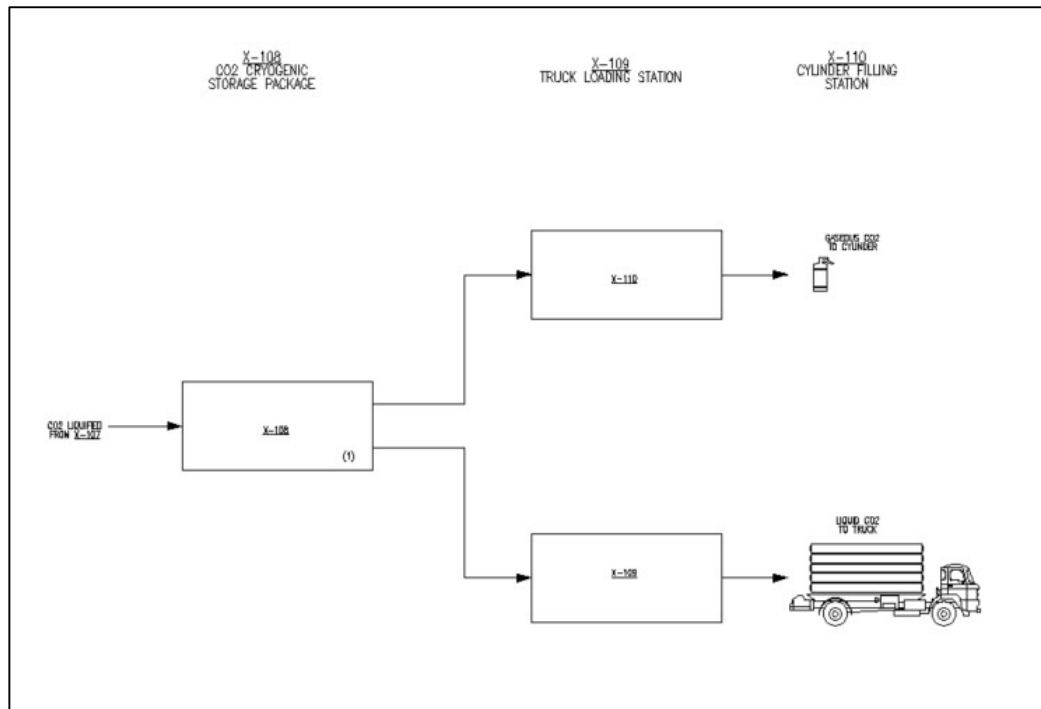
Considerando la capacità di produzione giornaliera di circa 3,68 ton/d verrà considerato uno stoccaggio criogenico di 50 m<sup>3</sup> equivalente a 13 giorni di produzione. Le varie soluzioni di stoccaggio possono trovarsi sia in forma verticale e sia in forma orizzontale ed in varie dimensioni standard.

Le condizioni di stoccaggio sono in fase liquida a circa -15°C.



### 2.3.2. Pensiline di Carico

La CO<sub>2</sub> prodotta dal sistema di recupero RPB verrà splittata nelle ipotesi di utilizzo, sia industriale mediante il carico su autocisterne “TO TRUCK” allo stato liquido e sia alimentare “FOOD GRADE” attraverso apposite stazioni di carica di bombole allo stato gassoso.



### 2.3.2.1. CO2 TO FOOD GRADE

Mediante un sistema di riempimento automatico la CO2 alimentare può essere stoccata e movimentata con diverse tipologie di recipienti, nella fase **gassosa**.

Il quantitativo prelevato dallo stoccaggio a valle della RPB sarà di circa 1/3 di quello totale rispettivamente:

- Stoccaggio totale giornaliero: 3,68 ton/d
- Quantitativo prelevato per food grade: 1.23 ton/d
- Capienza bombola: 500 gr cad.
- Totale bombole riempite al giorno: 2426 pz.





### 2.3.2.2. CO2 TO TRUCK FOR INDUSTRIAL USE

Mediante un sistema di riempimento automatico la CO<sub>2</sub> industriale può essere stoccata e movimentata attraverso autocisterne nello stato **liquido**.

Il quantitativo prelevato dallo stoccaggio a valle della RPB sarà di circa 2/3 di quello totale rispettivamente:

- Stoccaggio totale giornaliero: 3,68 ton/d
- Quantitativo prelevato per utilizzo industriale: 2.46 ton/d
- Capienza autocisterna: 20 m<sup>3</sup>
- Tempo riempimento di 1 cisterna: 8,14 d



### 3. Gestione degli Effluenti ed Emissioni in Atmosfera

L'impianto di produzione GNL considerato con la tecnologia Small Scale LNG avrà il seguente quadro di emissioni gassose ed effluenti liquidi.

- Scarico in Atmosfera da Unità di Liquefazione del Gas e Unità Rimozione Azoto (NRU)

54.149 Nnm<sup>3</sup>/giorno

25°C / ATM

Composizione stimata: Rif. Annesso 3: SCHEMA A BLOCCHI GENERALE

- Scarico in Atmosfera da Unità di Produzione Energia Elettrica e Vapore (nota 1)

922.784 Nnm<sup>3</sup>/giorno

300°C / ATM

Composizione stimata: Rif. Annesso 3: SCHEMA A BLOCCHI GENERALE

Nota (1): Questo scarico può essere convogliato ad un opportuno sistema addizionale di cattura e recupero della CO<sub>2</sub> per riduzione emissione GHG

Parimenti, sempre dall'unità di Recupero Purificazione e Imbottigliamento della CO<sub>2</sub>, attraverso le migliori tecnologie disponibili (BAT), si procederà alla cattura della H<sub>2</sub>S ivi contenuta (circa 1 ton/giorno) attraverso l'utilizzo di trappole catalitiche costituite da uno o più serbatoi riempiti con materiale granulare a base di ossido metallico misto poroso su una base igroscopica stabile. Il riempimento catalitico è licenziato ed idoneo alla rimozione della zolfo presente nella corrente gassosa. La corrente di gas a valle del suddetto trattamento raggiunge un contenuto finale inferiore a 100ppb(max).

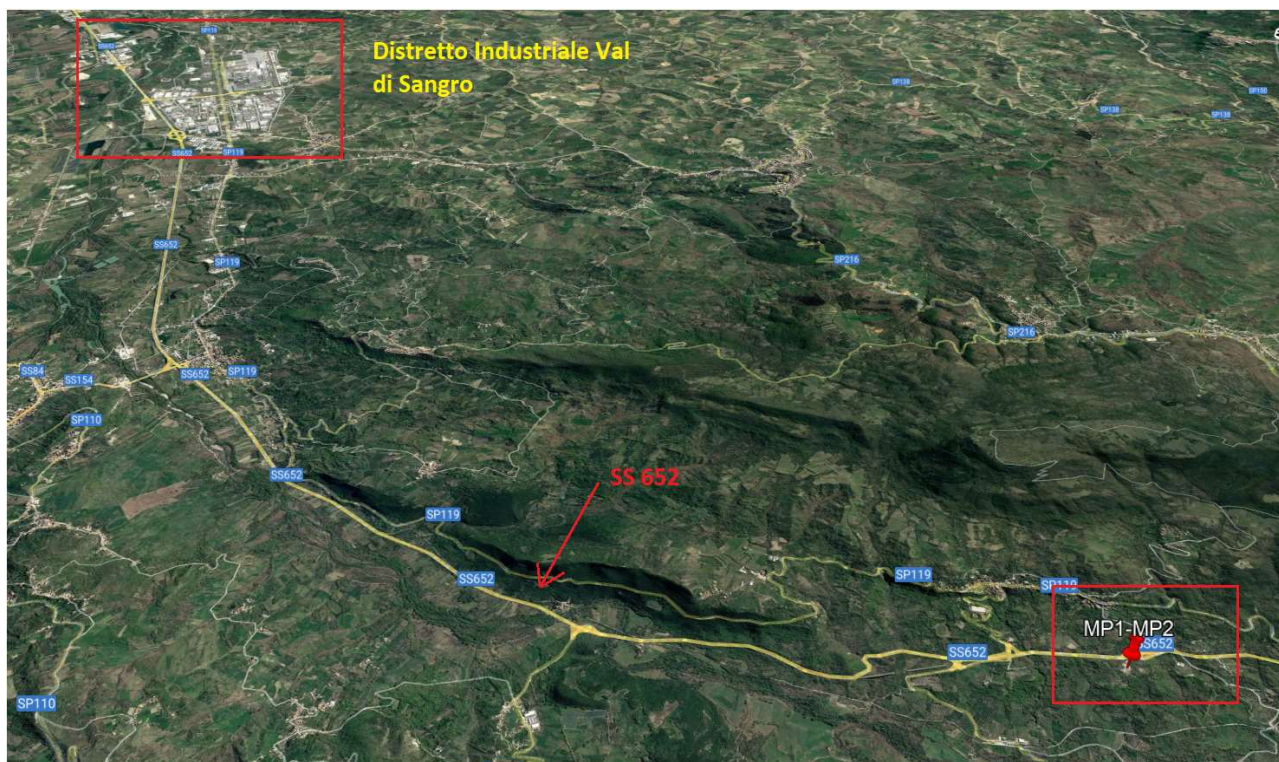
## 4. Utilizzo delle Infrastrutture Viarie Esistenti

Lo Small Scale LNG Plant sorgerà nella Regione Abruzzo, in provincia di Chieti nel territorio del comune di Bomba, riconducibile allo sviluppo del campo Monte Pallano ovvero alla messa in produzione e coltivazione dei pozzi già presenti **Monte Pallano 1** e **Monte Pallano 2**. Il sito è costeggiato dalla SS 652, arteria principale che collega l'interno del Molise alla costa adriatica, attraversando la val di Sangro e terminando nel comune di Fossacesia, in Abruzzo. Questa infrastruttura viaria rappresenta una, se non l'unica, delle opere civili idonee e necessarie all'esercizio di un modo di trasporto per mezzo di autocisterne adibite alla veicolazione del prodotto in una qualsiasi destinazione di interesse.

Infatti, per mezzo della SP 652 è possibile raggiungere perfettamente sia il Distretto Industriale Val di Sangro, cuore Industriale della Regione Abruzzo, sia l'Autostrada Adriatica A14 per la veicolazione del prodotto in qualsiasi direzione del territorio nazionale italiano.

### Raggiungimento Distretto Val di Sangro:

Distanza totale: 20 Km    Tempo di percorrenza: 18 min





Raggiungimento svincolo Autostrada Adriatica A14:

Distanza totale: 25 Km      Tempo di percorrenza: 22 min



- Considerando la produzione totale del prodotto liquefatto per un complessivo di 5 cisterne da 50 m<sup>3</sup> ogni 24 h, si avrà una viabilità di circa 1 cisterna ogni 4,8 h durante l'arco della giornata.
- Considerando la produzione totale dei sottoprodotti avremo 1 autocisterna ogni otto giorni circa per la CO<sub>2</sub> industriale ed un numero variabile di trasporti alla settimana per la CO<sub>2</sub> alimentare dipendente dalla dimensione delle bombole utilizzate.
- Si producono 2426 bombole da 0,5 Kg di CO<sub>2</sub> ogni giorno. Si considera 1 autocisterna a settimana per movimentare le bombolette come specificato al par. 2.3.2.1.

*Ipotesi utilizzo LNG per autotrazione nella movimentazione dei prodotti*

Risulta in corso l'introduzione di autocarri pesanti conformi a Euro 6 che funzionano con gas naturale liquefatto o biogas. I nuovi camion hanno le stesse prestazioni, guidabilità e consumo di carburante dei camion con motore diesel. Inoltre, le emissioni di CO<sub>2</sub> dei nuovi autocarri sono inferiori del 30% rispetto al diesel.

Questa soluzione risulta un'alternativa valida a basso impatto climatico che soddisfa anche elevati requisiti di prestazioni, efficienza del carburante e autonomia operativa, sfruttando direttamente lo stoccaggio trasportato giornalmente.



## 5. Sottoprodotto Acque di Produzione

### Effluente Liquido – Acqua di Produzione trattata

9.15 m<sup>3</sup>/giorno

50°C / ATM

Composizione stimata: Rif. Annesso 1 - H&MBs SMALL SCALE LNG PLANT - MP1 and MP2

L'Acqua di produzione associata al gas estratto dai pozzi MP1 e MP2 viene opportunatamente separata dal gas nelle apparecchiature dell'impianto e viene convogliata ad una specifica unità di trattamento dove l'acqua viene portata a specifiche di legge per essere convogliata a serbatoio di stoccaggio per riutilizzo interno all'impianto stesso.