GUIDE FOR THE DELIVERY OF BULK CARBON DIOXIDE

Doc 56/21

Revision of Doc 56/09

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Amendments to 56/09

Section	Change
	Editorial to align style with EIGA Style Manual
All	Complete re-write to re-style the publication from carbon dioxide manual to guide for the delivery of carbon dioxide

1 Introduction

Refrigerated liquified carbon dioxide has specific physical properties that present additional handling risks as compared to other cryogenic gases. This publication focuses on these risks and gives guidance on how they can be handled.

2 Scope and purpose

This publication contains information and guidance for transport function personnel dealing with carbon dioxide.

For further information on transport safety, refer to EIGA Info TS01 *Transport Safety Information, an Overview* [1].[1]

Some of the information and guidance given may also be applicable to other bulk gases. These are however not specifically inside the scope of this publication.

This publication does not include carbon dioxide tank wagons (rail containers), however the principles of this publication may be used.

3 Definitions

For the purpose of this publication, the following definitions apply.

3.1 Publications terminology

3.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

3.1.2 Should

Indicates that a procedure is recommended.

3.1.3 May

Indicate that the procedure is optional.

3.1.4 Will

Is used only to indicate the future, not a degree of requirement.

3.1.5 Can

Indicates a possibility or ability.

3.2 Technical definitions

3.2.1 Anti-whip device

A safety device that prevents a hose from whipping (flailing) in case the coupling fails, such devices are also known as restraints or tethers. There are various methods such as cables, slings, safety ropes or chains.

[1] References are shown by bracketed numbers and are listed in order of appearance in the reference section.

3.2.2 Carbon dioxide

In general, the terms carbon dioxide and CO_2 are synonymous.

The terms dry ice, carbon dioxide snow and solid carbon dioxide are used synonymously.

3.2.3 Pressure

In this publication bar shall indicate gauge pressure unless otherwise noted i.e., (bar, abs) for absolute pressure and (bar, dif) for differential pressure.

3.2.4 Road tanker or tanker

In this publication, (road) tanker is a collective term used for mobile equipment with tanks that transport refrigerated liquefied carbon dioxide, for example tank-vehicles, rigid tankers, tank containers.

4 Specific properties of carbon dioxide

Safety data sheets for carbon dioxide (which differ depending on the physical state) are available from the gas supplier. They detail hazards, classification, transport information, etc. A short summary of the specific properties of carbon dioxide is given below. Additional information on carbon properties can be found in EIGA Doc 66, *Refrigerated Carbon Dioxide Storage at Users Premises* [2].

4.1 Physical properties

Carbon dioxide (CO_2) can be produced, stored or used in any of the three different physical states (gas, liquid, solid).

Figure 1 summarises the physical state of carbon dioxide when pressure and temperature vary.

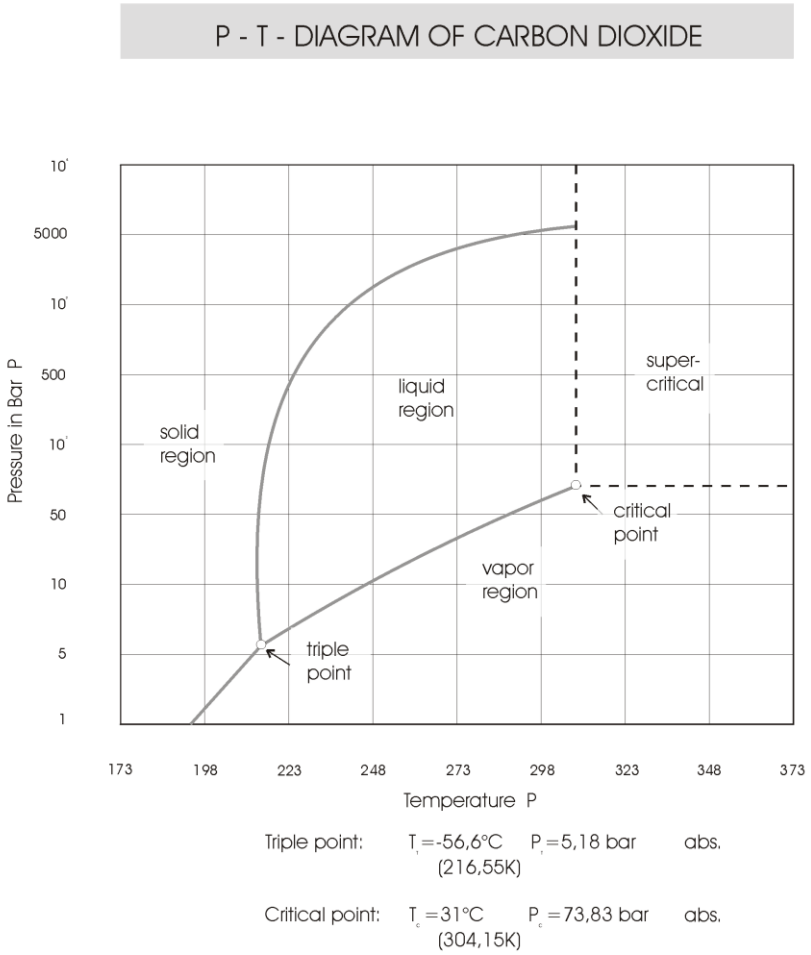

Figure 1: Carbon dioxide pressure-temperature diagram

Note that:

- Liquid carbon dioxide can exist only when the temperature is below 31 °C. It is transported, stored and handled in liquid form, either:
    - at ambient temperature in cylinders or non-insulated storage tanks at pressures typically between of 45 bar and 95 bar; or
    - as refrigerated liquid in insulated tankers and storage tanks with temperatures ranging typically from –40 °C to –15 °C and a pressure ranges from 10 bar to 25 bar.
- When liquid carbon dioxide pressure drops below 4.18 bar (5.18 bar, abs) solid carbon dioxide can form at low temperatures, see Figure 1.
- At +15 °C and atmospheric pressure carbon dioxide gas has a density of 1.87 kg/m³ and is 1.5 times heavier than air. It is a colourless and odourless gas (with a slightly pungent odour at higher concentrations) and spreads along the ground, collecting in low lying areas such as pits and cellars.
- When liquid carbon dioxide is released to the atmosphere it results in:
    - powdery solid carbon dioxide particles;
    - invisible gaseous carbon dioxide production; and

- cold temperatures from the released carbon dioxide leading condensation of moisture in the air and formation of a visible cloud.

4.2 Chemical properties

Carbon dioxide does not support combustion. When dissolved in water, carbon dioxide and water form equilibrium with carbonic acid (H_2CO_3). The pH-value of carbonic acid varies from 3.7 at atmospheric pressure to 3.2 at 23.4 bar. Carbonic acid provides the biting taste of soda water and it reacts in alkaline solutions producing carbonates. It has only very few vigorous reactions with other substances. It can react under special conditions such as high temperature or pressure with very strong reducing agents such as sodium and magnesium. For this reason, carbon dioxide should not be used as a fire extinguishing agent for reactive metals such as sodium and magnesium.

5 Hazards of carbon dioxide

Hazardous conditions can be created when carbon dioxide temperature and / or pressure are not controlled. Carbon dioxide in liquid or solid state is hazardous as it can cause cryogenic burns due to cold temperatures. When pressure is not controlled, dry ice plugs can form in piping which can lead to overpressure and rupture of the pipe or the ejecting of the dry ice plugs which can potentially strike equipment or people see 5.5.

Carbon dioxide is naturally present in air at a level of approximately 400 parts per million (0.04%). Carbon dioxide is a non-toxic gas, but at elevated concentrations acts as an asphyxiant as it causes oxygen depletion. However, carbon dioxide hazards and physiological effects are much more complex compared to other gases classified as asphyxiants. Namely, in contrast to other asphyxiant gases, carbon dioxide is a normal product of metabolism in human beings and takes an active part in pulmonary gas exchange principle when people breath. It forms a part of the human body's normal chemical environment as an active messenger substance in the linking of respiration, circulation, and vascular response to the demands of human metabolism.

For further information see EIGA Info 24, *Carbon Dioxide Physiological Hazards – "Not Just an Asphyxiant!"* [3].

5.1 Uncontrolled release of carbon dioxide

Any uncontrolled release of carbon dioxide is potentially hazardous especially inside poorly ventilated areas. Enclosed low-lying areas, where gaseous carbon dioxide could accumulate in high concentration, are particularly hazardous because the gas is slow to disperse unless the spaces are well ventilated. Details on physiological effects are found in EIGA Info 24 [3].

In the case of a significant release of carbon dioxide in confined areas, all personnel should be evacuated immediately. When confined spaces are entered before they are properly ventilated, personnel entering such areas shall wear self-contained breathing apparatus and be trained in its use. Confined space entry procedures shall be followed, including emergency aid and rescue provision. For more information see EIGA Doc 164, *Safe Handling of Liquid Carbon Dioxide Containers that have Lost Pressure* [4].

WARNING: *Cartridge respirators give no protection in atmospheres containing dangerous concentrations of carbon dioxide.*

Significant releases of carbon dioxide can occur through:

- failure of the storage vessel or pipework containing liquid and / or gaseous carbon dioxide;
- tow-away of the flexible hose(s) through movement of the road tanker while a hose is still connected between road tanker and storage vessel;
- release from a relief device;
- inadvertent opening of a drain valve while the system contains liquid carbon dioxide;

- failure of connections for example flexible hoses, flanges;
- tightening or loosening connections whilst under pressure; or
- failure to open / close valves according to proper procedure.

Uncontrolled release of carbon dioxide from any opening (valve or fracture / crack) can be violent in case of high pressure and can lead to serious injury upon impact. Uncontrolled and violent release of carbon dioxide may also cause considerable noise, which can lead to hearing damage.

5.2 Low pressure / low temperature in storage vessels

When compressed gas is allowed to expand or liquid to evaporate, the temperature of the system falls. Should larger quantities of carbon dioxide gas be rapidly lost from the storage vessel through automatic or manual relief, failed / stuck open valves or excessive withdrawal of carbon dioxide, the temperature in the vessel can fall below the minimum permitted operating temperature of the vessel.

If the temperature falls to the triple point (4.18 bar at –56.6 °C) solid carbon dioxide forms in the tank. If the pressure is reduced to atmospheric pressure, the temperature of the dry ice will be –78.5 °C. At this temperature many materials may become brittle and can fail if highly stressed. Under normal conditions the pressure should typically remain above 8 bar to avoid dry ice formation. See EIGA Doc 164 [4].

5.3 Exposure to low temperature of product

The carbon dioxide snow produced from expanding liquid carbon dioxide (for example leaks or openings of pressure vessels or piping) is extremely cold (–78.5 °C) and can cause frostbite if touched with bare hands. If carbon dioxide snow comes into contact with the eyes it can cause a severe eye injury.

Touching pipes and connections containing liquid carbon dioxide can cause frostbite or cold burns.

In case of a major release of gas, the atmosphere will cool down and visibility is likely to be limited due to the fog formed by the condensation of water in the air. These factors can make escape or rescue difficult.

5.4 Whipping hoses and tow-away incidents

If a hose connection fails during the transfer of liquid carbon dioxide, the hose can violently whip due to the pressure release, severely endangering people and equipment in the vicinity. The use of anti-whip devices during filling, securing each end of the liquid and gaseous (where used) hoses to specified points on the tanker and the storage tank or their piping with as little slack as practical, can reduce the risk of whipping hoses.

A system to prevent tow-away accidents should be used so that the road tanker is not moved while hoses are still connected, see EIGA Doc 63, *Prevention of Tow-Away Incidents* [5]. Break away couplings can be used to further mitigate consequences of tow-away events.

5.5 Dry ice plugs in pipes and hoses

Dry ice can be formed inside hoses and piping when liquid carbon dioxide pressure is decreased below the triple point pressure. The dry ice can be compacted into a plug which can trap gas or liquid, see Figure 2. The pressure behind or within a plug can increase as the dry ice sublimes or liquid evaporates until the plug is forcibly ejected or the hose / pipe ruptures. A dry ice plug can be ejected from an open end of a hose or pipe with enough speed and force to cause damage to installations or serious injury to personnel. Release of a dry ice plug can also cause hoses to whip.

Liquid carbon dioxide shall be purged from hoses or pipes before reducing the pressure below 4.18 bar. This can be done by supplying gaseous carbon dioxide under pressure to one end of the hose or piping system to keep the pressure above the triple point while removing the remaining liquid from the other end through a dedicated vent / drain valve preferably at the lowest point. This should be considered when designing equipment used to transfer liquid carbon dioxide.

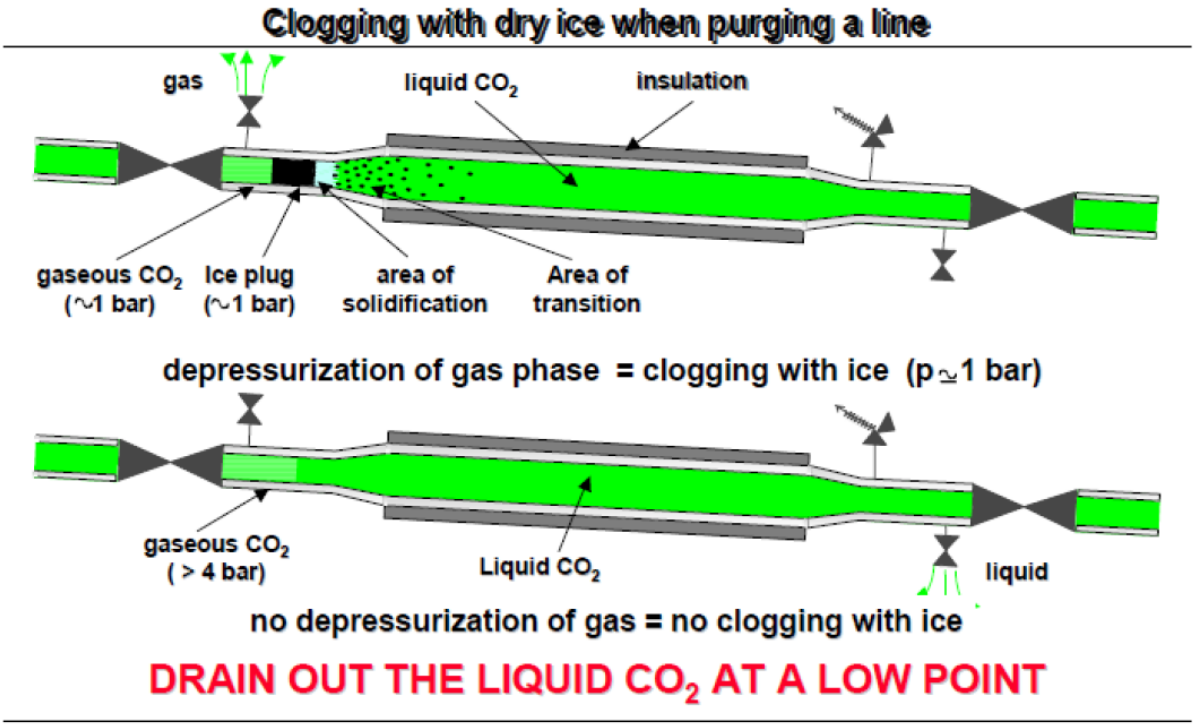

Figure 2: Plugging and purging of carbon dioxide lines

NOTE Figure 2 shows an ideal situation with continuous slope downwards towards a drain point. This is not always achievable in practice, for example when using transfer hoses.

5.6 First aid

The first aid treatment guidance given below is for information only. First aid measures are available on the gas safety data sheet. Medical assistance should be sought for any serious injury.

5.6.1 Inhalation

Increased concentrations of carbon dioxide cause heightened respiration and headaches. In high concentrations, carbon dioxide can cause asphyxiation. Symptoms can include loss of mobility / consciousness, but the person may not be aware of asphyxiation.

In the case where a person has been exposed to high concentrations of carbon dioxide the following should be done:

- the person should be moved to an uncontaminated area, without endangering other personnel. If the extent of the carbon dioxide concentration in the area of the incident is unclear this shall be done by a person wearing a self-contained breathing apparatus;
- the person should be kept warm and rested;
- seek medical assistance; and
- artificial respiration should be applied if breathing has stopped.

Further information on the physiological effects of carbon dioxide can be found in EIGA Info 24 [3].

5.6.2 Skin / eye contact

In the case of skin or eye contact:

- eyes that have come into contact with cold carbon dioxide should be thoroughly rinsed with warm water (no more than 40 °C) for at least 15 minutes;
- skin affected by frostbite should be warmed gently and placed in warm water (no more than 40 °C) for at least 15 minutes;
- the area should be dried, and a sterile dressing should be applied afterwards; and
- medical assistance should be obtained.

5.7 Storage tank loss of pressure

For storage tanks that have lost pressure see EIGA Doc 164 [4]. Re-pressurisation shall only be performed by trained personnel after a risk assessment.

6 Loading / unloading of tankers

6.1 General

The methods of delivering liquid carbon dioxide into users' bulk storage tanks are described in EIGA Doc 68, *Prevention of Carbon Dioxide Backfeed Contamination* [6]. Delivery methods can be restricted by local regulation or by requirements of the customer.

It is common for the delivery of carbon dioxide to use two hoses for transfilling. One hose connects the liquid phase of the tanker to the liquid phase of the storage vessel. The other hose connects their gas phases. Liquid carbon dioxide is pumped from liquid phase to liquid phase, and the displaced gas from the storage vessel is returned to the tanker during delivery.

Other procedures use only one hose to deliver liquid and different strategies may be used to deal with the displaced gas, such as top filling. In all cases an appropriate gas venting system should be installed to prevent accumulation of carbon dioxide gas in the delivery area.

Deliveries of liquefied carbon dioxide potentially represent a risk for backfeed and contamination of the supplying tanker. The widespread use of a gas phase return connection when delivering carbon dioxide increases the probability of spreading that contamination to other customers. The procedure for offloading carbon dioxide tankers to customer storage tanks should be agreed between the customer and the supplier. Carbon dioxide filling methods (single hose or dual hose) shall be determined according to EIGA Doc 68, local regulation and / or customer requirements, [6].

When filling and emptying tankers, the general safety instructions below should be observed in addition to the operating instructions for particular equipment used by the gas company:

- Position the tanker:
    - in well ventilated area; and
    - as level as possible.
- The tanker should be positioned such that it can be moved away without difficulty.
- The wheel chocks should be put in position immediately after stopping the tanker and turning off the engine.
- The stationary bulk tank and its accessories should be examined in accordance with the check list. For further information see EIGA Doc 66, [2].

If the pressure of the stationary tank is below a pre-set pressure (company specific value), the customer and also the gas company should be informed. The same principle applies to the pressure inside a

tanker. In these cases, the filling procedure should not be started unless specifically instructed by the gas company.

The equipment should be checked to ensure it has no serious defects that can affect the normal refilling operation, namely:

- the safety devices are not blocked by dry ice (visible because white frosting on the outside);
- the instrumentation, such as pressure gauges, level indicators or weighing scale function correctly;
- leakage of carbon dioxide gas or liquid or any other serious defect should be reported and advice obtained before starting to fill, minor defects should be reported and recorded for any eventual action;
- check that the hydraulic connections of the tanker do not leak, if applicable; and
- check that the electrical socket and plug for powering the transfilling system are in good condition before making the electrical connection and switching on the tanker pump, if applicable.

6.2 Connecting hoses

The following protective equipment shall be worn as a minimum:

- Safety footwear, helmet with ear protection if required, face shield, protective clothing with long sleeves, gloves when handling and connecting. For further information see EIGA Doc 136, *Selection of Personal Protective Equipment* [7].

When connecting hoses and preparing to unload:

- gaskets and screwed connections should be checked for good condition before connecting the hose(s);
- only the provided tools should be used for connecting hoses;
- connections shall not be hammered or hit with the spanners;
- when connecting hoses and before opening any valve anti-whip devices shall be applied, where fitted;
- for the preparation of the unloading operation and the unloading itself, the individual company instructions should be followed (connection of the hoses, pressurising with gaseous carbon dioxide, etc.);
- never attempt to tighten a screwed connection while under pressure;
- check that valves that should be closed are closed before starting delivery; and
- valves should be opened slowly.

The driver or specifically trained plant personnel should remain near the control cabinet of the tanker throughout the whole period of transfer, ready to take any action required in the event of any problems arising for example from overfilling or leakage.

6.3 Transfer of liquid carbon dioxide from bulk road tanker to storage tank

Road tankers are equipped with transfer pump(s) and pipe work for transferring liquid into the storage tank. Connections between the tanker and storage vessel are made with flexible hoses. The road tanker, the storage vessel and the operator can be protected by systems such as:

- safety relief valves;
- emergency switches;
- deadman devices;
- trycock valve;
- anti-tow-away system;
- slow opening valves; and / or
- over pressure switches.

NOTE Slow opening valves restrict the opening time of actuated delivery valves such that an operator can have time to react to an incorrect opening sequence of valves before hoses have been connected.

Systems are similar to those used for cryogenic tanker unloading, for more information see EIGA Doc 179, *Liquid Oxygen Nitrogen and Argon Cryogenic Tanker Loading Systems* [8].

A trycock valve should be used, to prevent overfilling of the storage tank. The trycock valve indicates the maximum allowable liquid level in the storage tank. When maximum level is reached during the filling operation, the filling operation shall be stopped (manually or automatically). The transfer pumps shall be stopped immediately if the tank pressure rises above maximum allowable working pressure. For further guidance on pressure protection during filling, see EIGA Doc 151, *Prevention of Excessive Pressure during Filling of Cryogenic Vessels* [9].

The flexible hoses required for the transfer are normally carried by the delivery tanker. However, if hoses have been supplied to the user and are retained on the customers premises, they should be regularly inspected and tested by a competent person, and also visually inspected for damage and impurities at time of each delivery.

Filling hoses should have an effective protection to prevent accumulation of dirt or humidity (water), for example hose caps. Hoses for filling carbon dioxide shall be compatible to avoid swelling, blistering, shrinking, or other forms of deterioration.

6.4 Purging and disconnecting hoses

The purging procedure is important to prevent formation of dry ice plugs (see 5.5). Company instructions shall be followed. A general procedure should include:

- After completing the transfer, the valves should be closed according the instructions and liquid hose should be purged only through one valve and, if possible, the one at the lowest point.
- A bypass line should be provided between the liquid and the gas phase to pressurise the liquid line with gaseous carbon dioxide.
- After purging and depressurising has been completed, check that the hose is flexible along its whole length (i.e. no dry ice plug has been formed inside the hose) and disconnect using the provided tools.
- Anti-whip devices shall only be removed after disconnecting the hoses, where fitted.

6.5 Checking the filling quantity

The weight or volume of product in the tanker after every refilling should be checked to make sure that it is not overfilled and / or overloaded.

The bulk tank should be checked during filling to make sure that it is not overfilled using trycock and / or level indicator.

6.6 Potential incidents during refilling

6.6.1 Dry ice plug formation

It can be difficult to determine if a dry ice plug has been formed. If such an incident is suspected, gas company instructions should be followed carefully. Company instructions should include a procedure for dealing with dry ice plug formation.

This procedure should include:

- closing the purging valve;
- warming the hose to ambient temperature;
- checking the build-up of pressure with the purge valve;
- not disconnecting hoses if the hose is inflexible / stiff; and
- do not pressurise a disconnected hose with the objective of ejecting ice plugs.

For further information see EIGA Info 28, *Operation of Carbon Dioxide Road Tankers and Equipment while Loading and Unloading* [10].

6.6.2 Leakage of liquefied or gaseous carbon dioxide

If a leakage occurs during filling, the transfer should be stopped. The lines should be de-pressurised. If there is no damage to the equipment, connections may be re-tightened with correct tools and the filling procedure can be restarted if safe to do so. If the leakage cannot be stopped, a responsible person on the premises and the gas company should be informed.

For further information on leaks, see 5.1.

7 Sampling of carbon dioxide: liquid, gas and dry ice

7.1 General

For their quality control, customers working in the food industry often required samples of the delivered goods, in this case dry ice or gaseous carbon dioxide.

However, taking samples from carbon dioxide stored in a stationary vessel, tanker or receptacle is potentially hazardous (see Section 5). For further information, see EIGA Info 28 [10].

Every gas company should have their own specific instructions for taking carbon dioxide samples. Special attention shall be given to the sequences of opening valves. All carbon dioxide tanker drivers should be aware of the hazards that the sampling operation can involve. Drivers who are required to take samples shall be trained and qualified to do so.

The driver is responsible for respecting and following the gas company procedure.

Only safe sampling equipment dedicated to carbon dioxide shall be used. Equipment shall be suitable for the designated operating conditions.

7.2 Personal protective equipment

For sampling, the driver shall use the following personal protective equipment as a minimum:

- safety footwear;
- helmet with ear protection;
- face shield and safety glasses;
- gloves; and
- protective clothing with long sleeves.

7.3 Sampling

Tankers, receptacles and stationary vessels should have dedicated permanent connections to the liquid phase for taking samples. Sampling equipment shall be cleaned before each use. In case of tankers and stationary vessels, filling and discharge connections are typically too large and will, in the event of being fully opened, create very high flow rates and forces. For safety reasons, sampling from the filling and discharge connections of a tanker or stationary vessel shall be avoided.

For sampling, connections of maximum DN15 (1/2” NPS) are recommended.

7.3.1 Snow, dry ice samples

Specific equipment should be used to take dry ice samples. Filling dry ice snow, created when purging liquid carbon dioxide through the analysis line, into non-dedicated equipment (for example buckets or bags) involves a high risk and shall, under no circumstances, be performed. Dry ice snow should be made with dedicated equipment and shall be collected in a suitable container, such as a clean bucket or tray.

Figure 3: CO_2 Snow horn and dry Ice pellitiser

A snow horn is utilised for producing loose dry ice snow. The device has a conically tapered shape, which is open at its lower, larger diameter end. The horn shall be held into a bucket to collect the snow.

A dry ice pelletiser produces individual pellet sizes (100 to 500 grammes) on site, wherever they are required. The pelletiser is screwed onto a defined coupling on the piping of the tanker and is operated by opening and closing the valve.

Personnel shall be trained to use the equipment safely, maintain the equipment and to verify if the equipment is able to be operated safely.

7.3.2 Gas samples

Piping for sampling of gaseous carbon dioxide should be equipped with a pressure reduction system. Samples should be collected in dedicated metal sampling cylinders, or in dedicated sampling bags (for example Tedlar gas sampling bags). To prevent accidents from uncontrolled movement of sampling devices and connection parts, the sampling device shall be secured during sampling. The sampling device should be connected by an appropriate and secure connection mechanism, such as a screw connector, to the sampling outlet on the tanker. Direct sampling into glass sampling devices (such as impingers or glass cylinders), or onto sampling tubes (adsorption tubes), requires accurate pressure control. Such equipment shall only be used with pressure regulators between the tanker gas line, and sampling equipment.

7.3.3 Liquid samples

Liquid carbon dioxide samples shall be collected in dedicated sampling cylinders (single or double-end, stainless steel or aluminium cylinders). To prevent accidents and impact injury from liquid carbon dioxide release, uncontrolled movements of sampling cylinders and connection parts, the cylinder shall be secured during sampling. The sampling cylinder shall be connected by an appropriate and secure connection mechanism, such as a screw connector, to the sampling outlet on the tanker. The sampling cylinder shall be fixed in a secure position during the sampling procedure. Attention should be given to:

- maximum content (prevention of overfilling of the cylinder);
- cylinder and valve shall be compatible with carbon dioxide (temperature and pressure); and
- applicable regulations for inspection and pressure testing verification / certification.

7.4 Transport of samples

The filling, labeling, inspection and transport of cylinders shall be carried out according to ADR, *The European Agreement concerning the International Carriage of Dangerous Goods by Road* [11]. This and local requirements shall be followed, including elements such as:

- ventilation of the vehicle;
- securing the load; and
- ensuring closed valves.

For further information on handling and transport of cylinders and dry ice see:

- EIGA Doc 52, *Load Securing of Class 2 Receptacles* [12];
- EIGA Doc 83, *Recommendations for safe filling of CO_2 cylinders and bundles* [13];
- EIGA Doc 150, *Guidelines for Safe and Hygienic Handling of Dry Ice* [14]; and
- EIGA Safety Leaflet 09, *Safe Transport of Dry Ice* [15].

Transport of carbon dioxide cylinders (UN 1013) is regulated by ADR [11]. Transport of dry ice (UN 1845) is exempted from ADR. However, ADR 5.5.3 shall be followed [11].

Sampling cylinders shall be secured during transport. Dry ice samples shall be stored in well ventilated spaces.

8 References

Unless otherwise stated the latest revision shall apply.

[1] EIGA Info TS01, *Transport Safety Information, an Overview*, www.eiga.eu.

[2] EIGA Doc 66, *Refrigerated Carbon Dioxide Storage at Users Premises*, www.eiga.eu.

[3] EIGA Info 24, *Carbon Dioxide Physiological Hazards – "Not Just an Asphyxiant!"*, www.eiga.eu.

[4] EIGA Doc 164, *Safe Handling of Liquid Carbon Dioxide Containers That Have Lost Pressure*, www.eiga.eu.

[5] EIGA Doc 63, *Prevention of Tow-Away Incidents*, www.eiga.eu.

[6] EIGA Doc 68, *Prevention of Carbon Dioxide Backfeed Contamination*, www.eiga.eu.

[7] EIGA Doc 136, *Selection of Personal Protective Equipment*, www.eiga.eu.

[8] EIGA Doc 179, *Liquid Oxygen Nitrogen and Argon Cryogenic Tanker Loading Systems*, www.eiga.eu.

[9] EIGA Doc 151, *Prevention of Excessive Pressure during Filling of Cryogenic Vessels*, www.eiga.eu.

[10] EIGA Info 28, *Operation of Carbon Dioxide Road Tankers and Equipment while Loading and Unloading*, www.eiga.eu.

[11] ADR *European Agreement concerning the International Carriage of Dangerous Goods by Road*, www.unece.org.

[12] EIGA Doc 52, *Load Securing of Class 2 Receptacles*, www.eiga.eu.

[13] EIGA Doc 83, *Recommendations for safe filling of CO_2 cylinders and bundles*, www.eiga.eu.

[14] EIGA Doc 150, *Guidelines for Safe and Hygienic Handling of Dry Ice*, www.eiga.eu.

[15] EIGA Safety Leaflet 09, *Safe Transport of Dry Ice*, www.eiga.eu.

9 Additional references

See also Focus Area on Safe Transport of Gases or Dry Ice in "Non Dedicated" Vehicles, www.eiga.eu.