

GUIDANCE ON RISKS AND PRECAUTIONS TO BE CONSIDERED FOR BULK LIQUID LOADING AND UNLOADING OPERATIONS IN ROAD TRANSPORT

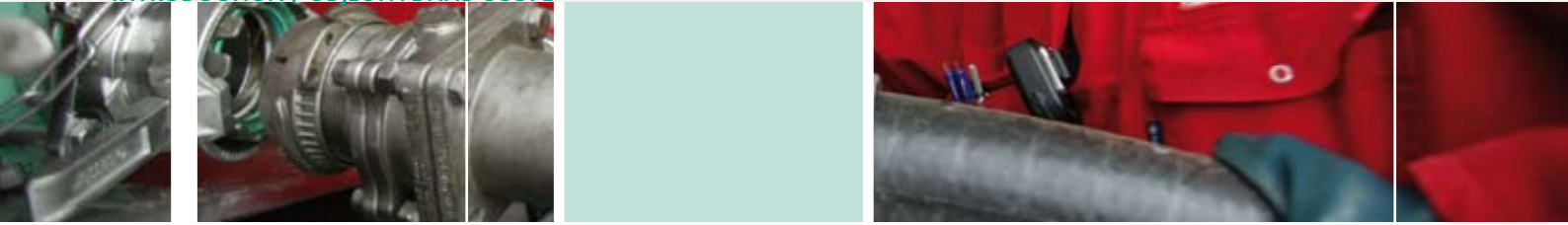
ISSUE 1 | NOVEMBER 2009





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INTRODUCTION

Continuous efforts to enhance safety during transport of chemicals and the associated handlings are part of the overall aim to improve the safety performance of both the chemical industry and the transport industry.

Analysis of accident statistics indicates that a substantial number of transport related incidents happen during loading and unloading operations. It is therefore essential that proper use is being made of appropriate equipment during these operations.

This Guidance should be considered as complementing the "Behaviour Based Safety (BBS) Guidelines for the safe loading and unloading of road freight vehicles", issued by Cefic and ECTA in March 2007 (2nd issue), which concentrate on clarifying the roles and responsibilities of the different parties involved. Reference is also made to guidelines for specific products such as styrene, chlorinated solvents, etc, which can be found on <http://www.cefic.be/en/transport-and-logistics-guidelines-on-transport-of-specific-chemicals.html>.

This Guidance is of a voluntary nature and individual companies may decide to apply the Guidance in full or partly in accordance with their own judgment and taking into account the specific circumstances and requirements.

Applicable national and international regulations, in particular Chapters 4.2 and 4.3 of ADR should always be complied with as they take precedence over the recommendations made in the present Guidance.

OBJECTIVE AND SCOPE

The objective of the present Guidance is to provide recommendations on the risks and precautions to be considered during the loading and unloading of chemicals, whereby particular attention is given to different loading and unloading schemes that may require specific precautions. The present Guidance is therefore providing illustrations of these different loading/unloading schemes and identifies the product related hazards and operational risks associated with these schemes. It also provides recommendations on general precautions as well as on precautions, specific to certain schemes, to be taken during loading and unloading operations.

This Guidance should help in selecting an appropriate loading/unloading scheme and in taking the necessary safety precautions. It offers both general and more scheme-specific advice, which can be used in training sessions etc.

The scope of this Guidance is limited to equipment used for the loading and unloading of bulk liquids in tank transport operations.

This Guidance does however not aim to provide an exhaustive overview of all existing transport equipment or loading/unloading schemes and of all possible risks and precautions that may need to be considered.

1 DIFFERENT TYPES OF LOADING AND UNLOADING SCHEMES

1.1 Loading Schemes

The following loading schemes are being considered in this Guidance (see also illustrations in APPENDIX 1):

- L1 • Top loading through open manhole
- L2 • Top loading through dome with cone and with vapour recovery
- L3 • Top loading with dip tube and with vapour recovery
- L4 • Top loading with dip tube and with inert gas blanketing
- L5 • Bottom loading with open manhole
- L6 • Bottom loading with closed manhole and with vapour recovery
- L7 • Bottom loading with closed manhole and with blanketing

1.2 Unloading Schemes

The following unloading schemes are being considered in this Guidance (see also illustrations in APPENDIX 2):

- U1 • Bottom unloading by pump with open manhole
- U2 • Bottom unloading by gravity with open manhole
- U3 • Bottom unloading by compressed air or inert gas
- U4 • Bottom unloading by pump with closed manhole and with intake of air
- U5 • Bottom unloading by gravity with closed manhole and with vapour return
- U6 • Bottom unloading by pump with closed manhole and with vapour return
- U7 • Bottom unloading by pump with closed manhole and with inert gas
- U8 • Top unloading by pump with closed manhole and with vapour return



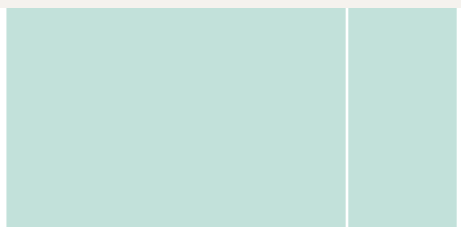
2 | RECOMMENDED SCHEMES FOR PRODUCTS WITH CERTAIN HAZARDS

A number of hazard categories of products are listed in the first column of Table 1. For each of these categories the Table indicates the recommended loading/unloading schemes. If a product exhibits more than one hazard a loading/unloading scheme should be selected that is recommended for each hazard.

Table 1

Product hazards	Loading/unloading scheme															
	L1	L2	L3	L4	L5	L6	L7	U1	U2	U3	U4	U5	U6	U7	U8	
Smelly or toxic by inhalation products			✓	✓						✓	✓	✓	✓	✓	✓	
Hot or corrosive products		✓	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	
Products with low flashpoint (<23°C) or with flashpoint lower than the loading temperature		✓	✓	✓		✓	✓			✓ ¹		✓	✓	✓	✓	
Products for which an extended release of vapour creates an hazard		✓	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	
Products for which a short release of vapour (when opening manlid) creates an hazard			✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	

(1) only unloading with inert gas, not with air



3 OPERATIONAL RISKS ASSOCIATED WITH EACH LOADING AND UNLOADING SCHEME

The main risks that may occur during loading/unloading operations are listed in the first column of Table 2. For each loading/unloading scheme the risks that require particular attention have been marked with an "✓".

Table 2

Operational risks	Loading/unloading scheme															
	L1	L2	L3	L4	L5	L6	L7	U1	U2	U3	U4	U5	U6	U7	U8	
Overpressure tank			✓	✓		✓	✓			✓	✓				✓	
Overpressure hoses			✓	✓	✓	✓	✓			✓	✓				✓	
Underpressure (tank collapse)											✓	✓	✓	✓	✓	
Product residue (previous load)			✓	✓		✓	✓									
Overfilling	✓	✓ ¹	✓ ¹	✓ ¹	✓	✓ ¹	✓ ¹									
Leaks through open bottom valve	✓	✓	✓	✓											✓	
Leaks through manlid			✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	
Leaking hose					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Load repartition (multi-compartment tank)	✓	✓	✓	✓	✓	✓	✓									
Run-away of loading arm/hose	✓															
Dropping object in manhole	✓	✓			✓			✓	✓							
Distance tank to truck (avoid using long hoses)					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Leaks through connections below liquid level					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Residues of inert gas, left after discharge, which may suffocate (N ₂)										✓				✓		

¹ extra attention should be given



4 | PRECAUTIONS

- Two different types of precautions should be taken during loading and unloading operations:
- General precautions that apply to all loading and unloading schemes e.g. use hoses compatible with the product
 - Specific precautions that apply only for a number of loading or unloading schemes e.g. use of dry couplings

4.1 | General precautions

Table 3 provides a non-exhaustive list of general precautions that apply to all loading and unloading schemes. Reference is made to ADR and the Cefic/ECTA Guidelines for the Safe Loading and Unloading of Road Freight Vehicles, where appropriate.

Table 3

General precautions	Comments
Ensure compatibility of tank and equipment with product	None
Empty hoses after operation	None
Prevent unintentional movements of vehicles	See BBS Loading/Unloading 1.2.2.3 See ADR (2009) 8.3.7
Only open valves after ...	See BBS Loading/Unloading 1.2.2.14
Ensure safe conditions for access to top of tank and for working at height	Use should be made of either the safety gantry of the site, or of a safety handrail or of a safety harness, or top valves should be operated remotely
Take preventive measures to avoid static electricity	See ADR (2009) 8.5 S2 (3) for provisions on earthing and CENELEC Technical report CLC/TR 50404 "Electrostatics - Code of practice for the avoidance of hazards due to static electricity"
Ensure tightness of all valves and dome covers	The proper closure of valves should be controlled visually
Use liquids lines with appropriate diameter (DN 80)	Recommended equipment specification
Ensure correct connection of couplings e.g. bolts in all holes	See BBS Loading/Unloading 1.2.2.12
Use hoses tested for pressure applied	See BBS Loading/Unloading 1.2.2.12
Use hoses compatible with product	See BBS Loading/Unloading 1.2.2.12
Check tank capacity to avoid overfilling	See BBS Loading/Unloading 1.2.2.9
Check correct line-up of valves before starting loading/unloading	See BBS Loading/Unloading 1.2.2.12



4.2 Precautions, specific for each scheme

Table 4 lists a number of precautions that should be taken and indicates to which schemes they are applicable.

Table 4

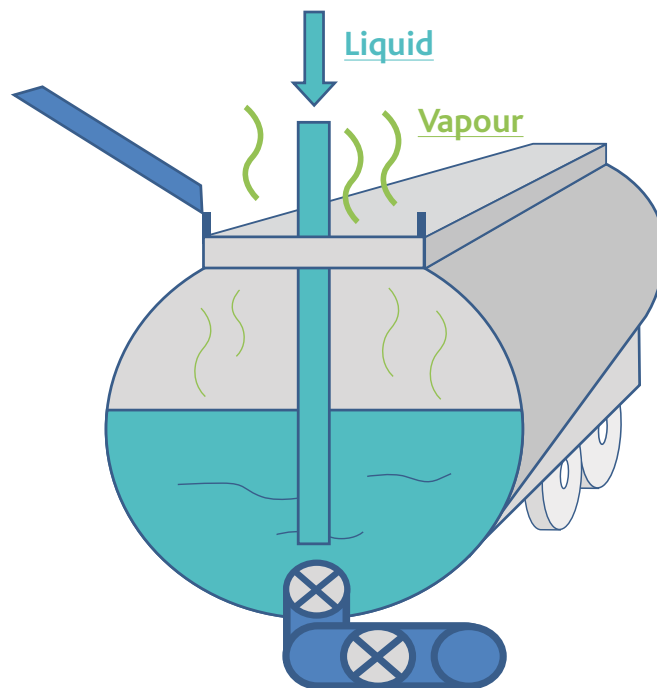
Specific precautions	L1	L2	L3	L4	L5	L6	L7	U1	U2	U3	U4	U5	U6	U7	U8
Carry out pre-loading test on tightness (1)	✓	✓	✓	✓	✓	✓	✓								
Use vapour lines with appropriate diameter (DN 50) (2)			✓	✓		✓	✓					✓	✓		✓
Use compressed air or N ₂ lines with appropriate diameter (DN 25) (2) (3)										✓	✓			✓	
Use personal respiratory protection device	✓	✓			✓			✓	✓						
Safety devices, if present, not to be used for coping with pressure variations during loading/unloading operations (only fit for coping with temperature variations during transport)			✓	✓		✓	✓			✓	✓	✓	✓	✓	✓
Bottom valve to be opened as last operation for products with high melting point								✓	✓	✓	✓	✓	✓	✓	
Ensure that maximum vapour/air/ N ₂ pressure does not exceed working pressure of tank			✓	✓		✓	✓			✓	✓	✓	✓	✓	✓
Release pressure after discharge or loading			✓	✓		✓	✓			✓	✓	✓	✓	✓	✓
Use dry couplings (4)			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes

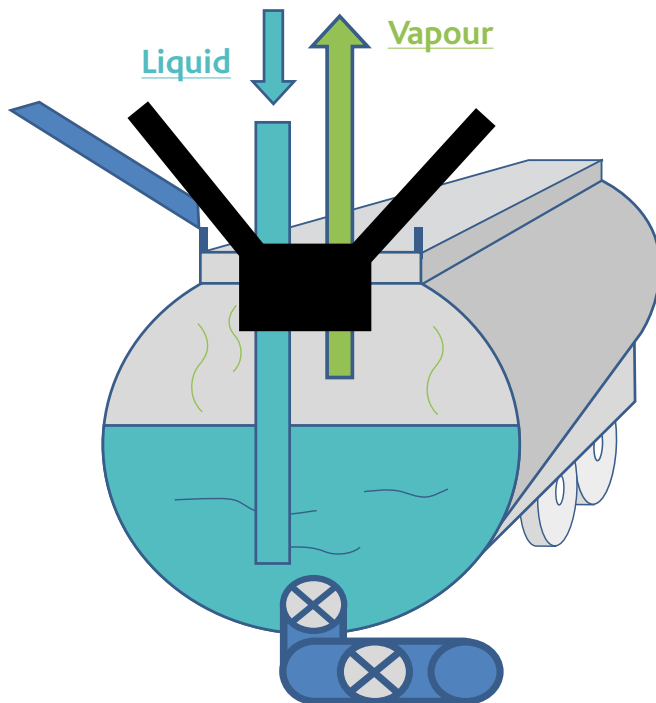
- (1) Tank pressure test and/or valve vacuum test (avoiding test conditions however that may render the valve defective) are recommended (particularly important for smelly products)
- (2) Recommended equipment specification in order to avoid a vacuum situation in the storage tank/vehicle configuration with the use of closed circuits
- (3) Only N₂ should be used with products having a flashpoint below 60°C
- (4) Recommended for product-dedicated vehicles (particularly important for smelly products)

APPENDIX 1

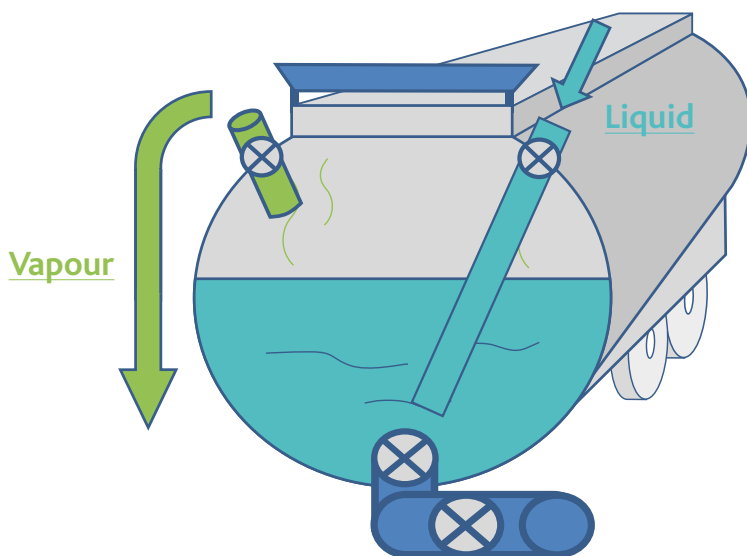
ILLUSTRATION OF THE DIFFERENT LOADING SCHEMES (cross section)



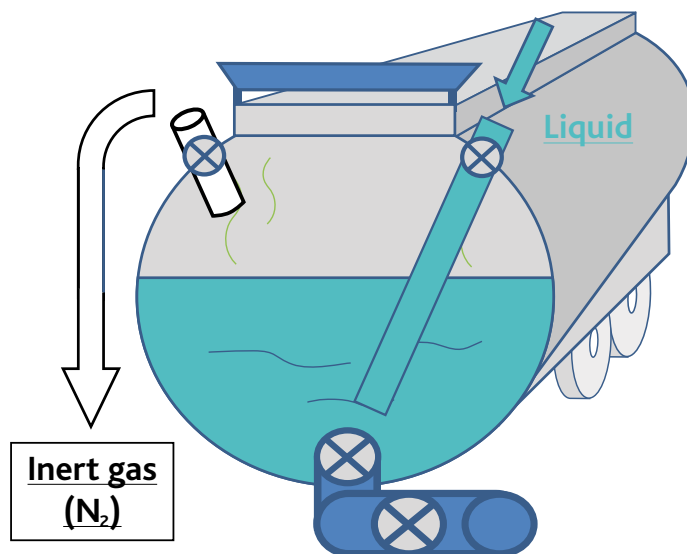
Loading Scheme L1
Top loading through open manhole



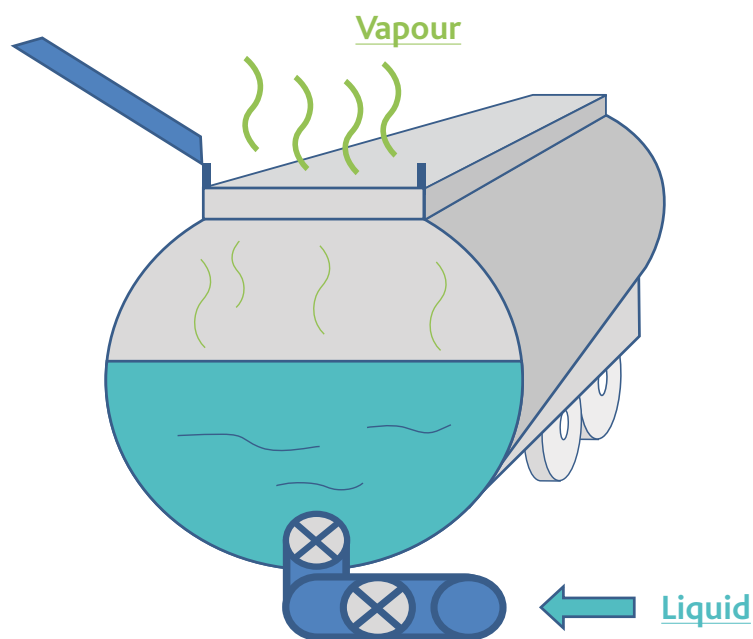
Loading Scheme L2
 Top loading through dome with cone and with vapour recovery



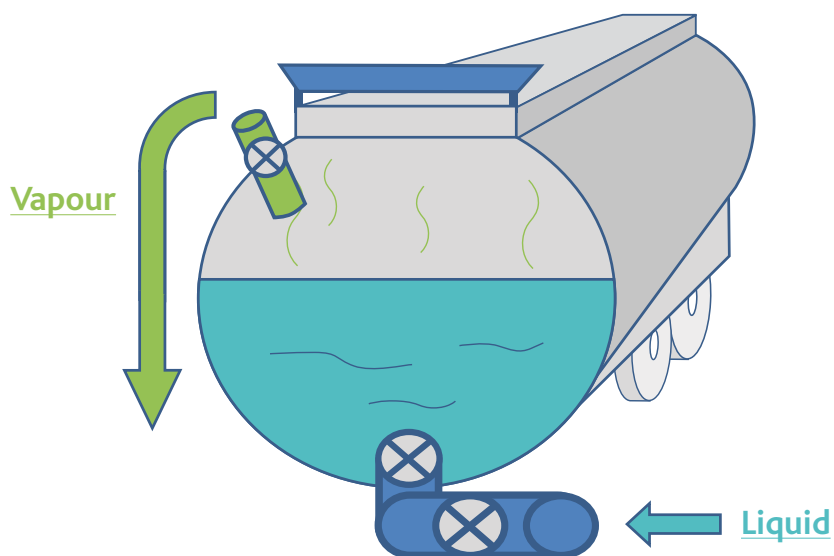
Loading Scheme L3
 Top loading with dip tube and with vapour recovery



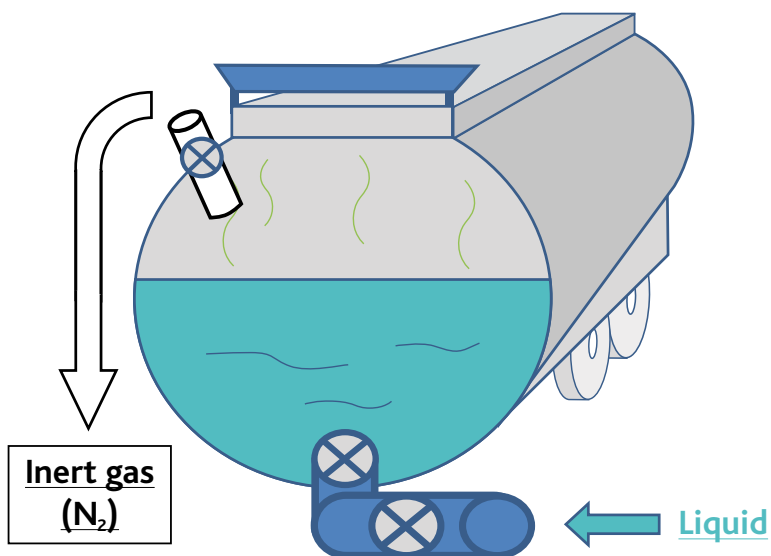
Loading Scheme L4
Top loading with dip tube and with inert gas blanketing



Loading Scheme L5
Bottom loading with open manhole



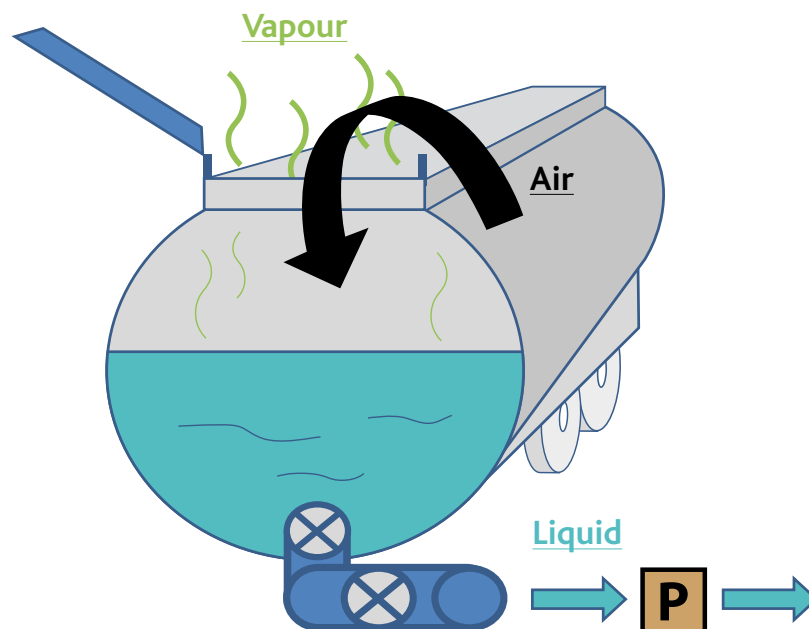
Loading Scheme L6
Bottom loading with closed manhole and with vapour recovery



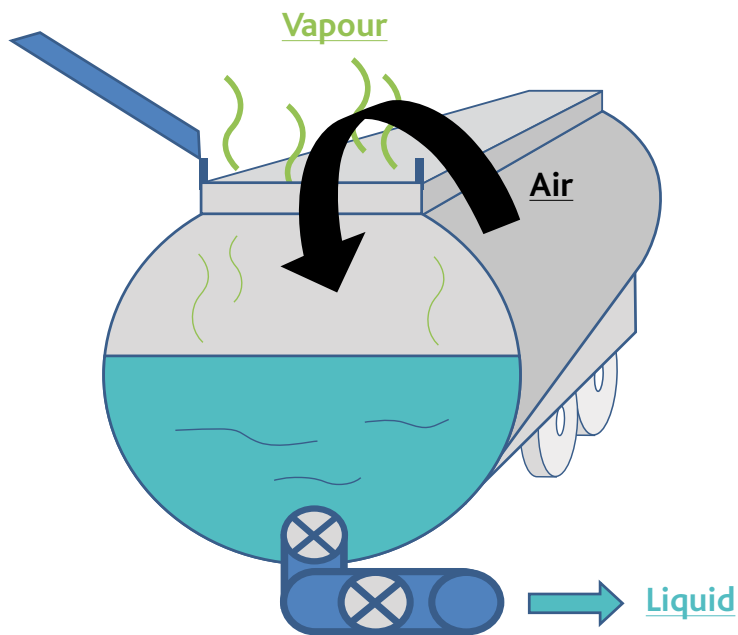
Loading Scheme L7
Bottom loading with closed manhole and with blanketing

APPENDIX 2

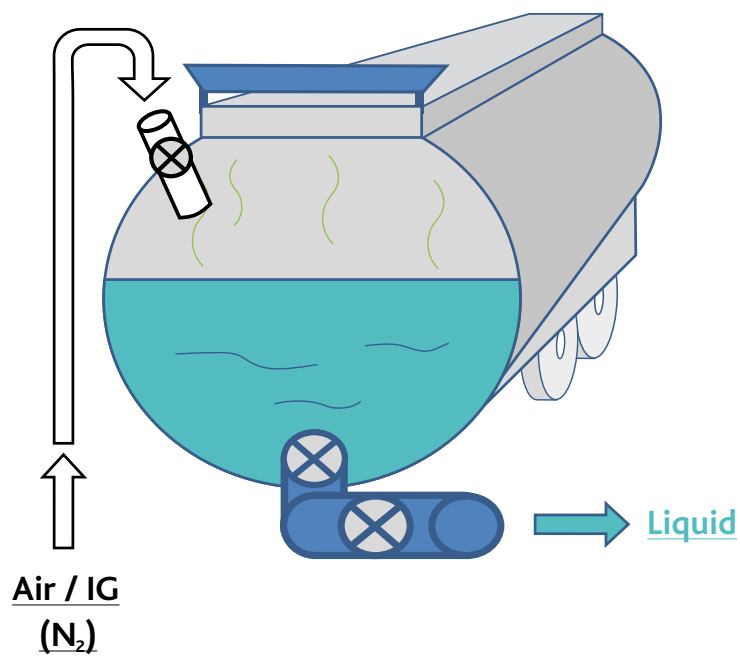
ILLUSTRATION OF THE DIFFERENT UNLOADING SCHEMES (cross section)



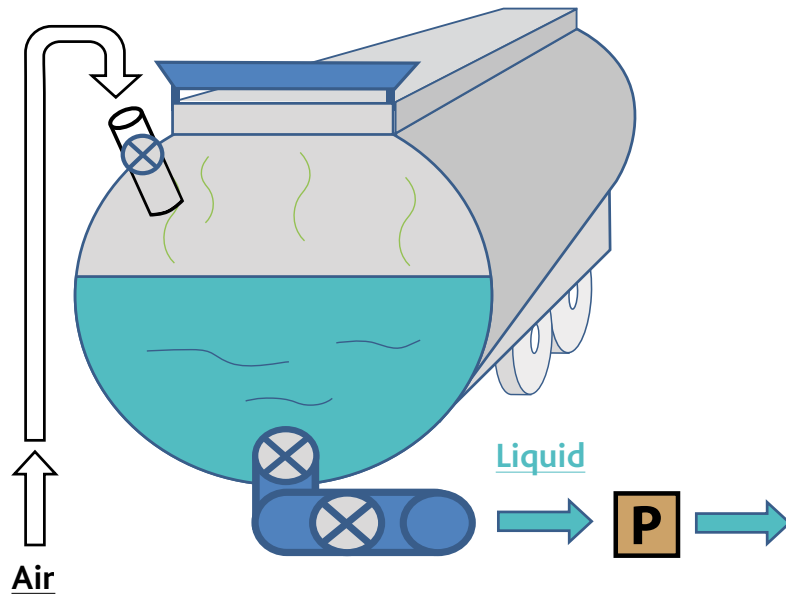
Unloading Scheme U1
Bottom unloading by pump with open manhole



Unloading Scheme U2
Bottom unloading by gravity with open manhole

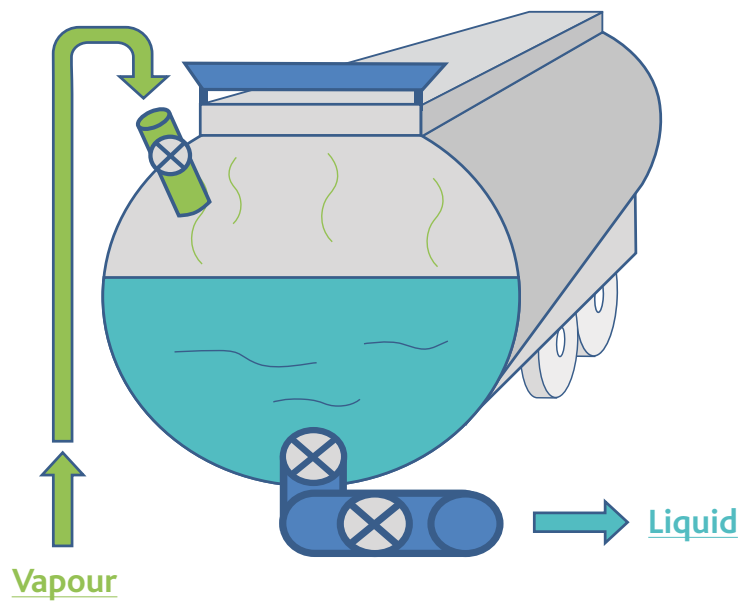


Unloading Scheme U3
Bottom unloading by compressed air or inert gas



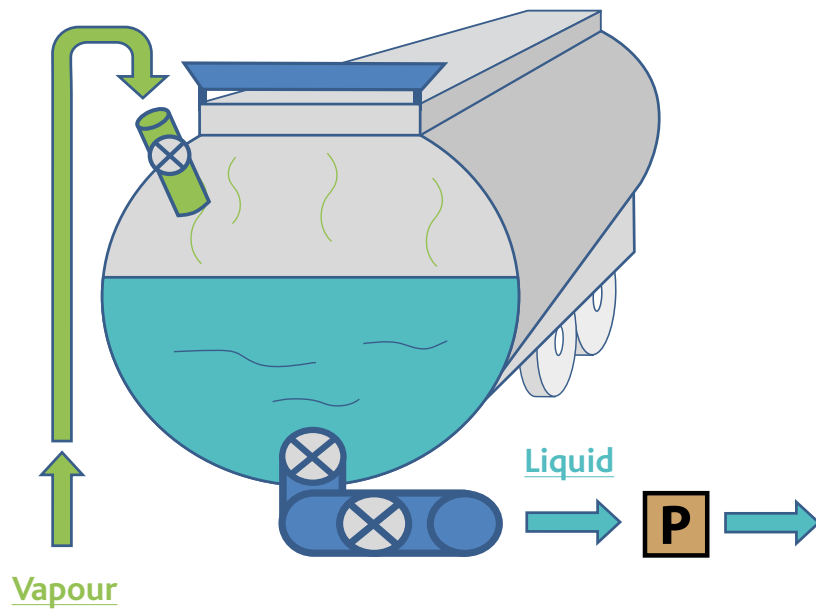
Unloading Scheme U4

Bottom unloading by pump with closed manhole and with intake of air



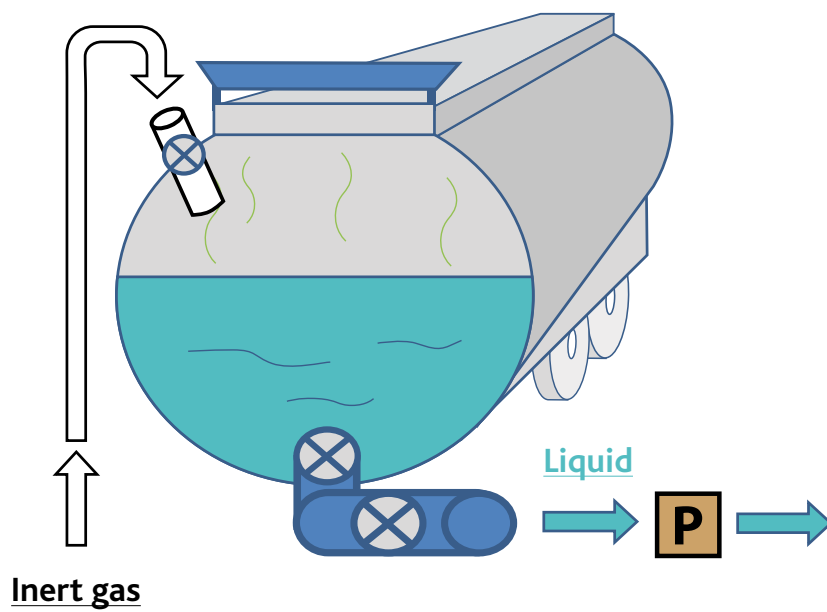
Unloading Scheme U5

Bottom unloading by gravity with closed manhole and with vapour return



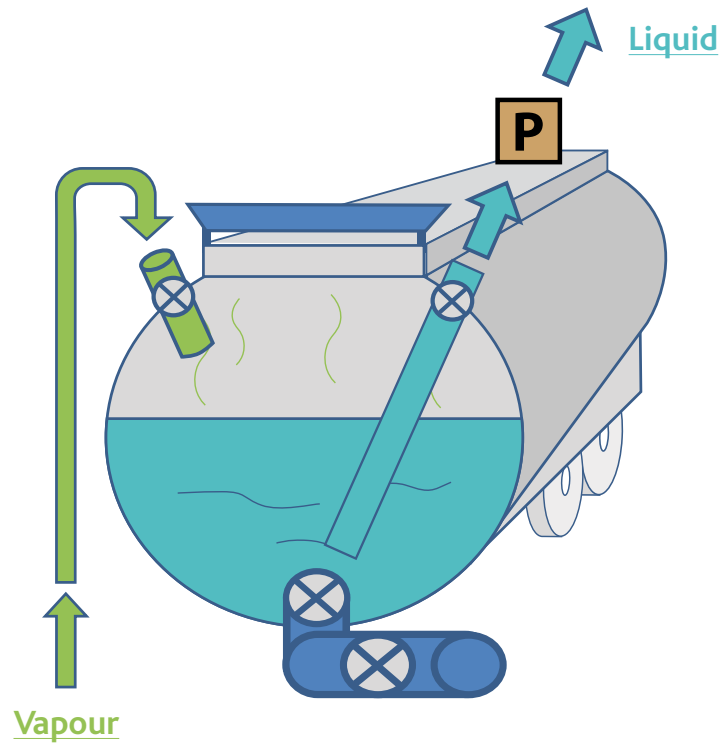
Unloading Scheme U6

Bottom unloading by pump with closed manhole and with vapour return



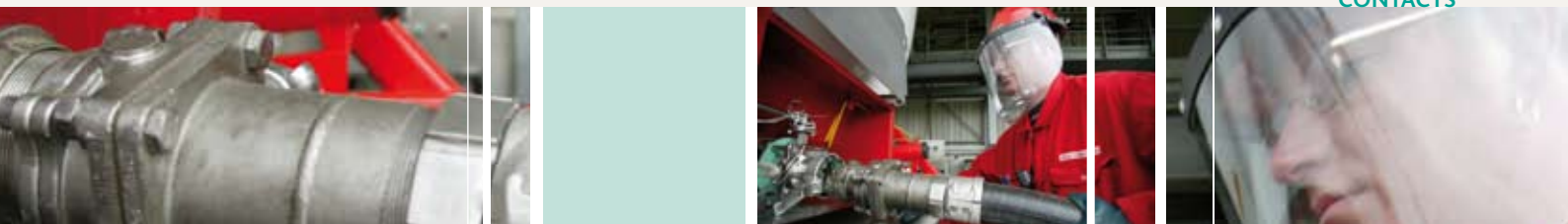
Unloading Scheme U7

Bottom unloading by pump with closed manhole and with inert gas



Unloading Scheme U8

Top unloading by pump with closed manhole and with vapour return



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DISCLAIMER

This document is intended for information only and sets out recommendations on risks and precautions to be considered during the loading and unloading of bulk chemicals of tanks and tankcontainers. The information contained in this Guidance is provided in good faith and, while it is accurate as far as the authors are aware, no representations or warranties are made about its completeness. It is not intended to be a comprehensive guide to all detailed aspects of this issue. No responsibility will be assumed by the participating associations, Cefic and ECTA, in relation to the information contained in this Guidance.



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