GIIGNL - THE INTERNATIONAL GROUP OF LIQUEFIED NATURAL GAS IMPORTERS

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GIIGNL - Technical Study Group

Overland Transport of LNG Study

Update to the 2009 “Overland Transport of LNG” Study

Document Information and Revision History

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0.1	29-Oct-2020	Hisham Uddin	First Draft
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0.3	23-March-2021	Central-Office	Publication on GIIGNL website

Contents

1. Introduction

1.1. Background

The GIIGNL has conducted surveys of the Overland Transport of LNG in the past and generated reports with the survey results in 1998 and 2009 respectively.

1.2. Scope of Work

The purpose of the study is to collect the latest data regarding Overland Transport of LNG from the LNG terminal operators and transporters and identify any trends in the overland transport of LNG.

The report also helps increase visibility of developments in overland transport infrastructure and to share learnings among members. A new survey to refresh the data was launched in 2018 and this report presents the outcome of that survey.

1.3. Organisation

The data gathering and reporting is done by a dedicated task force comprised of individuals from GIIGNL member organizations. The task force consists of central coordinators as well as regional coordinators for each of the three target geographies – Europe, Asia, and the Americas.

A brief timeline of the survey is illustrated below:

2. Study Results

2.1. Response to Questionnaire

A questionnaire was distributed to known current and future operators of LNG trucking activities worldwide. A copy of the questionnaire is provided in Appendix A. The number of responses to the latest questionnaire as well as a comparison against the 2008 questionnaire are shown in the table:

Number of Respondents		
Region	2008	**2020**
Europe	8	**16**
Asia	52	**27**
Americas	5	**4**
Worldwide	**65**	**47**

Although the total number of respondents went up in Europe and remained almost the same in the Americas, the number for Asia went down.

The regional coordinators reported considerable difficulties in obtaining responses and in 2020, a decision was made by the task force in collaboration with the Technical Study Group of GIIGNL, to start compiling the report with the responses received as there was sufficient representation from the three regions to identify any substantial trends.

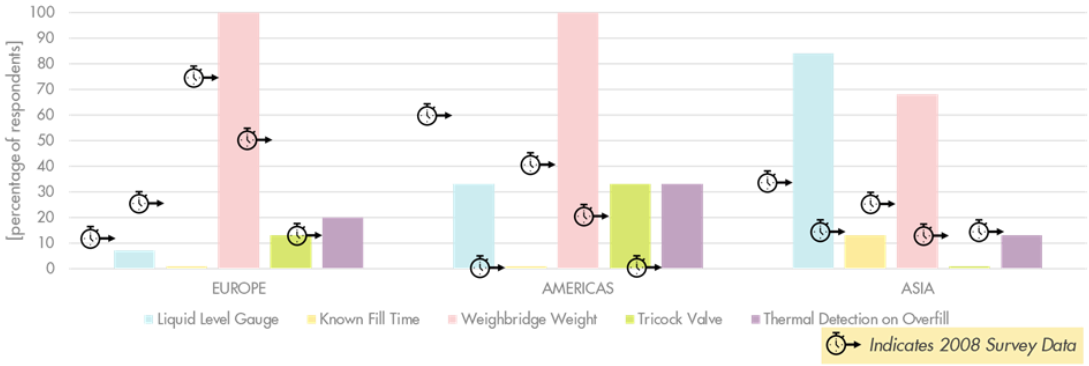
The questionnaire itself was largely similar to the questionnaire used for the previous survey in order to facilitate the identification of any trends by tracking the change between one survey to the other.

The questionnaire targets LNG terminal operators with road and rail LNG tanker loading as well as road and rail LNG transport operators. However, the majority of the data was from terminal operators and that too, only related to road operations. No data was received for LNG transport operations by rail. Additionally, a very small minority of LNG road transport operators responded to the survey. While the number of responses for road transport operators was insufficient to generate insightful statistics, the key learnings are still presented in the report.

The report presents the responses to all questions, where possible, in the form of a graphic with explanatory text to allow the reader to extract quick insights in a visual manner.

A sample graphic is shown below.

Figure 1 Tanker Overfill Detection



In addition to the bars showing the data in terms of the proportion of respondents that responded in the affirmative to that part of the questionnaire, the report also includes the clocks with an arrow symbol on many graphs. This clock indicates the average response to the same question in the previous questionnaire (2008) and allows the user to see how trends may have changed since the previous questionnaire.

The reader must bear in mind that certain shifts in the trends may be due to a change in the sample size and the respondents, and not necessarily due to industry wide shifts to a certain aspect of the overland transport of LNG.

2.2. Role of Responding Companies

2.2.1. General Company Details

This question aims to understand more about the companies responding to the Overland Transport Survey. A wide spread of responses was observed.

The average company turnover for the responding companies was in the range of 200 MMUSD per annum. However, the spread of responses ranged from approximately 25MMUSD all the way to around 400 MMUSD per annum. This represents the breadth of organizations operating in the LNG Overland Transport space ranging from small companies focused on regional customers all the way to large multinational organizations. The largest spread observed was within Europe with both the lowest and highest turnover organizations sitting within this group of respondents.

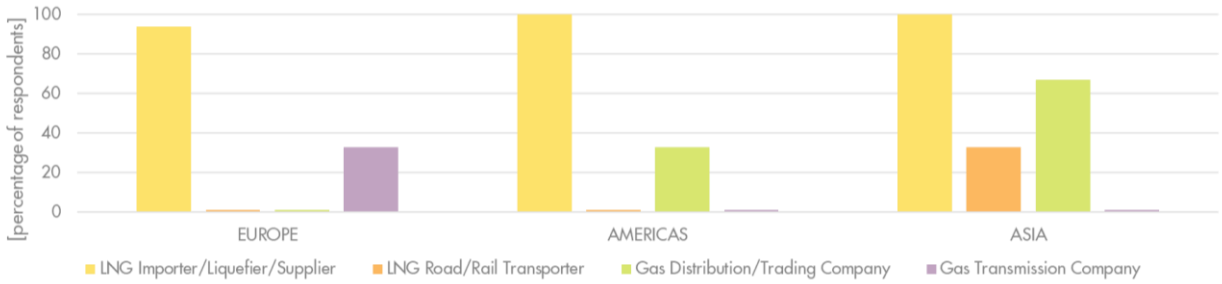
The size of the organizations by total employees was also a similar scenario whereby the number of total employees ranged from less than 100 to more than 20,000. Once again, the largest spread observed was in Europe with both the lowest and highest responses. Asia also showed a widespread, although not as big. Of the respondents in Asia, the lowest number of total employees was just over 100 whereas the highest number was just under 6,000.

The last part of this question was regarding the total number of employees solely dedicated to LNG operations. The spread wasn't as large this time, ranging from approximately 25 to 350 employees. In terms of the average responses by region, the Americas reported the lowest average number dedicated to LNG operations, with Europe taking the middle spot, and Asia reporting the highest number of employees dedicated to LNG operations.

2.2.2. Company Role in the LNG Overland Transport Industry

This question is meant to understand the respondents' positions in the LNG Overland Transport ecosystem. As expected, the predominant role occupied by the respondents was that of an LNG Importer and Supplier. Some of the respondents also had roles as Gas Distribution and Trading companies. A very small minority of the respondents also had their own LNG transport operations, whereas the majority worked with third party transportation companies. The split of respondents is illustrated below:

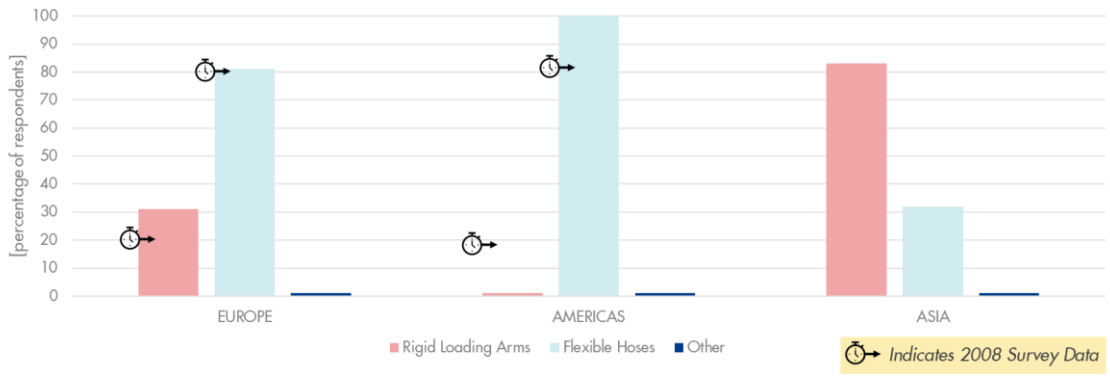
Figure 2: Role of Survey Respondents in the LNG Industry



2.3. Overland Transport Loading / Unloading Facilities

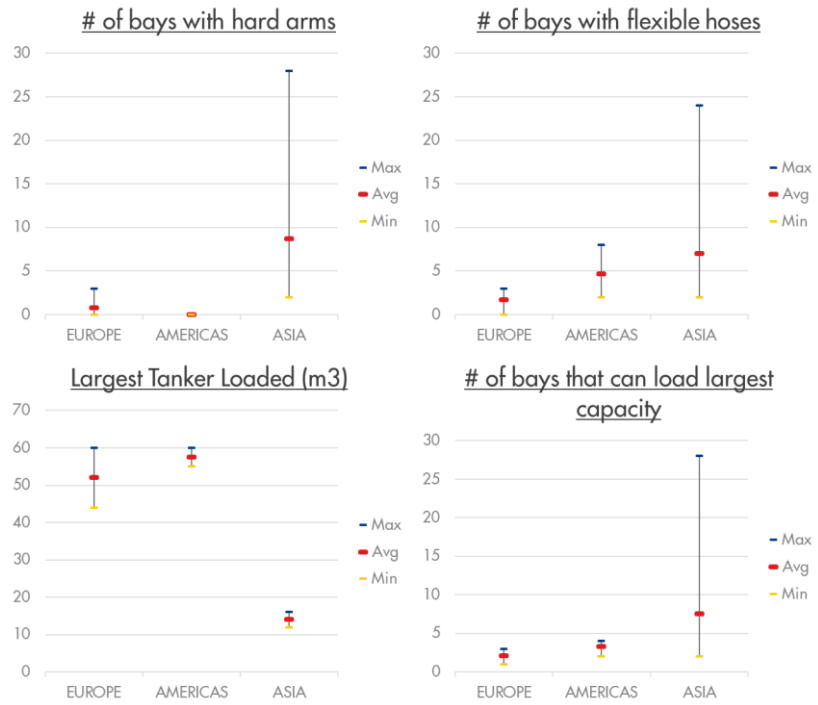
2.3.1. Number and Types of Loading Bay Facilities

Figure 3 Type of Connection (Rigid Loading Arm / Hoses / Other)



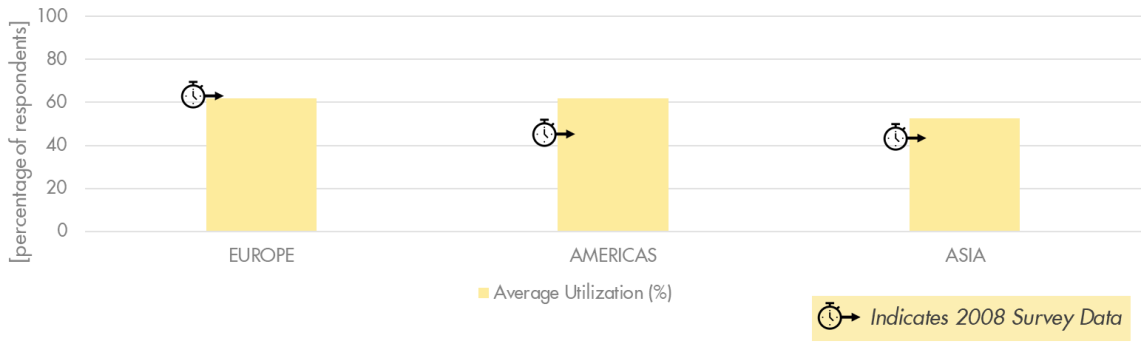
In terms of the type of loading connections being used in the different regions, we see flexible hoses being more commonly used in the Americas and in Europe, with Americas growing their flexible hose proportion since the last survey. Europe's split between flexible hoses and rigid loading arms remaining the same. The results are illustrated in the graphic above.

The graphics below illustrate the numbers of bays with the different loading connections as well as the largest capacity tankers that can be served at the respondents' facilities. In terms of couplings, threaded couplings were most common with some respondents using custom proprietary couplings.



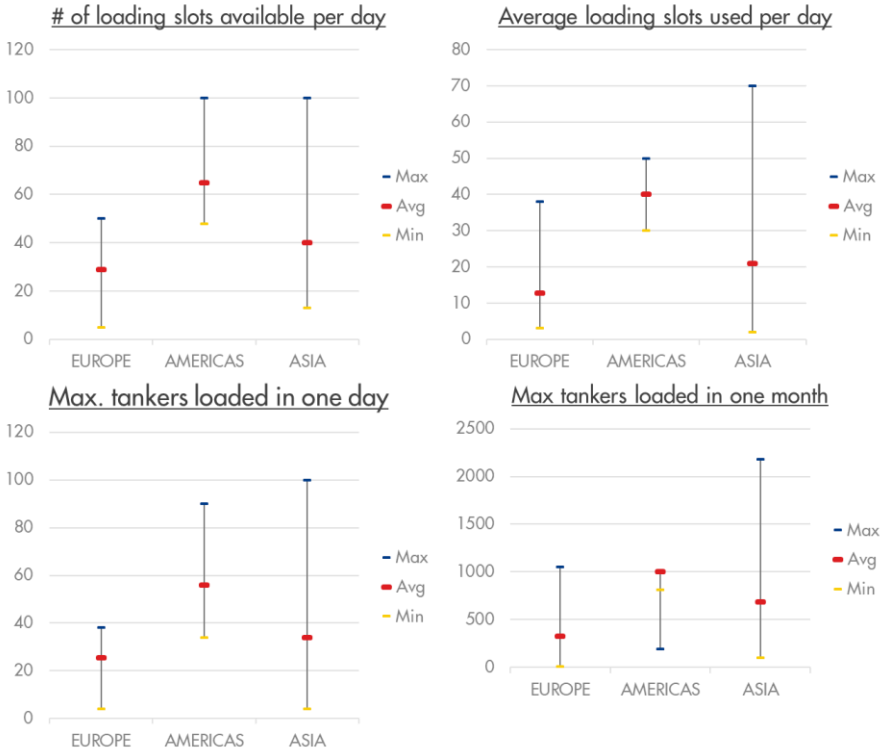
2.3.2. Uitilisation of Loading Facilities

Figure 4 Average Loading Bay Utilisation (%)



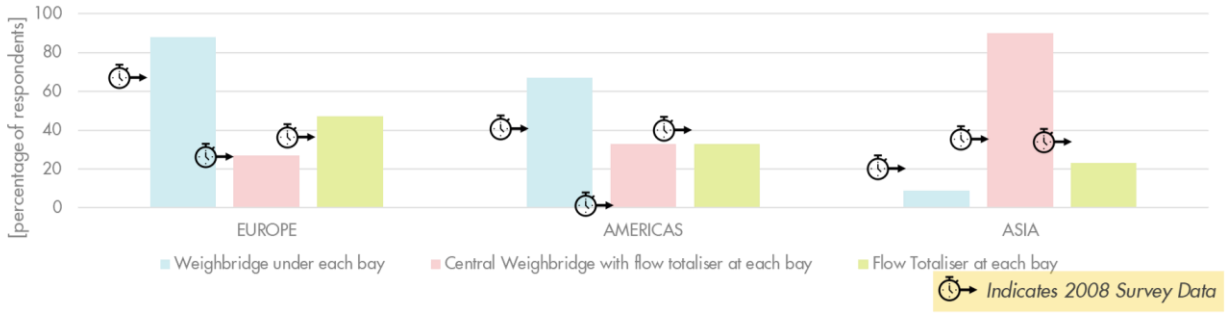
The graphic above illustrates the average loading bay utilization at the respondents' facilities. Compared to the previous survey, the numbers have stayed relatively constant around the 50-60% mark with the Americas and Asia showing a slight increase in loading bay utilization.

The graphics below show the statistics around how many loading slots are available and used in a month as well as how many tankers are loaded by the terminals on a monthly and daily basis.



2.3.3. Control of Loading Facilities

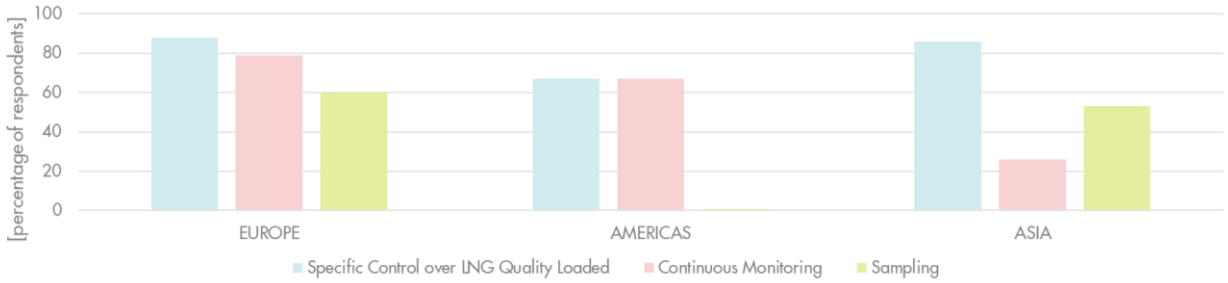
Figure 5 Type of Custody Transfer Measurement



This question seeks to understand the types of controls that are placed on custody transfer and product quality during the loading process.

From a custody transfer perspective, the most common method in the Americas and Europe is to use a weighbridge under the individual loading bay. In Asia, however, the predominant method seems to be the use of a central weighbridge. Compared the previous survey's responses, one of the major changes seems to be a higher proportion of respondents in Europe and the Americas now use weighbridges under individual bays. A significant change also took place in the responses from Asia, where now a much larger percentage of the respondents use a central weighbridge with flow totalizer at each bay. The results are illustrated in the graph above.

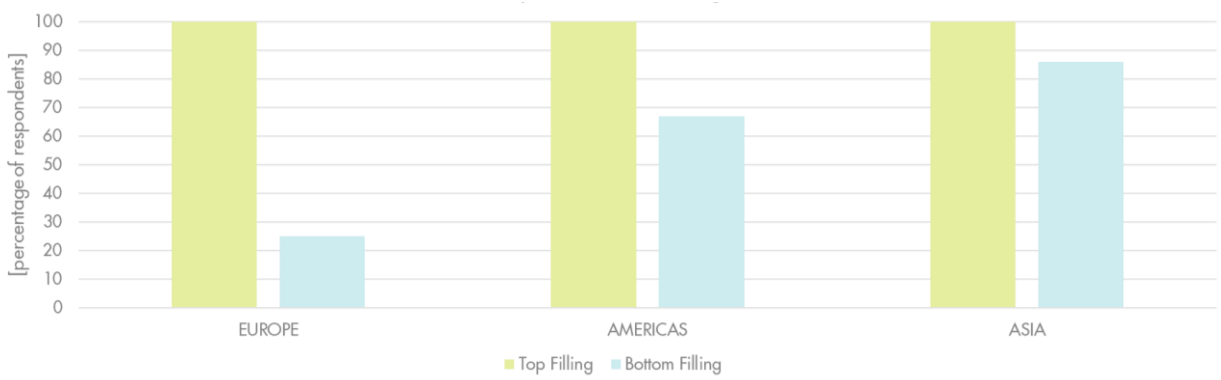
Figure 6 Type of Product Quality Measurement



In terms of Product Quality measurement, the most common technique is continuous monitoring with gas chromatographs. Some of the respondents also use periodic sampling instead of continuous monitoring. A minority of the respondents indicated that their organization does not use any means of product quality control over the LNG being loaded. The responses by region are illustrated in the graph above.

2.3.4. Filling Methods Available

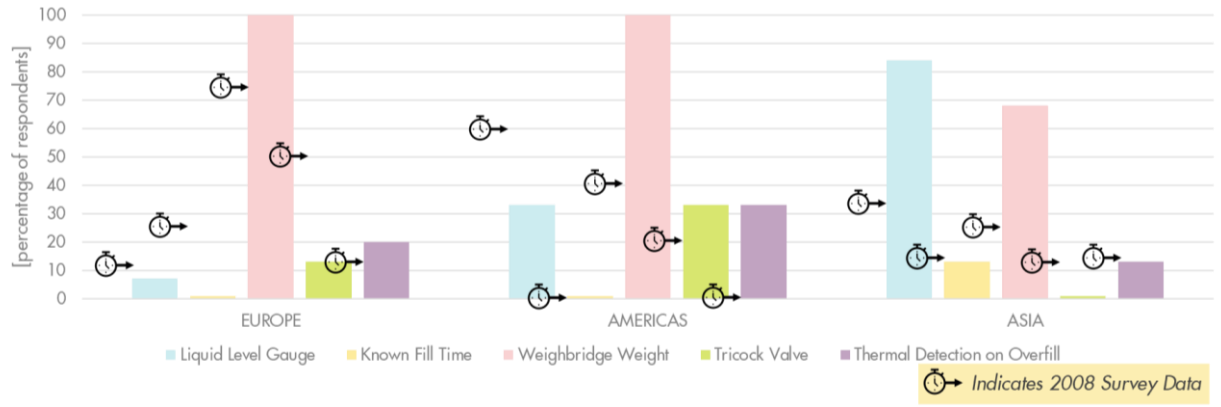
Figure 7 Top or Bottom Filling



While the most common method of filling tank trailers remains the use of top filling, some respondents indicated the availability of bottom filling at their facilities. The split is illustrated by region in the graphic above.

2.3.5. Detection of full fill / full load

Figure 8 Tanker Overfill Detection



The choice of overfill detection varies depending on the region. The most common technique remains the use of weighbridge weight to determine the allowable quantities and prevent overfill. The use of weighbridges was the most common technique as reported in the two previous GIIGNL Overland Transport Surveys and remains in the top spot this time as well and has actually seen an increase across the region in terms of the proportion of respondents using this technique.

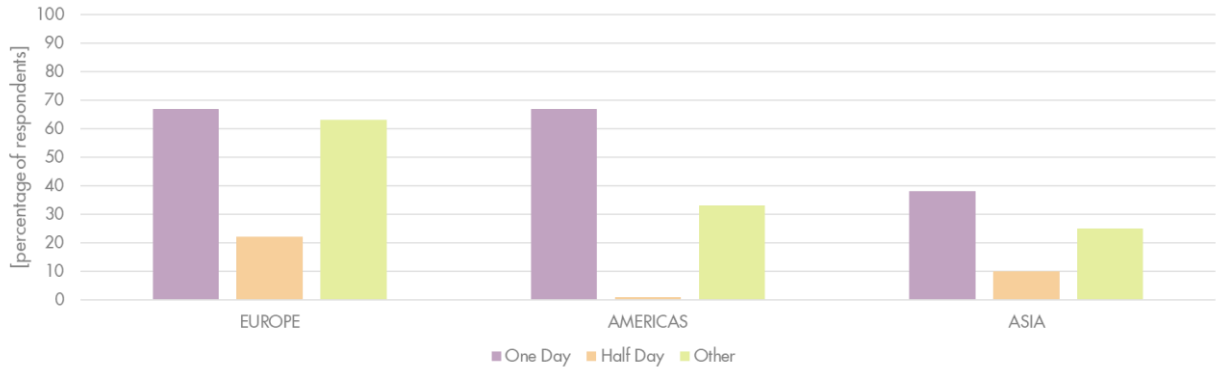
The other overfill detection method that showed a significant trend change compared to the previous survey is the increase in the proportion of respondents from Asia that use liquid level gauges as a means of overfill detection.

The least popular means of detection remained known fill time, the use of a tricock valve, and thermal detection on overfill, although all techniques were reported to be used by some of the respondents which is consistent with the findings of the previous survey.

The results are illustrated in the graphic above.

2.3.6. Scheduling Timeslots

Figure 9 Loading / Scheduling Timeslots



This question seeks to understand the timeslots allocated to a client within which they can arrive and load at the terminal. A one-day timeslot would mean that the client's truck can arrive at any time within that one-day period and be served at the loading gantry. The timeslot is the same as the laycan for a ship whereby the ship needs to be present for loading or discharging within that time period.

The most common timeslot across the regions was a one-day timeslot. In general, terminals with higher staffing and/or low utilization (usually a combination) had more generous timeslots. Some respondents had a first come, first serve policy, whereas others required a 4-hour notice or could accommodate urgent loading requests outside the formal timeslots at extra cost to the client.

Terminals with higher utilizations, on average, had shorter timeslots to manage loading gantry congestion and spread out loading activities over the whole day. One of the busier terminals in Europe reported having 90-minute timeslots.

The responses, grouped into three buckets, are illustrated on the graphic above.

2.3.7. Tanker Loading Durations

The intent for this question is to give the reader a feel for how long tanker loading takes in the different regions. Three different aspects are looked at, i.e. loading duration which represents the time spent actually filling the tanker, the time inside terminal, and the time on weighbridge.

The average loading duration for the three regions is quite similar at between 45 to 60 minutes. The data for Europe shows quite a wide spread, especially a very high maximum value which could be erroneous data, especially since the max loading duration is less than the max time inside terminal.

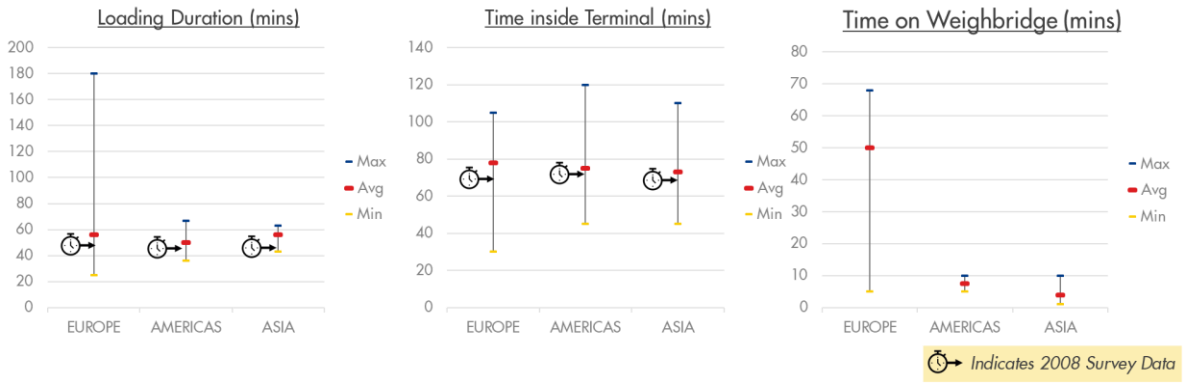
The average time spent inside terminal is also very aligned for the three regions at between 70 to 80 minutes. This suggests that the average time spent on non-filling activities is around 15 mins. A portion of those non-filling activities may be dedicated to the time spent on the weighbridge as part of the custody transfer process.

In terms of time spent on weighbridge, the Americas and Asia have tankers spending around 5 minutes on average on the weighbridge, whereas Europe spends 50 minutes which is the same as the average loading duration for the region. This implies that the loading bay itself is equipped with a weighbridge whereas the weighbridges for Asia and Americas are separate from the loading bay.

In terms of changes from the data received in the previous survey, both the average loading durations and time inside terminal went up slightly for all three regions. However, the changes are small and could be attributed to a slight change in the sample size as well as the terminals that responded.

The responses are illustrated in the graphic below.

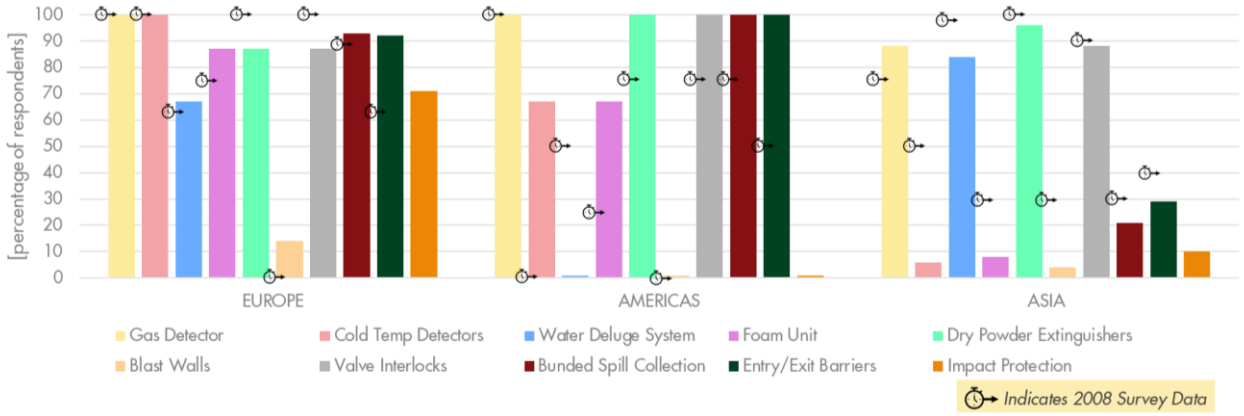
Figure 10 Loading Durations



2.4. Loading / Unloading Operational, Safety and Security Aspects

2.4.1. Safety Systems around loading bay

Figure 11 Safety Systems Around the Loading Bay



As with previous versions of the survey, all respondents indicated having some sort of safety system installed around the loading gantry. All respondents had more than one of the systems installed.

The most prevalent safety systems were the use of flammable gas detectors, dry powder fire extinguishers, and valve interlocks.

In the Americas and Europe, cold temperature detectors, foam units, bunded spill collection, and entry/exit barriers were also observed to be quite prevalent based on the responses. Most of the respondents in Asia did not report the use of these systems.

The safety system with consistently low deployment was the use of blast walls with only a very small number of respondents in total (three) reporting the use of blast walls.

Respondents from the Americas did not report the use of water deluge systems or impact protection barriers. However, water deluge systems were widely reported to be in use by respondents in Europe and Asia. Impact protection was also not widely reported in Asia.

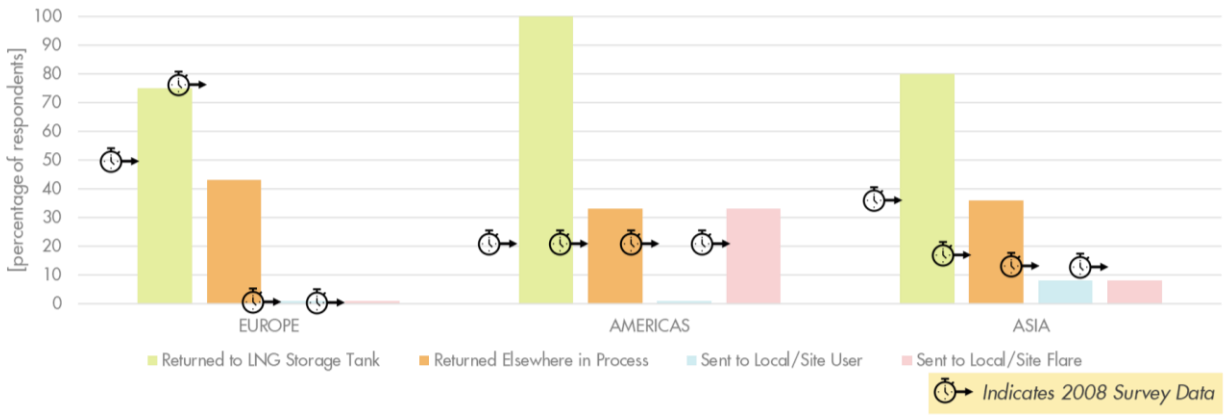
In terms of significant changes since the previous survey, an increase in the use of low temperature detectors and foam units in the Americas, and a decrease in cold temperature detector usage in Asia stand out as key noticeable differences. These could, however, be due to a change in the sample size and the terminals that responded from each region.

Some respondents also reported instances of the use of cold proofing on mechanical supports, the use of water curtains and firewater monitors, as well as the use of flame detectors.

The responses to this question are summarized and illustrated in the graphic above.

2.4.2. Handling of return vapour from tanker loading

Figure 12 What Happens to Return Vapours from Loading



This question seeks to understand how the respondents manage vapour return from tankers being loaded at their facility. The most popular method observed for vapor handling was to return it to the LNG Storage Tank. Both the Americas and Asia experienced a significant increase in the proportion of respondents returning vapor to the storage tank.

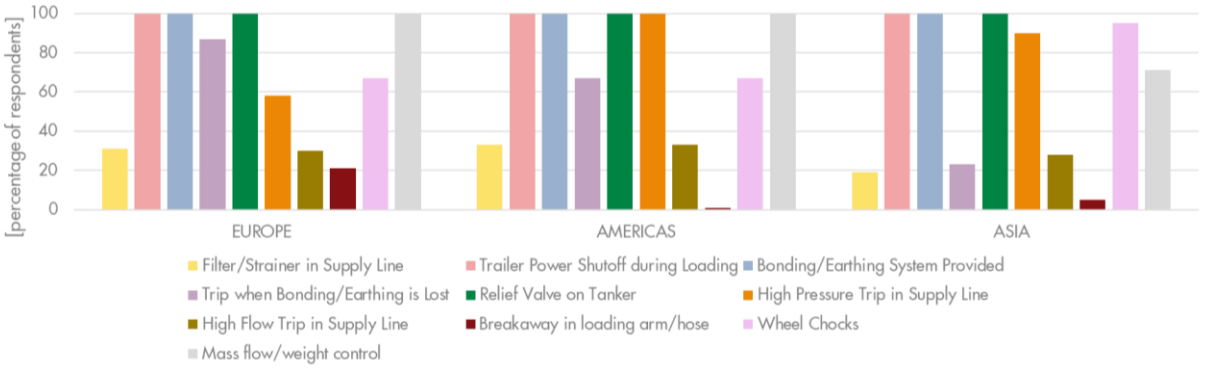
A sizable number of respondents (30-40%) also reported sending the vapor elsewhere in the process, for example, directly to recondensers or send-out compressors.

The use of vapor generated during loading for local users or sending vapors to a local flare were the least popular options with only a small number of respondents from the Americas and Asia opting for these techniques.

The responses to this question are illustrated in the graphic above.

2.4.3. Safety Systems for Filling Operations

Figure 13 Safety Systems for Filing Operations



In addition to a previous question on safety systems installed around the bay, this question is specifically around the safety systems which are in use during filling and directly interact with the tanker.

Among the more common systems across the board, we notice the use of bonding/earthing systems, relief valves on the tankers, high pressure trips in the supply line, and the use of wheel chocks.

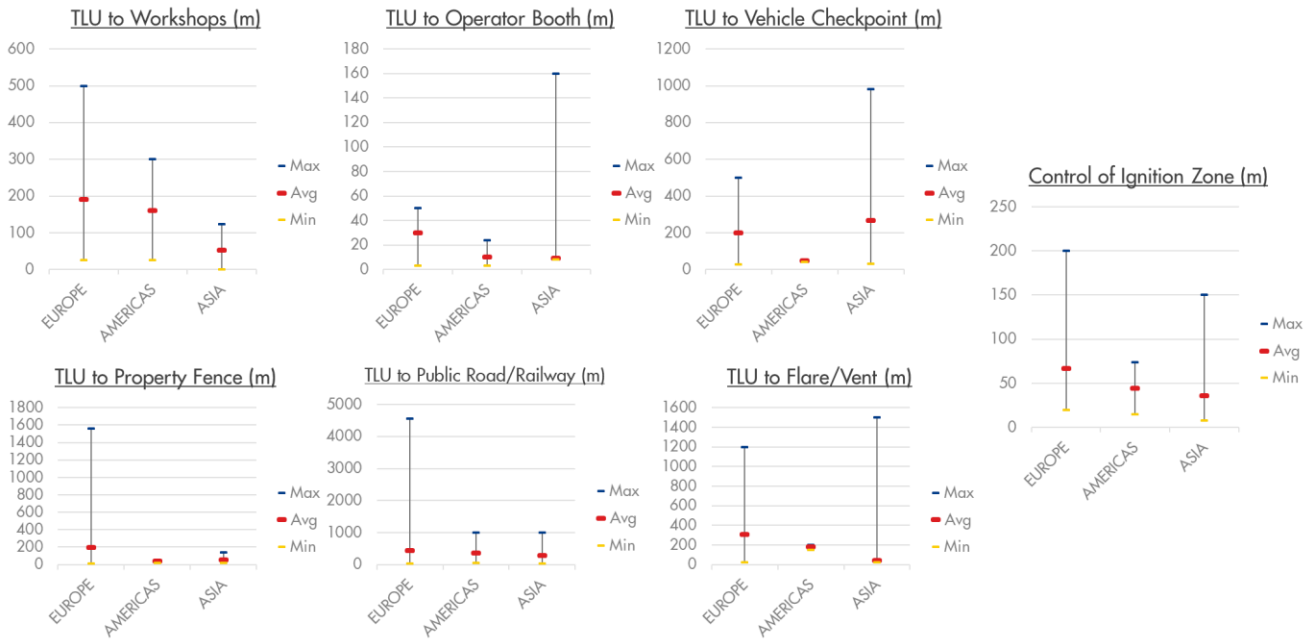
Safety systems which are less common include the use of filters or strainers in the supply line, a high flow trip in the supply line, and the use of breakaways in the loading arm or hose.

Some respondents also reported the use of brake interlocks and constant monitoring by terminal staff.

The responses to this question are summarized and illustrated in the graphic above.

2.4.4. Safety Distances Adhered to

Figure 14 Safety Distances Adhered to



This question summarizes the different safety distances being adhered to at the respondents' facilities in terms of the distance from the trailer loading unit or loading gantry to various receivers including workshops, the operator's booth, vehicle checkpoints, property fence line, public roads/railways, flare/vent, as well as the distance within which control of ignition sources is in place.

A very wide spread was observed driven by local regulations, organizational policies, as well as the plot layouts.

The responses are summarized in the graphics above.

2.4.5. What standards are followed / adhered to?

The standards followed by the respondents vary widely depending on the organization's policies as well as the local legislation in the particular geographies.

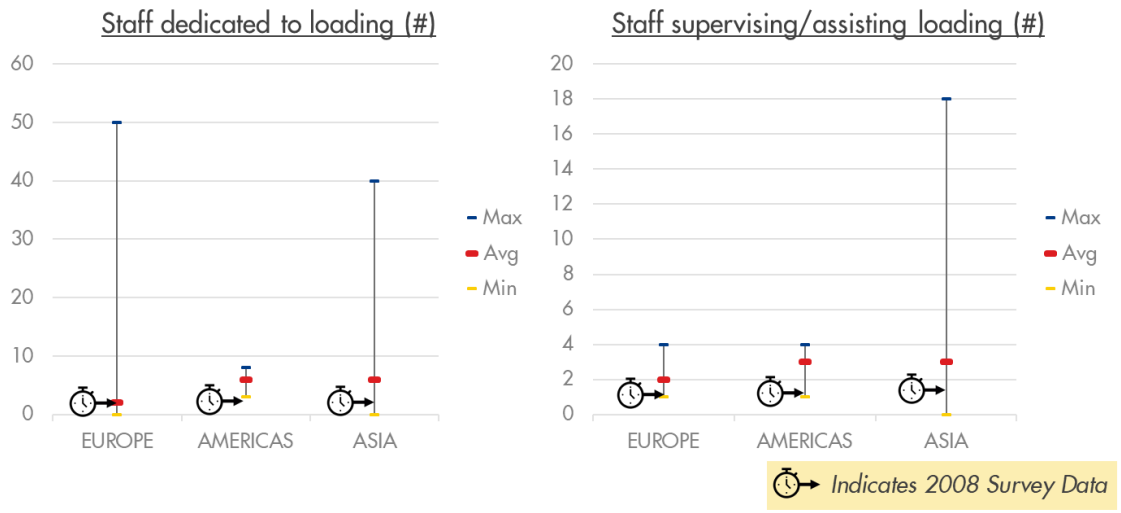
For the purposes of quality measurement and calibration, some of the standards being followed in the Overland LNG Transport Industry include EN12838, ISO 6976, ISO 13443, American Gas Association and Gas Processing Association Standards as well as other locally applicable standards.

For the purposes of custody transfer, some of the standards being followed include US DOT regulations, JIS standards, UNE45501 and the GIIGNL LNG Custody Transfer Handbook.

Regarding general design codes and standards being complied with, some of the sources mentioned by the respondents include the US DOT and ADR standards, JJG-539, JIS JPI and ISO standards, UNE1473 and NFPA 59A.

2.4.6. Tanker Loading Operation Staffing Requirements

Figure 15 Staff requirements per activity



Questions related to the staffing requirements also generated a wide range of responses based on the interpretation of the questions. Staff dedicated to loading here refers to those individuals actually physically loading or unloading the tankers. Staff supervising or assisting were not directly involved but may provide oversight and assist when required, for example, at terminals where the drivers actually connect and disconnect the tankers but are supervised by a terminal staff member.

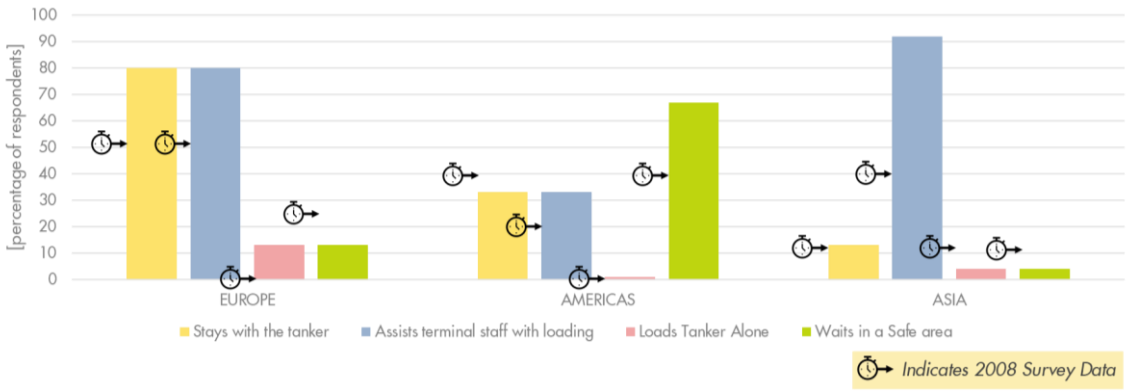
The responses to the questions are illustrated in the graphics above.

The average numbers of staff dedicated to loading are below 10 in all three regions which is consistent with the previous survey. The average number itself remained almost the same for Europe at around 1.5, whereas the number increased for the Americas and Asia, from 1.3 to 3 and from 1.4 to 5.8 respectively. In terms of the spread, both Asia and Europe reported a wide range of figures, in some cases as high as 50 staff dedicated to loading operations.

The average number of staff supervising and assisting loading remained below 4 for all three regions, however an increase was witnessed in all regions. The average number of staff supervising and assisting loading increased from 0.9 to 2.0 for Europe, from 1.0 to 3.0 for the Americas, and from 1.4 to 2.8 for Asia. The spread for Europe and Americas wasn't wide with the maximum number being 4. Asia reported a wider spread, going up to 18 staff for the supervising and assisting loading.

2.4.7. Driver activities during loading

Figure 16 What does the driver do during loading?



During loading, some terminals include the drivers in the process, whereas others perform the loading process only with their own staff and the driver waits for loading to finish.

This question aims to understand the different activities done by the driver.

In the case of most respondents', the drivers stay with the tanker and assist terminal staff with the loading process. The Americas was an exception, where several respondents indicated that the driver waits in a safe space while the terminal staff does the loading.

The least popular option was for the driver to load the tanker alone, with only a small number of respondents from Europe indicating this to be the case.

In terms of changes from the previous survey cycle, the proportion of facilities where the driver is involved in the loading process increased in Europe and Asia, with the increase in Asia being especially significant.

In the Americas, however, a decrease was observed in the proportion of terminals where drivers stay with tankers and participate in loading. This was, therefore, accompanied by an expected increase in the proportion of terminals where drivers wait in a safe area.

The responses to this question are summarized and illustrated in the graphic above.

2.4.8. Security Preparations made prior to tanker arrival

Figure 17 What Security Preparation are made prior to tanker arrival?

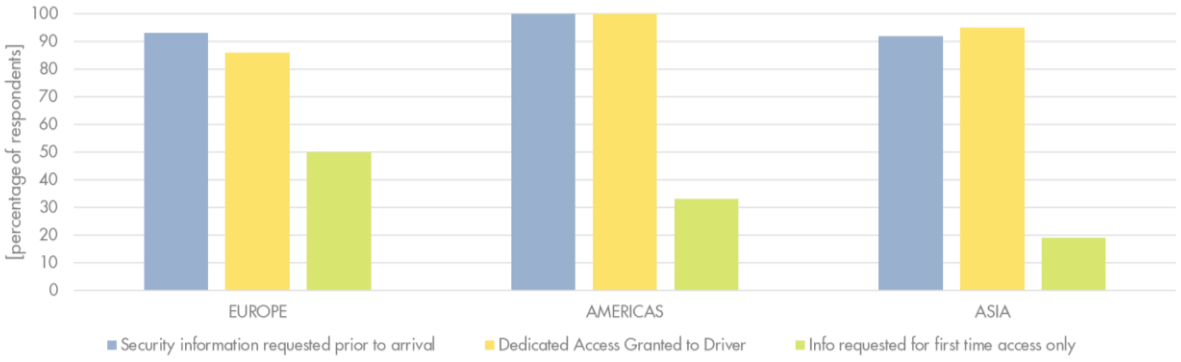


Figure 18 What details are requested in advance?

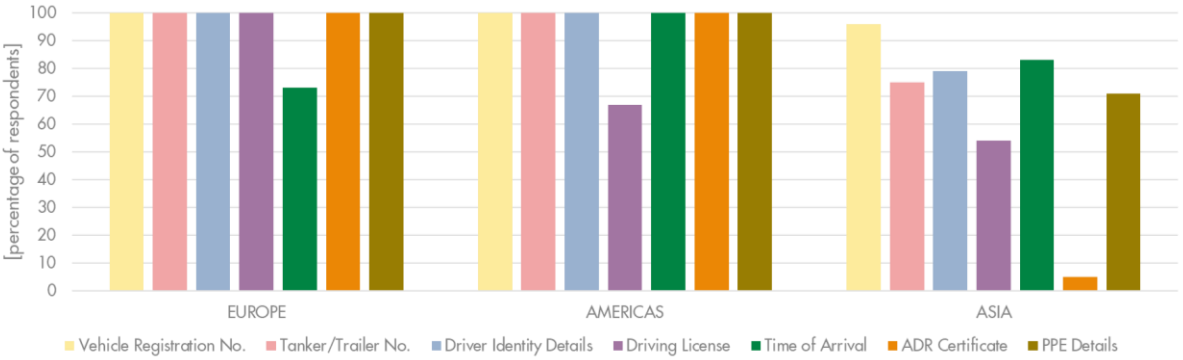
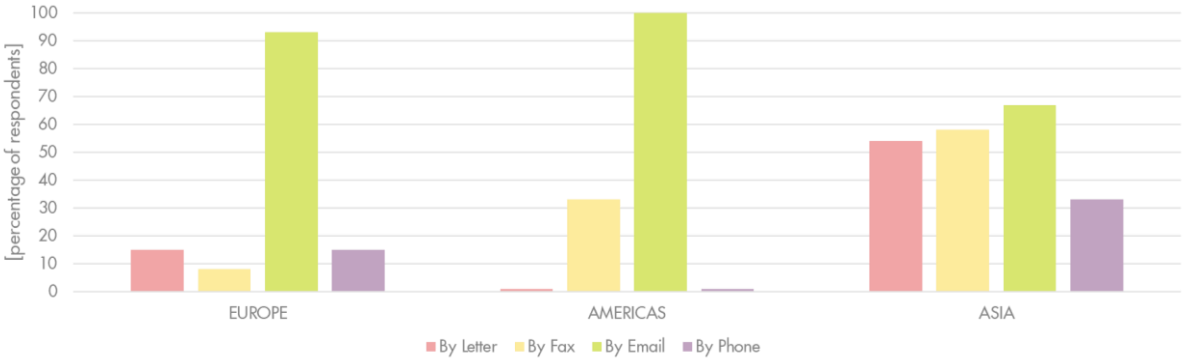


Figure 19 How are Security Details requested?



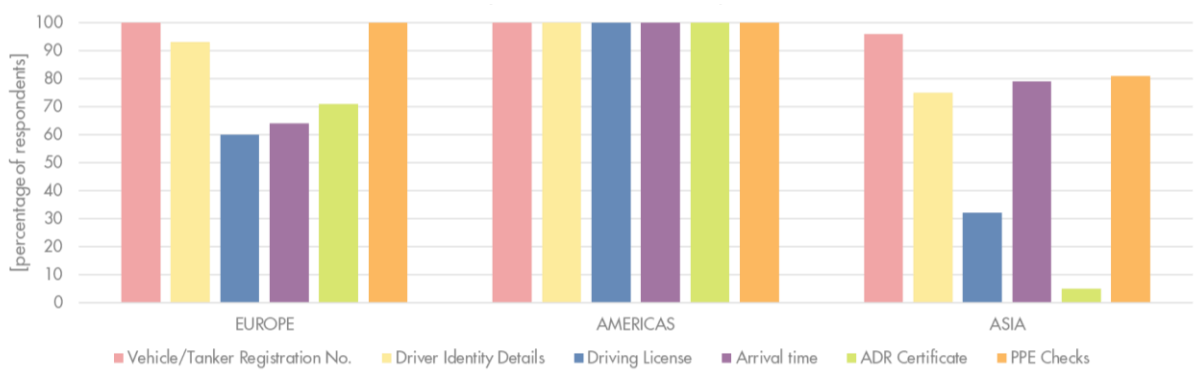
The graphics above summarize responses to the question around what security preparations are made to prior to arrival, and if details are requested prior to arrival, how does that process take place, and what information is requested.

In addition to the information summarized in the graphic, some of the respondents also indicated asking for insurance information, gas-freeing and inerting certificates for new or newly maintained tankers, as well as valid calibration certificates for tanker relief valve.

Several respondents also indicated using online document submission portals instead of requesting information by letter, fax, email, or phone.

2.4.9. Security checks performed on tanker arrival

Figure 20 What Security Checks are made upon arrival?



Upon arrival of a tanker to the respondents' facilities for loading, a number of checks are performed before the vehicle is allowed to access the terminal.

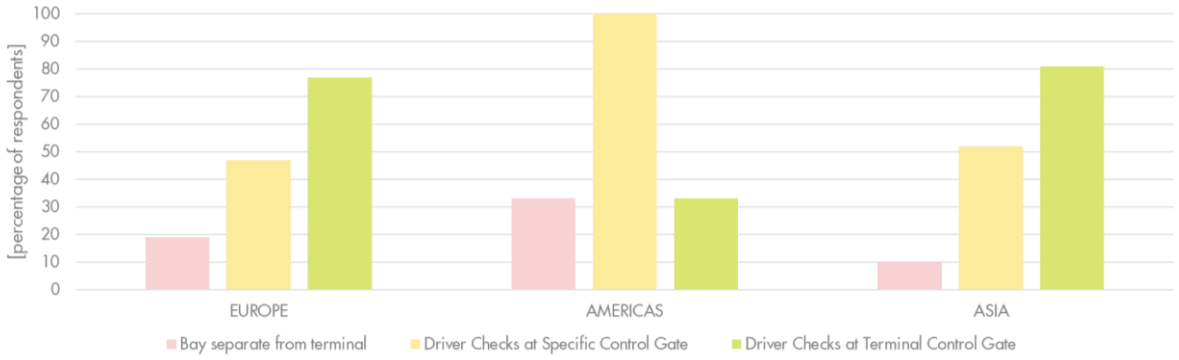
The responses to this question are summarized in the graphic above.

In addition to the options in the questionnaire which are shown on the graphic, several respondents also indicated the inclusion of the following as part of their checks:

- Pre-load checklist
- Verifying insurance validity
- Checking for valid order
- Checking for any visible leaks
- Spot checking safety equipment such as fire extinguishers and brake interlocks
- Checking brake temperatures etc.

2.4.10. Location of truck loading bay

Figure 21 Truck Loading Bay Location



This question seeks to understand whether the loading bays are separate from the terminal's storage, and the location where the pre-loading checks are performed.

The responses are illustrated in the graphic above.

What stands out is that the preference in the Americas is to conduct the checks at a specific control gate instead of the terminal gate, whereas in Europe and Asia, the checks are performed predominantly at the terminal gate.

2.4.11 Driver Training Requirements

Figure 22 Driver Training Requirements

This question summarizes the training requirements for drivers loading at a respondent's facility. The responses are illustrated in the graphic above.

A small minority of terminals from Asia indicated not having terminal safety induction for drivers. Whereas, the European and American facilities indicated 100% induction, with training material geared specifically towards the drivers and the loading operations.

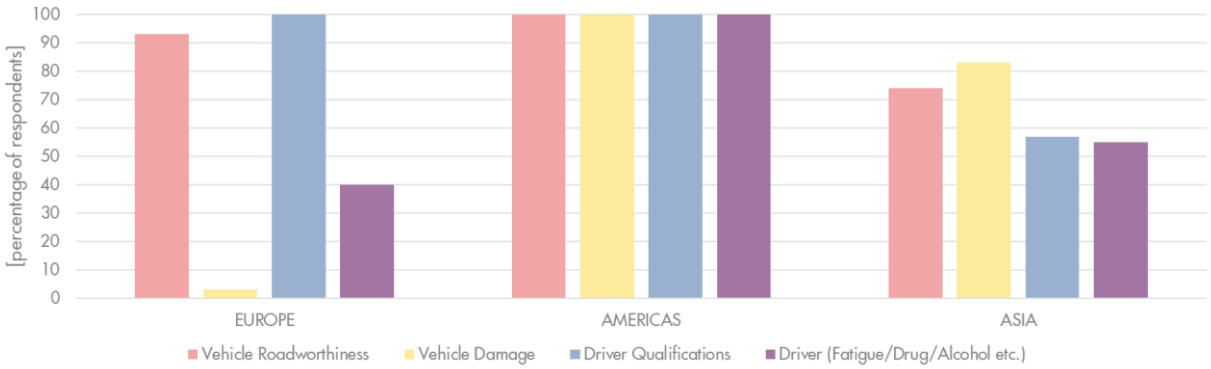
Other training requirements for the drivers were also reported by the respondents, primarily in place as a result of local legislation. These training or qualification requirements included:

- CDL with Tanker / HAZMAT / Combustible Liquids Endorsement

- Periodic Theoretical and Practical Training

2.4.12 Additional Safety Check prior to loading

Figure 23 Additional Safety Check upon Arrival



In addition to the checks performed on documentation, this question seeks to understand if any other checks are in place.

The responses to the question are illustrated above.

In addition to the options in the questionnaire, some respondents also indicated the implementation:

- Annual electrical system checks for all tankers
- Random blood alcohol level checks as well as in the case of suspected intoxication.

2.5. Safety

2.5.1. Safety Performance

In terms of safety performance, several respondents did not share information on this question. Some insights from the responses that were received below are described below.

It was mentioned by some respondents that thorough cleaning of couplings is crucial if leaks are to be avoided and that threaded couplings may occasionally need to be re-torqued after cooling down to stem a small leak. Others also indicated that leaks took place due to loading hose damage, incorrect truck relief valve installation, and malfunctioning truck valves due to debris.

2.5.2. Emergency Response Plans

Figure 24 Emergency Response Planning

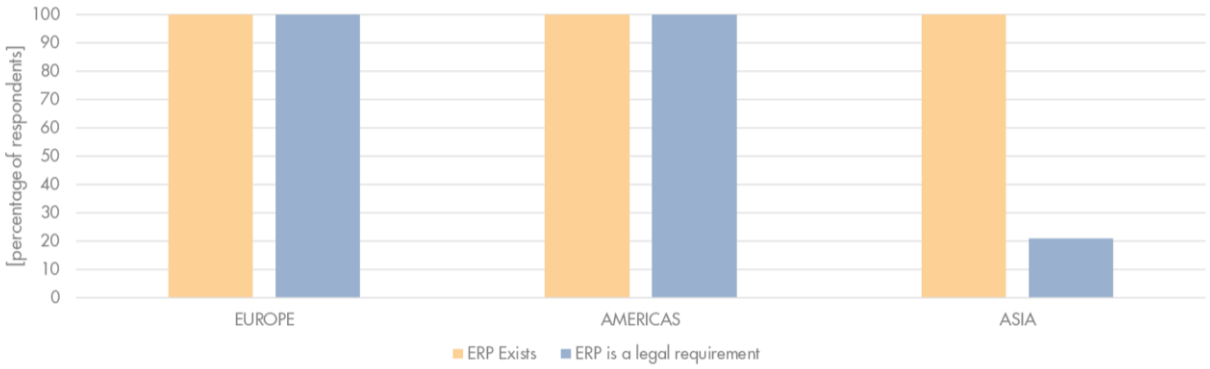
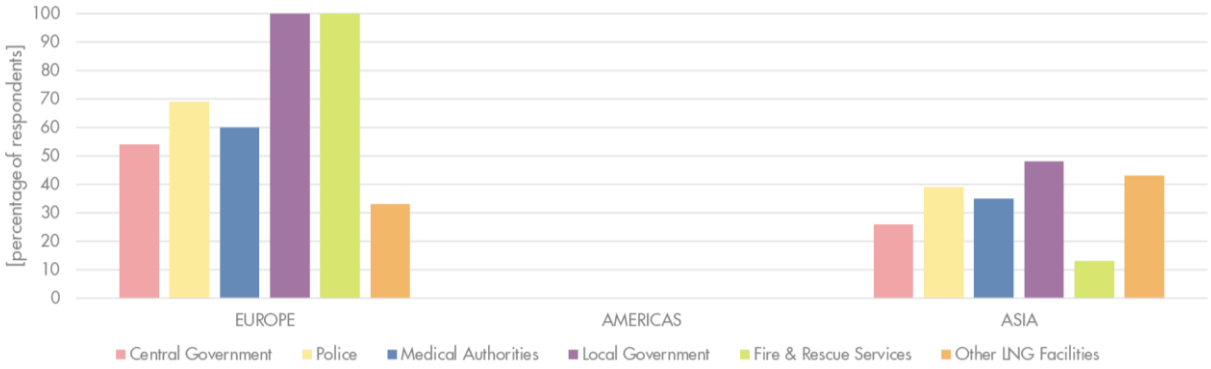


Figure 25 External parties involved in Emergency Response Plan development



All respondents indicated the existence of an Emergency Response Plan even when it may not be a legal requirement. The persons responsible for maintaining the plan varied widely but some of the responses included:

- Terminal Manager
- Safety Manager
- Operations Manager

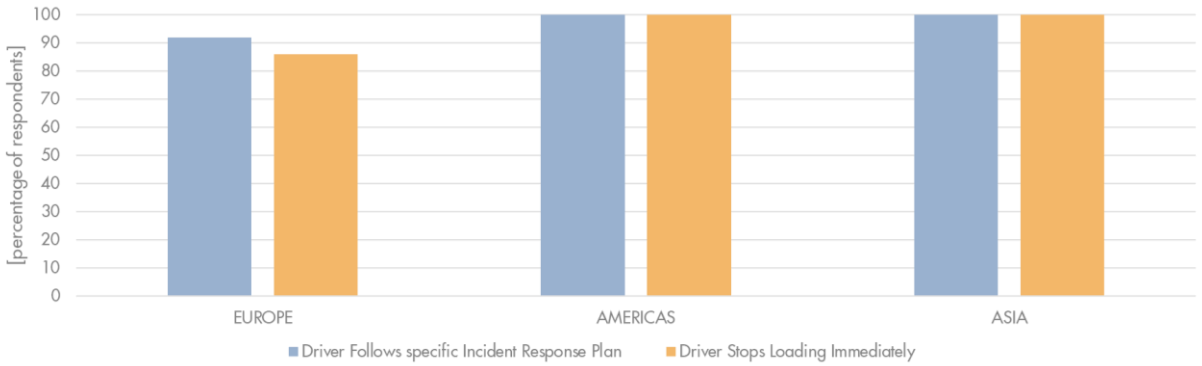
- Security Manager
- Dedicated Emergency Response Manager

In terms of external party involvement in the Emergency Response Plan development, the answers to the question are illustrated in the graphic above. For this particular question, no information was received from the Americas

Some respondents also indicated the involvement of port authorities, other nearby facilities – even if non-LNG, the transport contractors, and local gas associations when it came to developing and periodically reviewing the emergency response plans.

2.5.3. Driver Incident Response

Figure 26 Driver Response to an Incident



Lastly, this question indicates how the driver is expected to react in case of an incident.

In the Americas and Asia, all respondents indicated that the driver follows a specific incident response plan and stops loading immediately.

For Europe, a small number of respondents did not indicate driver actions, as the drivers are not involved in loading activities at terminals and incident response is done by terminal staff.

3. Road Transport Owners Responses to the Survey

As mentioned earlier, a very small minority of LNG road transport operators responded to the survey. While the number of responses for road transport operators was insufficient to generate insightful statistics, the key learnings are still presented in the report.

From the responses received, articulated tanker trailers seem to be the most common form of LNG road transport equipment with rigid trucks having a significant representation in Asia.

Only a very small number of foam trailers were reported to be in use for the transport of LNG by the respondents. The foam trailers were more than 10 years old and lost 2% of their foam insulation's thermal performance per year. Double Walled Vacuum insulated trailers with multilayer insulation or perlite were reported as the most commonly used types with the vacuum measured on an annual basis by certain respondents to ensure adequate insulation and minimize boil off.

Periodic inspections of the safety equipment were reported to be performed by a mix of government inspectors, third party specialists and in-house personnel.

The use of bidirectional ESD links for loading and discharging operations was reported by some respondents but within the sample set, did not seem commonplace. The majority of trailers had working pressures (relief valve setpoints) of 3-5 barg with the maximum degree of filling driven by the relief valve setpoint.

In terms of driver management, all respondents reported the use of policies regarding background and experience checks as well as strict control over the maximum number of hours that a driver can work in a day, usually driven by local legislation.

Some respondents also reported the use of driver league systems to incentivize and reward safe driving with periodic awards for drivers with the best driving and safety statistics.

4. Conclusion

The purpose of the survey and subsequent report was to highlight the trends in the overland transport of LNG and share them with the GIIGNL TSG.

While the number of responses were not as high as initially hoped for and the regional coordinators worked very hard to gather the data, the data that was gathered was a large enough sample size to provide reasonably representative insights.

During this study, certain key statistical patterns as well as changing trends compared to the previous study have been identified. At the same time, some best practices have been reported by some of the respondents which are worth mentioning. The key trends, highlights, and observed best practices are listed below:

- Overland Transport of LNG continues to comprise of a wide variety of organizations in terms of size and complexity ranging from small organizations serving a few regional LNG customers all the way to large multinational companies operating in various parts of the energy sector.
- Based on the sample size, an increasing preference for the use of hoses over loading arms was observed compared to the previous survey, however, this may be due to a change in the respondents
- Europe and the Americas continue to use larger road LNG tankers on average compared to the average size of road LNG tankers in Asia where a sizable number of rigid trucks are also in operation
- The utilization of loading bays remained relatively steady at between 50 and 60% with minor increases observed in the Americas and Asia
- Terminals with higher staffing and/or low utilization had more flexible loading slots with some implementing a 24/7 first come, first serve policy. Busier terminals, however, had more rigid and shorter loading slots with one of the busier terminals in Europe reporting the use of 90-minute timeslots
- In terms of loading durations, and time spent inside terminals, no major change was witnessed compared to the previous study, suggesting that operating procedures and flowrates have remained similar
- A wide variety of safety systems are used around the loading bays with the most prevalent systems across the board being the use of flammable gas detectors, dry powder fire extinguishers, and valve interlocks
- Blast walls were the least commonly used safety measure
- Vapors returned from the loading bay were most often sent to the facility's LNG storage tank(s)
- Filters and strainers were not reported to be used widely which suggests that LNG contamination is not a concern and / or customers rely on downstream filtration

- Safety and separation distances varied considerably for different sites and were driven primarily by local legislation and quantitative risk analyses
- While the staffing requirements remained relatively the same as the previous survey, a minor increase was observed for all staffing statistics across the regions
- With respect to obtaining information regarding a customer prior to approval, for example documents and certificates, several respondents reported the use of bespoke online document submission portals in lieu of exchanging information by letter, fax, or email.
- Only a very small number of foam trailers were reported to still be in use for the transport of LNG by the respondents and these were on average more than 10 years old confirming that the industry has moved towards double walled vacuum insulated trailers with multilayer insulation or perlite as the filling in the annular space.

It is suggested that the study be repeated at an 8 – 10 year interval to identify changing trends in the overland transport industry. The key challenge for the study is the timely gathering and analysis of quality data from a large enough number of respondents. The following are suggested as potential mitigations for that challenge:

- Engage GIIGNL members early on and ensure responding to questionnaires is emphasized and periodic meetings and via the central office
- Instead of sending out spreadsheet based questionnaires by email to the respondents, it is strongly recommended to use a web based data gathering service such as web forms which would automatically ensure data is of a specific type and is presented as a single spreadsheet which can easily be analyzed.

5. APPENDICES

Appendix A – Blank Questionnaire sent to respondents

June 2018

GIIGNL study on the Overland Transportation of LNG

INTERNATIONAL GROUP OF LIQUEFIED NATURAL GAS IMPORTERS

INTRODUCTION

Who are GIIGNL

The Groupe International des Importateurs Gaz Natural Liquéfié (GIIGNL), is a non-profit organization founded in December 1971 and has its central office located in Paris. It is composed of 86 member companies from over 25 countries involved in the importation of Liquefied Natural Gas (LNG).

GIIGNL's main objectives are to promote the development of activities related to LNG : purchasing, importing, processing, transportation, handling, regasification and various uses of LNG. To this purpose, the Group provides an overview of the state-of-the art technology in the LNG industry and its general economic state in order to enhance facility operations, to diversify contractual techniques, to develop positions to be taken in international agencies, etc

Purpose of this Questionnaire

GIIGNL completed an industry-wide study of the transportation of LNG by road truck in 1998 and 2007. The industry has seen a significant growth over the past 10 years and is further expanding today. **GIIGNL wishes to capture the developments in technology, trading practices and operational practices and therefore seeks information on the transportation of small quantities of LNG by both road and rail for the period from 2007 to 2017**. This survey has a similar structure to survey that was distributed 11 years ago to allow for data comparison and trending.

Scope and distribution of this Questionaire

The scope of the study involves the complete transport of LNG value chain and aims to report statistics on design & operational practices of the truck loading unit (TLU), the LNG tanker (road/rail) and the LNG receiving facility. In addition, GIIGNL wishes to report the number of incidents and near misses that occurred along the value chain to demonstrate the very good safety record of LNG transport overland and capture learnings from the incidents that did occur to help prevent any repetition.

The questionnaire is built-up in two parts: part 1 – to be completed by LNG terminal owners and part 2 – to be completed by rail/road LNG tanker fleet owners. This questionnaire will be distributed to all GIIGNL members that own terminals with a TLU. The terminal owners are requested to fill-out the 'TLU owner' questionnaire (4 sheets).

Confidentiality

GIIGNL, through its Technical Study Group, performs a range of studies into LNG issues such as safety. The aim of these studies is to learn and develop good practice, not to blame. To get highly sensitive data from participants strict confidentiality is essential and rigorously enforced. Regional co-ordinators ensure that data collected on safety and security management is non-attributable to any specific location or company.
The report will NOT identify individual companies.

What happens to the results

All participants - terminals and transportation companies - who provide data into the study will receive a copy of the report. The report will also be circulated to GIIGNL members, most of which have their own LNG trucking businesses.

How to answer the questionnaire

- Many questions can be answered by entering "Yes", "No", "Y" or "N"
- If you have additional comments please add them to the sheet titled "additional information"
- Data can only be entered into the spreadsheet cells shown in yellow. For example this field data entry should be completed
- Text in green aims to provide help and guidance on the answer required

Regional Co-ordinators

A task force within the GIIGNL has been set-up for the update of this Overland Transport Study Report dating from 2007. The following regional co-ordinators have been selected to assist with management of the study

June 2018

GIIGNL study on the Overland Transportation of LNG

INTERNATIONAL GROUP OF LIQUEFIED NATURAL GAS IMPORTERS

COMPANY INFORMATION

Question 0.1: Please provide the following general information about yourself/company

Company Name			
Country of Operation			
Contact person		Position/Title	
Phone		Fax	
Email			
Company's turnover	in currency	for year	
How many Employees		Employees in LNG	

Question 0.2: What is your role in the LNG Rail/Road trucking industry? *(please reply yes or no to all that apply)*

LNG Importer/Liquefier/Supplier Yes/No
eg I run a LNG import terminal, LNG liquefier exporting liquid

LNG road/rail transporter Yes/No
eg I operate a LNG road and/or rail tanker fleet

Gas Distribution/Trading Company Yes/No
eg I use LNG to distribute as gas to customers or am a gas trader

Gas Transmission Company Yes/No
eg I use LNG to support temporary and emergency pipeline operations

Other *please detail*

LNG TANKER LOADING FACILITIES

Question 1.1: How many road/rail tanker bay facilities are there?

	Road Tankers	Rail Tankers
Tanker bays with:		
Hard arms	#	#
Flexible hoses	#	#
Other designs	#	#
please detail		
Largest tanker to be loaded is	in units	in units *(eg m3, gallons, kg)*
Number of bays that can load this capacity	#	#
Tanker connection using:		
Hard arms	#	#
Flexible hoses	#	#
Other designs	#	#
If hose connection, type of coupling:		
Standard thread	#	#
Standard flange	#	#
Dry/quick coupling (QCDC)	#	#
Non-standard connection	#	#

Question 1.2: How much use is made of the facilities ? *(reference year 2016)*

	Road Tankers	Rail Tankers
Number of tanker slots available daily	#	#
Average tanker slots used daily	*#/day*	#
Maximum tanker slots used on one day	*#/day*	#
Maximum demand	*#/month*	*#/month*

Question 1.3: How is tanker loading controlled?' *(please answer all that apply)*

	Road Tankers	Rail Tankers
Weighbridge under each bay	*(Yes/No)*	*(Yes/No)*
Central weighbridge with flow totaliser at each bay	*(Yes/No)*	*(Yes/No)*
Flow totaliser at each bay	*(Yes/No)*	*(Yes/No)*
Other: *please detail*		
Is there specific control over LNG quality loaded?	*(Yes/No)*	*(Yes/No)*
If yes, what method is used to determine quality of LNG that is loaded?		
Continues monitoring	*(Yes/No)*	*(Yes/No)*
Sampling	*(Yes/No)*	*(Yes/No)*
Other: *please detail*		

Question 1.4: How can filling be performed?

	Road Tankers	Rail Tankers
Bottom loading	*(Yes/No)*	*(Yes/No)*
Top loading	*(Yes/No)*	*(Yes/No)*

Question 1.5: How is a full road tanker detected?

	Road Tankers	Rail Tankers
Liquid level guage	*(Yes/No)*	*(Yes/No)*
Known fill time	*(Yes/No)*	*(Yes/No)*
Weighbridge weight	*(Yes/No)*	*(Yes/No)*
Tricock valve	*(Yes/No)*	*(Yes/No)*
Thermal detection on overflow	*(Yes/No)*	*(Yes/No)*
Other: *please detail*		

Question 1.6: What timeslots are used for scheduling i.e. what time window is available for the tanker loading?

	Road Tankers	Rail Tankers
One day	*(Yes/No)*	*(Yes/No)*
Half a day	*(Yes/No)*	*(Yes/No)*
Several others	*(Yes/No)*	*(Yes/No)*
please clarify/detail		

Question 1.7: Tanker loading times

	Road Tankers	Rail Tankers
Average loading duration	*min*	*min*
Maximum loading duration	*min*	*min*
Minimum loading duration		*min*
Typical times:		
Total time inside the terminal	*min*	*min*
Time on weightbridge (if applicable)	*min*	*min*
Effective loading time	*min*	*min*

please now complete "TLU Owner Questionnaire (2)"

LNG TANKER LOADING OPERATIONAL, SAFETY & SECURITY ASPECTS

Question 2.1: What safety systems are installed around the tanker bay?

	Road Tankers	Rail Tankers
Flammable gas detectors	*(Yes/No)*	*(Yes/No)*
Cold detectors	*(Yes/No)*	*(Yes/No)*
Water deluge system	*(Yes/No)*	*(Yes/No)*
Foam unit	*(Yes/No)*	*(Yes/No)*
Dry powder extinguishers	*(Yes/No)*	*(Yes/No)*
Blast walls	*(Yes/No)*	*(Yes/No)*
Valve interlocks	*(Yes/No)*	*(Yes/No)*
Bunded spill collection	*(Yes/No)*	*(Yes/No)*
Entry/exit barriers	*(Yes/No)*	*(Yes/No)*
Equipment impact protection	*(Yes/No)*	*(Yes/No)*
Other systems: *please detail*		

Question 2.2: What happens to return vapour from tanker loading?

	Road Tankers	Rail Tankers
Returned to LNG storage tank	*(Yes/No)*	*(Yes/No)*
Returned elsewhere in process line-up	*(Yes/No)*	*(Yes/No)*
Sent to local/site user	*(Yes/No)*	*(Yes/No)*
Sent to local/site flare	*(Yes/No)*	*(Yes/No)*
Other system: *please detail*		

Question 2.3: What safety systems are included in the tanker loading unit design for filling operation?

		Road Tankers	Rail Tankers
Filter/strainer installed in supply line?		*(Yes/No)*	*(Yes/No)*
Trailer power shut-off during loading?		*(Yes/No)*	*(Yes/No)*
Bonding and earthing system provided?		*(Yes/No)*	*(Yes/No)*
Is loading tripped when it disconnects?		*(Yes/No)*	*(Yes/No)*
Trailer overpressure protection system:			
RV on tanker		*(Yes/No)*	*(Yes/No)*
High pressure trip supply line		*(Yes/No)*	*(Yes/No)*
Other:	*please detail*		
Hose rupture detection system:			
High flow measurement in supply line?		*(Yes/No)*	*(Yes/No)*
Other:	*please detail*		
Slide-away / drive-away protection systems:			
Break-away in supply hose/arm?		*(Yes/No)*	*(Yes/No)*
Wheel cocks		*(Yes/No)*	*(Yes/No)*
Other	*please detail*		
Trailer overfill protection system:			
Max filling level allowed		%	%
Mass flow/weight control		*(Yes/No)*	*(Yes/No)*
Other	*please detail*		

Question 2.4: What safety distances are adhered to?

	Road Tankers	Rail Tankers
Tank loading unit to workshops	m	m
Tank loading unit to observation/operator booth	m	m
Tank loading unit to vehicle check point	m	m
Tank loading unit to property fence	m	m
Tank loading unit to public roads/railway	m	m
Tank loading unit to flare/vent stack	m	m
Exclusion zone or control of ignition zone	m	m

Question 2.5: What standards are followed / adhered to?

	Road Tankers	Rail Tankers
For quality measurement & calibration methods		
For custody transfer certification		
For design: codes and (inter)-national standards complied to		

Question 2.6: What are the terminal staffing requirements?

	Road Tankers	Rail Tankers
How many dedicated staff or Full Time Equivalent is dedicated to tanker loading?	#	#
How many LNG staff assists/supervises tanker loading?	#	#

Question 2.7: What does the road tanker/train driver do during loading?

	Road Tankers	Rail Tankers
Stays with the tanker	*(Yes/No)*	*(Yes/No)*
Assists terminal staff with loading	*(Yes/No)*	*(Yes/No)*
Loads tanker alone	*(Yes/No)*	*(Yes/No)*
Waits in a safe area	*(Yes/No)*	*(Yes/No)*
Other: *please detail*		

All security details provided below will be kept strictly confidential and will not be attributable to any one company

Question 2.8: What security preparations are made prior to tanker arrival?

Is security information requested prior to tanker arrival?	*(Yes/No)*
How far in advance is security information requested?	
Is dedicated access granted to truck drivers?	*(Yes/No)*
Is security information requestion for first time access only?	*(Yes/No)*

What details are requested?

Vehicle registration number	*(Yes/No)*	Other details and comments, *please detail*
Tanker/trailer number	*(Yes/No)*	
Driver identity details	*(Yes/No)*	
Driving license	*(Yes/No)*	
Time of arrival	*(Yes/No)*	
ADR certificate	*(Yes/No*	
Personal Protective Equipment	*(Yes/No*	

How is security information requested?

By letter	*(Yes/No)*	Other details, *please detail*
By fax	*(Yes/No)*	
By email	*(Yes/No)*	
By phone	*(Yes/No)*	

Question 2.9: What security checks are made on tanker arrival?

Vehicle/tanker registration number		*(Yes/No)*
Driver name/identity details		*(Yes/No)*
Driving licence		*(Yes/No)*
Arrival time		*(Yes/No)*
ADR certificate		*(Yes/No*
Personal Protective Equipment		*(Yes/No*
Other checks *please detail*		

Question 2.10: Where is the truck loading bay located?

Is the truck loading bay separated from the terminal?		*(Yes/No)*
Where are driver checkes done:		
at specific control gate		*(Yes/No)*
at terminal control gate		*(Yes/No)*

Question 2.11: What safety preparations are made prior to tanker loading?

Is terminal safety induction training for tanker drivers?		*(Yes/No)*	*please detail*
Same training as people working in the terminal?		*(Yes/No)*	
Specific to truck loading?		*(Yes/No)*	
Any other requirements regarding truck driver training?		*(Yes/No)*	

Question 2.12: Are checks made for safety purposes?

Which checks are made:			
Vehicle roadworthiness		*(Yes/No)*	Other, *please detail*
Damage to vehicle		*(Yes/No)*	
Driver qualifications		*(Yes/No)*	
Driver (drug/alcohol policy, etc)		*(Yes/No)*	

please now complete "TLU Owner Questionnaire (3)"

LNG TANKER LOADING OPERATIONAL, SAFETY & SECURITY ASPECTS

Please copy and complete this sheet as many times as required to describe your business

Question 3.1: GIIGNL is trying to make this questionnaire as inclusive as possible. To enable this to happen could you please share the Tanker Owner questionaire with the LNG transport companies that load at your LNG terminal? Please copy all the 'Tanker Owner Questionnaire' sheets that you receive from the LNG transport companies in this Excel document and provide the company details in this sheet so that these individuals can be contacted and final report will also be shared with them.

LNG Transport Company details

	Transporter 1	Transporter 2	Transporter 3
Contact			
Position			
Company			
Address			
Phone			
Fax			
E-mail			

	Transporter 4	Transporter 5	Transporter 6
Contact			
Position			
Company			
Address			
Phone			
Fax			
E-mail			

please now complete "TLU Owner Questionnaire (4)"

Question 4.1: Incidents & Near Misses between 2007 & 2016

How many incidents have there been within the bounderies of TLU in your terminal? #

An incident is defined as loss of material, injury to individuals, damage to equipment

How many near misses have there been? #

A near miss is defined as an action that could have led to an incident in certain circumstances but did not escalate in this case

How many vehicle roll overs have there been? #

A roll over is defined as the trailor/tanker over turning while stationary or in motion

LNG Spills in TLU area

Number of spills less than 10 kg #

Number of spills between 10 kg and 100 kg #

Number of spills between 100 kg and 1000 kg #

Number of spills greater than 1000 kg #

Number of spills of other material (eg oil/diesel) #

Number of spills that escalated to fires or explosions #

Number of incidents that occurred during:

Tanker loading #

Other #

please describe

Number of incidents caused by

- Road accident
- Valve problems
- Control system malfunction
- Hose/loading arm problem
- Vehicle malfunction (eg diesel/oil spill)
- Human error
- Design fault
- Poor maintenance
- Other

Please describe any learning points of interest to others

Question 4.2: Emergency Response Plans

Does an emergency repsonse plan exist?	(Yes/No)		
Who is responsible for the plan?			
Is this a legal requirement?			
What agencies are involved in formulating the plan?			
Central government	(Yes/No)	Local Government	(Yes/No)
Police	(Yes/No)	Fire & Rescue services	(Yes/No)
Medical authorities	(Yes/No)	Other LNG facilities	(Yes/No)
Other *please describe*			
How frequently is the plan tested?		*eg monthly, quarterly, annually*	

Question 4.3: Driver Incident Response

How does the driver/oeprator respond to an incident?		
Follow a specific incident response plan	(Yes/No)	
Stop the loading immediately	(Yes/No)	
Other *please describe*		

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OF LIQUEFIED NATURAL GAS IMPORTERS

ADDITIONAL INFORMATION

I believe that the following information on my business would be valuable to this study

I think it would be useful to contact the following people about the study

Name	Position	Company
Telephone	Email	Address
Name	Position	Company
Telephone	Email	Address
Name	Position	Company
Telephone	Email	Address

Please contact me to discuss this _____ *(Yes/No)*

June 2018

GIIGNL study on the Overland Transportation of LNG

INTERNATIONAL GROUP
OF LIQUEFIED NATURAL GAS IMPORTERS

THANK YOU

Thank you for completing the GIIGNL LNG road and rail trucking study

The summary report will be anonymous and will not identify individual companies.

The summary report will be provided electronically to each respondent as soon as it is available

If you have any comments on this questionnaire or issues you would like to raise please fill in the box below

I have the following comments

Please contact me to discuss my comments *(Yes/No)*

Thank you

June 2018

GIIGNL study on the Overland Transportation of LNG

INTERNATIONAL GROUP OF LIQUEFIED NATURAL GAS IMPORTERS

QUESTIONNAIRE FEEDBACK

Question 1: How easy was the form to complete?

Very Easy	Easy	OK	Difficult	Very Difficult	Could not complete

Question 2: How long did the form take to complete?

Question 3: Were all the questions easy to understand?

Very Easy	Easy	OK	Difficult	Very Difficult	Could not complete

The particularly difficult questions were:

Sheet	Question	Sheet	Question

Question 4: Was the use of Microsoft Excel (rather than paper) helpful in completing the questionaire

Very Helpful	Helpful	Neutral	Unhelpful	Very Unhelpful	Completed a paper version

Question 5: Did you have any computer problems with the questionnaire?

Loading/operating the spreadhseet		*(Yes/No)*	comments
Saving the spreadsheet		*(Yes/No)*	
Navigating around the spreadsheet		*(Yes/No)*	
Colour scheme difficult to see		*(Yes/No)*	
Instruction unhelpful		*(Yes/No)*	

Question 6: Can the questionnaire be improved?

please consider

Table of Figures

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