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Well Heeled

The bulletin for the LNG and gas transportation, trading and offshore production industry

In this issue

Introduction

Chief Editor, Nikki Chu

Welcome to the fifth edition of Well Heeled, Stephenson Harwood's bulletin for clients engaged in LNG and gas transportation, trading and offshore production.

Our aim is to provide insights into legal issues, practical recommendations based on matters we have handled and comments on recent developments in the industry.

In this edition, the general theme is to raise awareness of the important legal and technical issues and risks arising from LNG shipping and gas transportation.

We hope you find this bulletin useful, if you have comments or would like to learn more on any topic please feel free to contact chief editor Nikki Chu (nikki.chu@shlegal.com) or any of the other authors.

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Consumption assumptions

LNG is conventionally carried by vessels on time charter terms; the charterer pays the cost of bunker fuels. As most LNG vessels use LNG lost as boil-off for propulsion and other energy needs, charterers provide fuel by allowing owners free use of boil-off occurring during the voyage. As with all tanker time charters, the owners warrant how much fuel is needed to meet required speeds. Conversely, the owners warrant the speed achievable on a given consumption of fuel. In each case, an accurate measurement of the fuel consumed at any given time is needed. How is that achieved for the operation of LNG vessels?

One solution, adopted in the standard ShellLNG Time charter forms, is to calculate consumption by reference to boil-off occurring throughout the voyage. LNG lost as boil-off is measured by taking the quantity of LNG immediately after loading compared to the quantity immediately before unloading. Suitable adjustments are made to take account of temperature, pressure and composition of the cargo. This provides an accurate measurement of LNG lost during the voyage, from which an assumed average daily consumption may be calculated. However, it does not provide a calculation of consumption on any day of the voyage; the actual boil-off on any given day may vary according to a range of factors. Indeed, under the ShellLNG Time Charter actual boil-off is never measured, as such, but simply assumed to have been lost based on the reduction in the volume of LNG in the vessel's tanks for the duration of the voyage. This has a number of consequences that should be considered when approaching any speed and consumption calculation of LNG vessels.

- The consumption taken into account is for all the energy needs of the vessel, and would include any boil-off gas wasted by being burned in the general combustion unit.

- If the volume of boil-off is excessive, the consumption will be deemed to be excessive by the same degree. If owners are required to compensate charterers for excess boil-off, owners would wish to avoid being liable for the equivalent excess consumption.

- The consumption required at slow speeds should not be less than the average daily boil-off naturally generated; alternatively any boil-off not needed at slow speeds should be excluded from the measurement of actual consumption.
- The computation of average daily boil-off taken from the total LNG lost during the voyage is not a reliable method of calculating the consumption occurring during any specified period of the voyage.
- This method of calculation is unsuitable where the vessel has reliquefaction facilities; the definition of consumption would need to be separate from that of LNG lost as boil-off.

These issues, and the relevant charter provisions, are explained in more detail in the soon to be published INTERTANKO Guide to LNG Charters.

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Issues arising from Gas Tanker Voyage Charters

BIMCO and the Association of Ship Brokers & Agents (USA) published the ASBAGASVOY charterparty on 28 September 2020 which is aimed at the chartering of both refrigerated and pressurised liquefied gasses such as LPG and petrochemicals.

ASBAGASVOY is based on the widely recognised ASBATANKVOY charterparty and is specifically adapted to address the gas tanker trade. We will provide our thoughts on the ASBAGASVOY in the next Well Heeled Edition.

In this article we provide our thoughts on a few of the legal and technical issues which can arise in the chartering of gas tankers. We also take a look at GASVOY 2005 and, where appropriate, provide a comparison with the ASBATANKVOY. GASVOY 2005[1] was previously published by BIMCO to address the specific issues which arise in the gas tanker trade.

Presentation

A key issue is the presentation of gas tankers for loading. The presentation clause could affect when a notice of readiness is tendered and when laytime starts to run. For example, Clause 4 of GASVOY 2005 deals with presentation and provides that the vessel is to present at the loading port and satisfy the charterers' inspector that the cargo systems are in conformity with the stipulations in Part I. Clause 4 specifically refers to Clause 6 (Notice of Readiness), to establish a working definition of the vessel being "*ready*".

[1] GASVOY 2005 is a voyage charter party developed for use in the LPG, ammonia and liquefied petrochemical gas trades.

There are a number of different technical issues to consider with regard to presentation. The simplest scenario is where the grade of cargo to be carried is identical to that in the previous voyage. In such cases, the calculations concerning the residual cargo on board carried either as a heel or simply as residue are used to inform the charterparty.

However, where the grade of cargo is different from the previous, the ship must be completely purged of the previous cargo. This involves pumping out (at the discharge port) every drop of liquid cargo, warming the tanks to ensure any residues turn to gas, displacing the gas with inert gas and then, at the loading port, replacing the inert gas with the new cargo in gaseous form. Once this purge is complete, the tanks can be cooled and liquid product loaded.

Another technical issue to consider is the type of cargo previously carried. For example, if the prior cargo was anhydrous ammonia there would be a requirement to wash the cargo system with fresh water. Ammonia is toxic and highly reactive. For this reason, it is dangerous to introduce water into a tank containing ammonia vapour - this is normally removed from the tanks at sea by introducing large amounts of air and ventilating to atmosphere. However, the removal of all traces of ammonia by ventilation alone is a lengthy process. Remaining traces of ammonia may be removed by water washing or water sweeping.

Half Percent Loss Clause

Cargo retention clauses are common in a number of the standard tanker charter forms. In particular, in the carriage of crude oil, a certain amount of residue sticks within the cargo tanks upon completion of discharge. In contrast, whilst gas cargoes do not form a residue, there can be residual amounts. These can be safely ignored if subsequent grades are similar; otherwise they must be totally removed.

The ASBATANKVOY does not contain a cargo retention clause and a provision is usually added in the gas trade dealing with cargo shortages. London Arbitration 10/06 provides a useful illustration. There, an LPG/C type gas tanker was chartered on an ASBATANKVOY form with additional clause 12 (Half percent loss) which provided, inter alia: "*Notwithstanding anything contained in this Charter Party, neither the Owners nor the vessel shall be liable for any other loss or shortage due to incondensable matters, nor for any other loss or shortage except to the extent that such loss or shortage exceeds one half of one percent (0.5 percent) of the bill of lading figure…*"

In contrast, clause 20 (Half Percent Loss) of GASVOY 2005 imposes liability on the Owners for losses or shortages that exceed half of one percent (0.5%) of the aggregated quantity stated in the bill of lading. However, there is no reference to "*incondensable matters*".

The difference between the ASBATANKVOY and GASVOY 2005 clauses here is noteworthy. In many LPG cargoes, there will be a very small amount of impurity, which will not be amenable to reliquefaction, and as such forms a part of the residue of cargo left on board. It is possible that in London Arbitration 10/06 the parties were anticipating cargo could be lost in this way.

GASVOY 2005 is directed at addressing the difficulties that arise from determining the precise cargo quantities loaded and discharged when variables such as density, pressure, temperature and the limitations of measuring equipment are accounted for. An express allocation of liability on Owners for shortages that exceed a specific percentage has the direct benefit of minimising expensive and costly disputes.

When parties are drafting a cargo retention clause, they should consider whether there are any particular types of losses or shortages they would like to include, such as incondensable matters. Parties should also consider whether the drafting is clear enough to include those losses or shortages.

Lighterage Operations

Lighterage is the process of transferring cargo between vessels of different sizes. Lightering operations for gas cargoes carry the same risks, as those for liquid cargo in terms of damage to the ships and pollution. The added risk is that whilst a terminal is quite capable of handling large and unexpected quantities of vapour that may be generated by a mistake on board, the transhipping vessel may not be suitable and the only viable option becomes venting into the atmosphere. The toxicity of many LPG cargoes makes venting highly undesirable.

Clause 18 of GASVOY 2005 is a detailed provision which provides that if lighterage is required, it shall be at the risk, cost and expense of the Charterers. Under Clause 18, Charterers are required to provide a safe and protected area for the lighterage operation, but always subject to the Master's approval. Clause 18 also gives Owners' discretion to approve the lighterage vessel(s) (but approval shall not be unreasonably withheld), which is important if there are concerns about the quality of the vessels used.

The above are some of the specific issues which can arise from chartering gas tankers and in our experience, it is important for parties to identify the key issues at the outset and ensure that the express clauses are drafted to specifically address such issues in the charterparty.

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Renegotiating long-term LNG sale and purchase agreements (SPAs) in a crisis

The current state of the market

According to global energy and consultancy group Wood Mackenzie, "*an already oversupplied LNG market comes out of a mild winter with high inventories across Europe and Asia, only to face a global pandemic which has already destroyed gas demand across China and looks increasingly set to do the same across the Asia Pacific and Europe.*"[1] Added to this over-supply and lack of demand is a desperate lack of storage facilities. This combination of factors has had a dramatic impact on energy prices.

The volatility caused will prompt buyers and sellers in SPAs to revisit their contractual arrangements. This article considers two issues in particular which are likely to arise.

Force Majeure

If there is a Force Majeure clause in the LNG SPA, parties need to examine it closely and ask themselves whether their delay or non-performance is caused by a Force Majeure event as defined in the clause. If there is a specific reference to "epidemic" or "pandemic", parties then need to consider whether they can establish a causal link between the Force Majeure event and the impact on performance: "but for" the epidemic or pandemic, performance would not have been affected. Even if there is no such specific reference, wording such as "compliance with any order or instruction of any port, transportation, local or other authority" could be relied on by an affected party in circumstances where governments are imposing stringent lockdown measures.

Contracts which contain Force Majeure terms will often require strict compliance with procedural requirements to invoke Force Majeure, e.g. notices, provision of documents. The terms will also usually include a time limit by which the affected party must notify the unaffected party and the method in which such notice should be transmitted, for example, by email or registered post.

Reliance on Force Majeure may lead to other contractual consequences such as termination of the contract, suspension of performance or of

[1] LNG Industry, "Wood Mackenzie releases gas and LNG outlook, 1 April 2020".

particular obligations (such as take-or-pay liabilities and delivery obligations, time extensions or allocation of losses). Termination will need to be looked at in the context of the entire supply chain to ensure it is permissible across all agreements.

Parties to long-term LNG contracts may consider it more commercially attractive to look at other contractual ways to face the current disruptions such as re-negotiating terms and introducing flexibility in areas such as destination and additional volume or amending the duration of the SPA.

Price Reviews

Another consequence of a falling demand for and oversupply of LNG is that both sellers and buyers will be looking at the terms of any price review clause. Such a clause is usually found in long-term contracts (typically with a duration of up to 20 years). Given that falling demand has such a negative impact on markets, parties will be looking to see whether the price review clause can be triggered.

Whether the clause can be triggered will depend upon a number of factors such as the terms of the clause itself, the formula used to calculate the LNG priced under the SPA and the identity of the comparator "market".

LNG is usually delivered on either an FOB or DES delivery basis. Of course, the problems of finding the correct comparator market are obvious. There may be no actual LNG "market" at the place of delivery under an FOB contract (the place of shipment of the LNG) and at the discharge port where there is a mature gas market. A classic example here would be the prospect of FOB shipments from the Canadian East Coast to the European markets. Here, the gas markets would be priced by reference to the Dutch TTF or UK NBP prices. In long term contracts used in Asia, the LNG price is usually indexed to crude oil prices such as the Japanese Customs-cleared Crude or "JCC" price. When considering the price review clause and looking to how one chooses the comparator, one needs to compare "apples with apples" - the disjoint between the place of delivery and the actual market may require an adjustment to the comparator or to the elements that make up the comparator. A classic conundrum may be where the contract is under FOB terms but where the pricing is on a "delivered" basis i.e. DES and where the price will involve a netting back of the delivered price by deducting the freight cost, regasification costs and any gas "market entry" costs which may form part of the comparator "delivered" gas price but not for arriving at an FOB value at the load port.

Having identified and defined the contract price and comparator, consideration needs to be given to the trigger requirements; what is the required level of divergence and of what, over what period, are we looking at averaging the divergences and over what period does the averaging take place (within a quarter, at the end of each quarter and should the averages be rolling and what, if any, indices can be used)? Finally, should the trigger be proven or simply determined by a party's reasonable opinion, this can then raise issues as to whether the price review requires a hearing (whether by expert or arbitration).

There are other questions and issues that arise. For example: should there be a period where the parties try to negotiate a new price, including considerations of when and over what period; if there is no agreement, what are the criteria a tribunal or expert are entitled to look at to decide any new price; and is this the first ruling by the tribunal or expert, if not, do any earlier rulings have relevance? Such clauses typically entail a framework which involves good faith discussions between the parties followed by arbitration, if it is not possible to reach agreement. They also specify the circumstances and at what stage those discussions can begin. This could be every three or five years and/or on the occurrence of specific events.

While an oversupply of LNG may put buyers in a stronger negotiating position to adopt a more aggressive price review, in the absence of clear wording in the SPA, a buyer will have no contractual right to demand a review simply because of the pandemic.

If a buyer is trapped in an unfavourable position, other options may need to be explored such as economic hardship clauses or a re-negotiation of the entire deal by committing to purchasing greater volumes. Subject to the terms of the SPA, parties may be able to exercise a termination right if they are unable to reach an agreement on the price review, but again this needs to be looked at in the context of the overall supply chain.

Closing Remarks

These are unprecedented times which will impact global economies for a substantial period of time. Commercial parties would be wise to negotiate alternative solutions such as a price and delivery adjustments, deferring or cancelling take-or-pay obligations, amending the contract duration or introducing quantity and destination amendments. Renegotiation of some of these key terms with flexibility in mind would serve to alleviate and mitigate the commercial impact caused by the current crisis.

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LNG bunkering

Introduction

In recent years a number of issues have arisen in relation to the supply of traditional marine fuels. In 2014, the insolvency of OW Bunkers exposed a number of deficiencies in the standard form contracts routinely entered into for the sale and purchase of bunkers which left buyers at risk of being obliged to pay twice for the same fuel. In 2018, numerous vessels encountered difficulties in burning bunkers supplied out of the US Gulf Coast, but the cause of those difficulties has never been established definitively.

LNG has a long history of being used effectively and safely as fuel on board LNG carriers. More recently, LNG has been used as fuel on other types of vessel but initially this was on the basis of dedicated LNG supplies to specific vessels. With the advent of IMO2020, LNG is being considered as a more environmentally friendly alternative to traditional marine fuels on a wider range of vessels and it is thought that a spot market for LNG bunkers will develop that is similar to the current market for traditional marine fuels.

However, should LNG be treated as just another form of bunker fuel?

LNG specifics

LNG bunkers have historically been supplied from tanker trucks or shore terminals but it is envisaged that supplies will increasingly be delivered from LNG bunker barges, and it is this form of supply upon which this article will focus.

LNG is inherently very different to traditional marine fuels, and as a result the operational and safety constraints associated with the supply of LNG bunkers are also very different to those relating to the supply of traditional marine fuels. In particular:

- LNG is carried at or just below its boiling point, which cannot effectively be handled and used without proper management of its vapour. That vapour is flammable and any escaping vapour poses an immediate and far-reaching hazard.
- LNG is inevitably lost as boil off, which reduces the quantity of LNG in the tank. The composition of the LNG will also change over time (a process known as weathering) and this will alter the

specification of the LNG which may in turn lead to inefficiency of combustion.

- LNG is stored at -162°C. This necessitates the use of insulated hoses with line inerting, purging and cooling and stringent emergency shutdown procedures. Leaving aside the risk of death or personal injury, LNG leakages have the potential to cause damage to the steel of the LNG bunker barge and the receiving vessel.
- The bunker tanks of the receiving vessel must be cooled before receiving LNG and the manifold connection on the receiving vessel must be compatible with the supply hose on the LNG bunker barge.
- Differentials in temperature and density must also be avoided when supplying LNG into tanks already containing fuel to minimise the risk of major vapour flashing and rollover, which will lead to significant pressure increases in the receiving tanks. Atmospheric tanks have a very low tolerance to overpressure.
- Safe loading levels must be monitored carefully as liquid and vapour volumes will expand, increasing the pressure in the receiving tanks and reducing available storage.
- The measurement of the quantity of LNG delivered must take into account temperature, pressure and vapour return.
- Effective crew training on the safe handling of LNG including purging and cooling procedures is essential. Crews on LNG carriers have such training as a consequence of dealing with LNG as cargo, but this will not be the case on other types of vessel.

LNG bunker supply contracts

In view of the matters set out above, it is not possible to take a contract for the supply of traditional marine fuels and to use it for the supply of LNG bunkers by simply replacing all references to RMG380 with LNG. The following issues need to be taken into consideration when contracting for the supply of LNG as bunkers:

Quality and Sampling

Buyers of traditional marine fuels will be very familiar with the various editions of the ISO 8217 standard and suppliers of those fuels will endeavour (with varying degrees of success) to deliver to that standard. However, there is no equivalent international standard for LNG bunkers as the precise composition of LNG will differ depending on the composition of the feed gas.

Whilst these differences in composition should not affect the ability of the vessel's engines to consume the LNG, consideration will need to be given to the parameters which should be specified. For example, the efficacy of the LNG as fuel will depend on its methane number and provision may need to be made for the reduction in the methane number over time due to weathering.

The quality of traditional marine fuels is usually assessed by the testing of retained samples and parties endeavour to have those samples taken as close as possible to the point at which title and risk in the fuel passes from the seller to the buyer. However, the nature of LNG means that any breaks in the system (e.g. sampling ports) involves significantly greater risks than with traditional marine fuels. Those risks can be ameliorated by the use of samples taken at the shore facility at which the LNG is produced, but this will inevitably lead to disputes about the representativeness of those samples. Issues are also likely to arise in relation to the safe retention of buyer's samples on board vessels which are not specialist LNG carriers.

Quantity

It may not be appropriate to measure the quantity of LNG supplied simply by volume or mass as the calorific value (i.e. its efficacy as fuel) will also be relevant. If the quantity delivered is to be assessed by reference to the LNG's calorific value then provision will need to be made in the supply contract as to how this is to be assessed.

The measurement of the quantity of LNG supplied will also need to take into account the vapour returned from the receiving vessel to the LNG bunker barge during the supply of the LNG (which will be re-liquefied on board the LNG bunker barge).

Title and Risk

The vapour return during the supply of the LNG will also be relevant to the question of the transfer of title and risk, as it means that the traditional transfer of title and risk at the manifold of the receiving vessel or bunker barge is not appropriate. It may therefore be necessary for the transfer of title and risk to be delayed until loading has been completed and the quantity of LNG supplied has been determined.

Whilst there is no reason in principle why contracts for the supply of LNG as bunkers cannot contain the retention of title clauses (and associated licences to consume) found in contracts for the supply of traditional marine fuels, it must be borne in mind that (a) the residual quantity of LNG will inevitably reduce over time due to boil off if the gas cannot be burned as fuel; and (b) the specification of the LNG supplied will inevitably change over time due to weathering, making such clauses less effective.

Delivery

As has been set out above, the operational and safety constraints involved in the supply of LNG as bunkers are very different to those associated with the supply of traditional marine fuels. It will be more important for the vessel to arrive within the delivery window, and she will need to arrive with her bunker tanks pre-cooled and ready to receive the LNG (and the contract will need to allocate responsibility for the receiving vessel arriving late and/or in a condition where she is not ready to receive the fuel).

The bunkering operation will need to be planned carefully to ensure that the receiving vessel is compatible with the bunker barge and there will need to be a clear exchange of information between the receiving vessel to ensure that there are no issues with temperature and pressure differentials if the LNG supplied is to be commingled with fuel already on board the receiving vessel.

Consideration should also be given to allocating responsibility for making the connection between the bunker barge and the receiving vessel to the LNG bunker supplier, given that the bunker supplier will have more experience of and expertise in handling LNG.

Health, Safety and the Environment

The standard form contracts for the supply of traditional marine fuels often provide that "*The Seller shall not be responsible in any respect whatsoever for any loss, damage or injury resulting from any hazards inherent in the nature of any Marine Fuels*" and that "*If a spill occurs during the supply Buyer shall promptly take all action reasonably necessary to remove the spillage and mitigate its effect. If the Buyer fails to promptly take such action, the Seller may, at its option and upon notice to the Buyer, take such measures it considers to be required in connection with the removal of the spillage. The Buyer will indemnify the Seller against all liability, costs and expenses incurred by the Seller in accordance with the provisions of this clause*".

Whilst the LNG bunker supplier will understandably wish to minimise its potential exposure to liabilities, in circumstances where that supplier will have much greater experience of and expertise in handling LNG than the owner of the receiving vessel, consideration should be given to making the supplier responsible for the risk of matters such as spillages during the supply (with appropriate carve outs for issues which occur as a result of negligence on the part of the receiving vessel).

Conclusion

As matters stand, it appears that LNG will become an increasingly important source of marine fuel. However, when contracting for the supply of LNG bunkers care needs to be taken not to perpetuate the deficiencies which have been exposed in the standard form contracts for the supply of traditional marine fuels and to take into account the very different nature of LNG.

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The Five Principal Hazards – Transporting Liquid Gas

Hydrocarbon and chemical gases are widely used as fuel, as a chemical feedstock to produce plastics and fertilizers, and to enable industrial processes such as the manufacture of pesticides.

These substances exist as gases in normal atmospheric conditions and are uneconomical to ship in quantity in this form. Refrigerating the gases to their liquid form is the preferred method of moving these gases in bulk because of their typically high expansion ratios.[1]

The transportation of liquid gas presents five principal hazards that must be effectively managed if it is to be carried out safely. Failure to do so can result in losses that are at best undesirable and at worst catastrophic.

The hazards to people are, in general order of severity (highest first),

- Fire/explosion (in gaseous form)
- Very low temperature
- Asphyxiation
- Toxicity
- Chemical burns

A more detailed description of each hazard is considered below.

Gas carriers are designed to prevent the crew and shore personnel from being exposed to these five principal hazards. This is not a simple matter and so gas carriers are technically complex and operated by specifically trained crews. High standards of maintenance, careful supervision and strict adherence to procedures are the most effective hazard control measures.

[1] The expansion ratio of a liquefied and cryogenic substance is the volume of a given amount of that substance in liquid form compared to the volume of the same amount of substance in gaseous form, at room temperature and normal atmospheric pressure.

Substance	Flammable	Carriage temperature °C	Toxic or Asphyxiant	Corrosive	Narcotic
Methane	Yes	-160	Asphyxiant	No	Yes
Ethane	Yes	-90	Asphyxiant	No	Yes
Propane	Yes	-45	Asphyxiant	No	Yes
Butane	Yes	-1	Toxic	No	Yes
Ethylene	Yes	-104	Asphyxiant	No	Yes
Propylene	Yes	-48	Asphyxiant	No	Yes
Butylene	Yes	-6	Toxic	No	Yes
Butadiene	Yes	-5	Toxic	Yes	Yes
Ammonia	Limited	-35	Toxic	Highly	Yes
Vinyl Chloride	Yes	-14	Toxic	Yes	Yes
Ethylene Oxide	Yes	-20	Toxic	Highly	Yes
Propylene Oxide	Yes	-18	Toxic	Highly	Yes
Chlorine	No	-34	Toxic	Highly	Highly

The table above lists the principle products carried as liquefied gas together with an overview of the hazards they present. Whilst the first three hazards apply to all gases, toxicity and chemical burns are hazards most associated with the chemical gases. In addition to toxicity, most gases in enough concentration will have a narcotic effect which will affect alertness, perception and mobility.

When carried by sea the shipper must provide the carrier with a data sheet setting out all the physical properties of the cargo, the hazards it presents and the means to deal with those hazards if they materialise into harm.

Fire and Explosion

Gas cargoes are liquefied to provide more efficient transport. This costs money and the cooler the liquid the more the cost. As such, liquid gas cargoes are carried typically at just below their boiling point. That means that there will be cargo in vapour form above the surface of the liquid. This vapour exerts a pressure on both the liquid and the containment and pipework. The containment is typically designed to accommodate an overpressure of about 0.3 bar and allows for some flexibility during cargo operations. Gas carriers are designed to keep the vapour in a closed cycle i.e. nothing gets in or out of the containment and pipework. This is because these cargoes are characterised by the flammability of the evolved vapour.

Small leaks are always possible where both on board and in the terminal there is so much jointed pipework. The rapid and energetic vaporisation of spilled liquefied gases is far more extensive than in the case of oil. The chances of ignition following a spill of liquefied gas is therefore much greater. This is why gas carriers and terminals put so much emphasis on the intrinsic safety of electrical equipment [1] by design, prohibition on the use or carrying of unapproved equipment or smoking materials and specifying materials for hand tools that will not generate a spark if dropped.

All hydrocarbon vapours, and most chemical gas vapours, are flammable. Ammonia is difficult to ignite but it will, burning with a relatively cool, pale blue flame. Some vapours, like methane, rise and dissipate rapidly. Others, like vinyl chloride, are much heavier than air and will linger around the ship's structure.

Very Low Temperatures

In normal operations the product cools pipework to very low temperatures. In practice the exposed pipework insulates itself by growing a sheath of water ice condensed from the atmosphere. The ice sheath may protect the unwary from the worst effects of direct contact.

[1] This includes portable communications, monitoring equipment, lighting, pumps and switchgear. There are rigorous engineering standards for intrinsically safe equipment.

Human tissue begins to suffer damage as soon as it is in direct contact with temperatures below 0°C. The severity of the resulting injury is dependent upon the temperature encountered and the length of exposure.

In the case of a cargo spill, direct exposure to most liquid gas cargoes will result in catastrophic damage to the affected tissue. There are anecdotal stories of crew members surviving being doused in LPG by jumping into the sea. Survival is only the avoidance of death and so contact with liquid product will be, at the very least, a life changing experience.

Liquid product in contact with the ship structure outside the containment will cause rapid cooling of the steelwork which in turn leads to brittle fracture and structural failure.

Liquid product entering the sea rapidly forms large chunks of ice, a mixture of water and product. The product is now at the point where very large quantities of vapour rapidly evolve and the subsequent pressures achieved cause violent detonations within the ice. This is Rapid Phase Transition. Although the explosions are not caused by combustion, they are still capable of hurling large chunks of ice great distance and at speed.

Asphyxia

Humans need to breathe air with an oxygen content of 21%. Slightly lower concentrations are tolerable for short periods. Anything below 19% rapidly brings about mental impairment, reduced mobility and confusion. At less than 16% loss of consciousness occurs and if the oxygen level does not increase, brain damage and death will follow.

Oxygen contents, particularly in enclosed spaces, can be reduced if the air is partially replaced by cargo vapour or the inert gas used to displace air from cargo containment.

Some cargo vapours are of themselves toxic. Most of the hydrocarbons are not inherently poisonous but while reducing oxygen content they also have a narcotic effect of their own, hastening the point at which impairment threatens escape or survival.

It is a common misconception that oxygen deficiency is noticeable and comes on at a rate slow enough for the victim to take corrective action. In practice this is not the case; impairment and unconsciousness occur quickly. Without immediate access to an independent portable air supply, self-rescue is unlikely.

Toxicity

Toxicity is the ability of a substance to damage the brain and/or body if inhaled or touched. Ammonia, chlorine, ethylene oxide and propylene oxide are also very corrosive to the skin. Vinyl chloride is known to cause cancer at low concentrations and butadiene is suspected as having similar harmful effects.

In the case of fire, the incomplete combustion of hydrocarbon vapours may produce carbon monoxide which is also found in inert gas. Vinyl chloride fires produce carbonyl chloride, more commonly known as phosgene.

Toxic substances may result in one or more of the following effects:

- Permanent damage to the body
- Narcosis
- Corrosion and/or irritation of the skin, lungs, throat and eyes.

One useful measure of toxicity is the Threshold Limit Value (TLV), the concentration of the substance that can be inhaled or touched with no permanent ill effects. TLV is usually quoted in ppm (parts per million of vapour-in-air by volume) but may be quoted in mg/m3 (milligrams of substance per cubic metre of air).

However, it is not just the threshold that determines toxicity, but exposure over time. Safety Data Sheets contain more detail regarding exposure, but in general terms, no liquid gas cargo vapour is safe to be around in any concentration.

Curiously ammonia, one of the most toxic gases, is also the smelliest. The average person can smell ammonia at levels far below the TLV. The same is not true of other products which are essentially odourless.

Chemical burns

Chemical burns are caused by acids or oxidisers. The destruction of tissue is similar to radiation burns but there are critical differences. All oxidisers are highly miscible with water and so concentrated vapours will dissolve into eyes and sweat on the skin to form acid solutions. Chemicals may soak into clothing, making contact more persistent and prolonged. Chemical burns can also lead to poisoning. Finally, chemicals which are inhaled or ingested can cause severe burns and swelling to the nose, throat and digestive tract.

Associated hazards

LPG cargoes are prone to either the formation of hydrates[1] or polymerisation.[2] Hydrocarbons tend to form hydrates and vinyl chloride and butadiene are prone to polymerisation. Both processes can damage the cargo and cause an unsafe situation on board.

These processes can be prevented by adding chemicals, known as inhibitors, into the cargo. Typical inhibitors for hydrates are ethylene glycol or methanol. Inhibition of polymerisation typically uses hydroquinone or tertiary butyl catechol.

These substances are as unpleasant as they sound. They will be present in a spillage of liquid product or from their own containments on board. As with all hazardous substances, there will be a Safety Data Sheet to guide the crew. They are toxic and corrosive.

Summary

The safe handling of liquid gases is a mature and well researched activity. Although the consequences of a mistake can be catastrophic, the safety record of the industry in the context of quantities shipped worldwide is very good. That said, there will always be operators who seek to cut into safety margins to offer a better price. When the consequences of a loss on the balance sheet and reputation are weighed against the difference in price offered by reputable carriers against the lowest possible price available, going too cheap seems like a false economy and I advise against it.

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Marine Director

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[1] Some hydrocarbon cargoes will combine with water under certain conditions to produce hydrates that resemble crushed ice or slush. The water for hydrate formation can come from purge vapours with an incorrect dew point, water in the cargo system or water dissolved in the cargo. Hydrates can cause pumps to seize and monitoring equipment to malfunction.
[2] The combination of two or more molecules of the same chemical to form a larger molecule called a polymer. The reaction can become self-propagating causing liquids to become more viscous or even solidify. Polymerisation is strongly exothermic.

Case digest

Defective passage plan – vessel unseaworthy

The passage plan is an aspect of seaworthiness, not of navigation. The passage plan on board the CMA CGM LIBRA was defective because it did not record a warning to mariners about depths outside the fairway being unreliable. A prudent owner would not have sailed with a passage plan which was defective or inadequate in the way in which this one was.

Therefore the vessel was unseaworthy at the beginning of the voyage. Owners were not able to claim contributions in general average from cargo interests.

(*Alize 1954 and CMA CGM SA v Allianz Elementar Versicherungs AG* [2020] EWCA Civ 293)

Limitation of liability – whether party could limit as "operator"

Stema UK was able to limit its liability as operator of a dumb barge which broke free from its anchor and caused damage. This was in spite of the fact that Stema UK had only been involved for two weeks putting people on board to safely anchor the vessel and ensure safe ballasting. It had been the only company operating the vessel at that time. Stema AS was the charterer of the barge and operator at all other times, but there could be more than one operator for the purposes of the Convention.

(*Splitt Chartering v Saga Shipholding, The "STEMA BARGE II"* [2020] EWHC 1294 (Admlty))

Demurrage time bar – supporting documentation – bill of lading not provided

Where the charterparty required "all supporting documentation" for demurrage claims and that demurrage should be calculated by reference to bill of lading quantities, the provision of the statement of facts was not sufficient, even though it recorded the bill of lading figure. The bill of lading was within the definition of "all" supporting documentation. Owner's demurrage claim was therefore time-barred.

(*Tricon Energy v MTM Trading LLC* [2020] EWHC 700 (Comm))

Charterparty – subject supplier's approval

The requirement during charterparty negotiations that the vessel had to be approved by the supplier of the cargo was a pre-condition of the contract coming into existence. Therefore no binding contract had been concluded and the defendant was not liable to pay the claimant owner damages.

(*Nautica Marine Limited v Trafigura Trading LLC* [2020] EWHC 1986 (Comm))

Bill of lading – apparent good order and condition

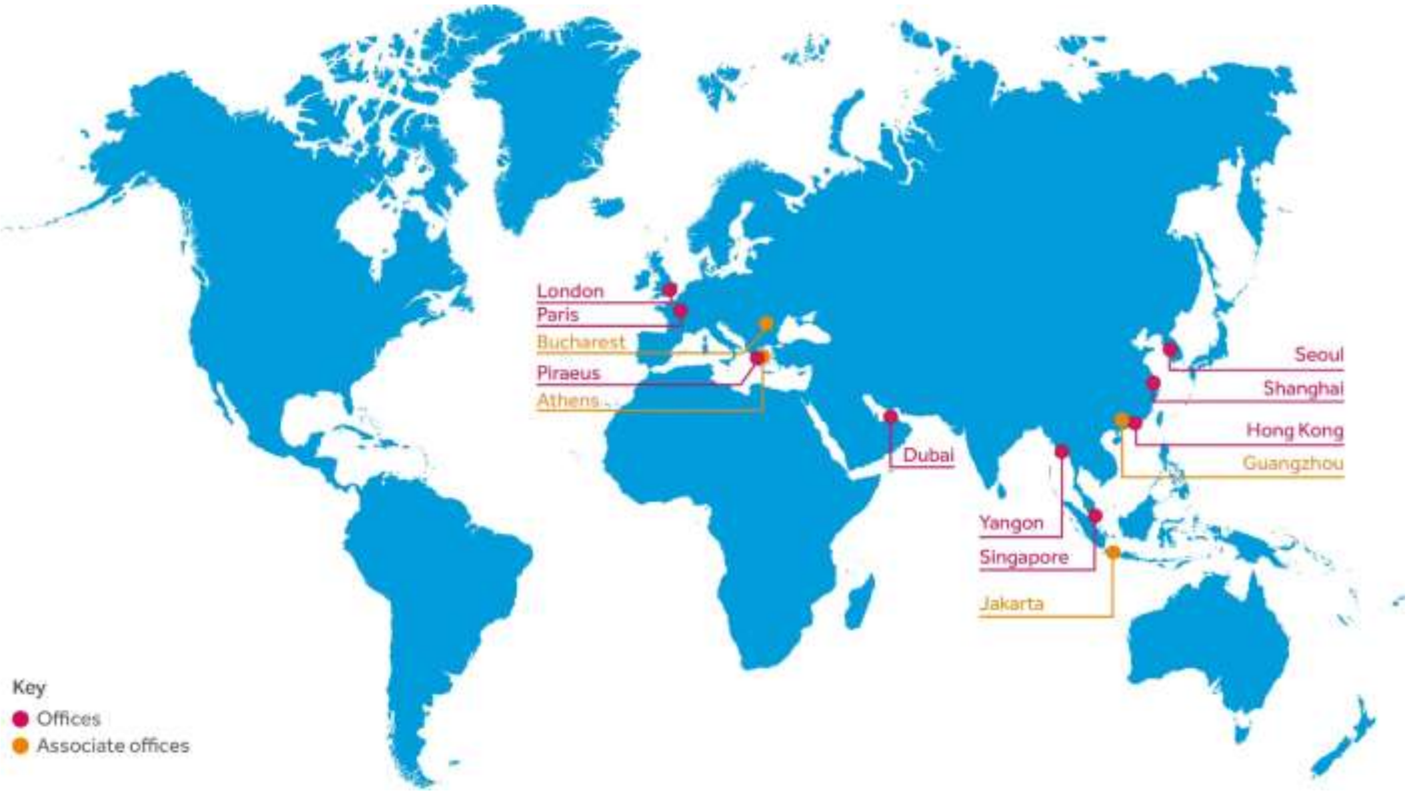
A statement in a bill of lading that cargo was in "apparent good order and condition" was not a warranty by shippers. It was an invitation to the master to make a representation of fact in accordance with his own assessment of the cargo condition. Where cargo damage was not reasonably visible to the Master, the representation that it was in "apparent good order and condition" was accurate.

There was no implied indemnity in respect of the statement of apparent good order and condition on the bill of lading.

(*Priminds Shipping v Noble Chartering, The MV "TAI PRIZE"* [2020] EWHC 127 (Comm))

Staying in touch

Stephenson Harwood has a leading team of specialist lawyers with true strength in depth in all aspects of LNG. Please see below a breakdown of our offices which are able to assist with any concerns or issues. We would be pleased to organise a remote workshop to discuss any of the issues raised in this edition of Well Heeled.



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Get in touch

If there is a topic or area that you would like us to cover in future editions, or if you have feedback or comments, get in touch by email (nikki.chu@shlegal.com) or telephone (+44 20 7809 2631).

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