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HKJB & HKIMT Activities

Technical Seminar on "LNG – The Future of Hong Kong"

A technical seminar about "LNG – The Future of Hong Kong" was jointly organized by HKJB, HKIMT and HKIE MMNC on 16 August 2017. We are privileged to have Mr Kaushik Roy, who is the SHEQ Manager, DPA & CSO of China Energy Ship Management Co Ltd, as our speaker.

Mr Roy firstly introduced Hong Kong's Climate Action Plan 2030+ ("the Plan") before highlighting the latest situation of using LNG in Hong Kong. According to the Plan, in order to make Hong Kong a better place to live and work in, we should target to reduce 65% to 70% of the carbon intensity of the 2005 level by 2030. Since electricity accounts for about 55% of the annual energy use in Hong Kong, it means that almost all our coal-fired power plants should be phased out to achieve our target by 2030 in the Plan.

Then what should the electric companies do to achieve this target? The answer lies in the reliance of cleaner fossil fuels. Mixing natural gas in fossil fuels for electricity generation will achieve this goal.

Over 90% of electricity is consumed by residential and commercial buildings in Hong Kong. When comparing the use of fossil fuels, renewable energies and LNG, LNG appears to excel in these options. Its major advantage is its efficiency in producing energy, which is much higher than other fossil fuels and

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the renewable energies. In addition, LNG is in abundance and is more economical to mine and transport in the liquid form.

Not only can LNG be used in power plants to generate electricity, it can also be used in locomotive engines and in the household for heating and cooking. Thus, with its multipurpose usage and cleaner nature, LNG is a suitable energy source for Hong Kong to achieve the goals in the Plan.

Hong Kong has a strong marine background. The expansion of the LNG market means that Hong Kong has to transform its infrastructure and trading pattern to accommodate this increase. Its LNG fleet, LNG import and export trade and LNG terminals will have to expand. In the process, Hong Kong may be transformed into a major LNG bunkering hub for passenger and container ships in the region.

In conclusion, Mr Roy highlighted the need of LNG for Hong Kong. His presentation gave the audience clear perceptions about LNG, its current development and environmental impact, supply and demand, and the considerations of using LNG as an alternative fuel for power generation. The seminar ended with a question-and-answer session. Many of the participants raised their interests on the use of LNG in Hong Kong. Mr Roy's presentation was very inspiring and was well received by the audience.

(*Reported by Mr HO Wang Kit Reggie*)

InnoTech Expo 2017

This year is the second year InnoTech Expo was held at Hong Kong Exhibition and Convention Centre in Wan Chai, Hong Kong. Thanks for Our Hong Kong Foundation who organised such meaningful event that by inviting mainland renown scientists and engineers to present talks on state of arts scientific development of China, moreover some models and / or real products were also exhibited for visitors to have actual experience on the recent magnificent achievement of Chinese science and technology development. This year's theme was revealing of China

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past scientific achievement and the revitalization of scientific development in modern China. The Expo started on 24 September 2017 to 2 October 2017. The opening ceremony attracted over 300 guests and notable guests included The Chief Executive of HKSAR, Ms Carrie Lam Cheng Yuet-ngor and honourable guest speaker: Minister of Ministry of Science and Technology, State Council, Mr. Wan Gang.

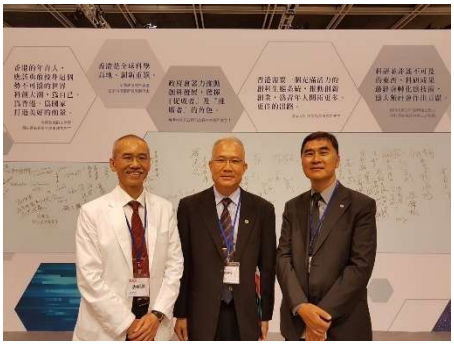
Mr. Wan Gang delivered his speech to express China's goal to become an innovative science country. To achieve the goal Chinese government has set objectives by 2020 to be listed as one of the innovative science and technology countries, in 2030 China aims to be the leading members of innovative science and technology countries and by 2050 about 100 years anniversary of People Republic of China, China will be leading the world in innovative science and technology.

In his speech, he gave positive comments on local innovative development in robotics, bio-medical, smart city and financial technology; and in addition he expressed his strong view that Hong Kong should look after young people to have their development prospect in innovative science and industry. To accomplish this objective he gave his advices in three directions:

Firstly both mainland and Hong Kong have to take opportunities by sharing and benefit each other the advantages in innovative science software and hardware, in order to unite together to build an international innovative science road of success.

Secondly community should encourage young people to participate in trend of innovative industries, provide a platform for mainland and local innovative industries leaders and participants become friends or partners.

Thirdly mainland departments would increase resource, investment and policy making to push Hong Kong innovative science development momentum in particular to provide good and healthy conditions and environment for youngster to walk their innovative industry development road.



Other than the opening ceremony, some HKIMT council members also attended the Forum: Legendary in Deep Sea presented by well experienced deep sea exploration team leader Mr. Liu Xin Cheng who led the national famous manned submarine "Jiao Long (蛟龍)" to break the world deep diving record at depth of 7,062 metres in 2012. Moreover, China also developed unmanned abyss landing platforms with code named "Yuan Wei Shi Yan (原位實驗)", "Wan Quan (萬泉)" and "Tian Ya (天涯)" respectively to explore

ocean depth up to 10,800 metres. In addition, China also developed "Hai Yi (海翼)" deep sea glider to carry out sea bed survey and searching duties up to depth of 6,239 metres.

In the closing ceremony the organiser acknowledged all supporting organizations including HKIMT.

(*Reported by Ir. Moon-chung Chan*)

Members' Corner

Investigation of LNG cargo overflow on a vessel

1. Summary

An LNG (Liquefied Natural Gas) vessel overflowed its LNG cargo from No.1 tank vent mast while she was ramping up its cargo at a terminal in 2015. The accident caused the brittle fractures of its upper deck and the rounded gunwale. The accident had undermined the reputation of the owner, ship management company and charterer. The presenter of this seminar who represented one of the interested parties, had participated in the investigation of the accident. The investigation carried out an in-depth analysis to the causes of the accident. It was hoped that the content of this seminar will provide a lesson to be learnt for LNG operators and managers.

1.1 Briefing of accident

On the 7th day in certain month, an LNG vessel was fully loaded with LNG cargo and set sail to the discharge port. By 19th, the vessel berthed at its destination and started to discharge its LNG cargo. It commenced the discharge at 17:12 local time. By 19:59, reports were received that LNG gas was venting from the No.1 vent mast and the safety relief valve was also lifted. By 20:10, LNG had overflowed from the vent mast to the trunk deck. At 20:12, manual emergency shut down (ESD) was activated from the cargo control room by the cargo officer and cargo transfer stopped. By 20:15, the onboard and company emergency response was initiated with the assistance from the Ship Emergency Response Service. By 21:40, a new discharge plan was developed and was approved by the terminal and the ABS Class surveyor. At 10:36 on the next day, the vessel completed the discharge and proceeded to the outer anchorage waiting for the accident to be investigated.

1.2 Hazard of LNG

Liquefied Natural Gas (LNG) is a natural gas (predominantly composed of methane, CH4 and also a small amount of ethane C2H6). The gas is liquefied for ease of storage and transportation. LNG in

its liquid state will take up about 1/600th of the volume of its gaseous state at atmospheric pressure. LNG is odorless, colorless, toxic and non-corrosive. Its hazards to human include the formation of a flammable atmosphere, low temperature burns and asphyxia. During the liquefaction process, impurities such as dust, acid gases, helium, water, and heavy hydrocarbons which may cause blockage, corrosion, toxicity, stratification and rollover in the downstream are removed. LNG can be condensed into a liquid at atmospheric pressure by cooling it to approximately −162 °C. The maximum allowable transportation pressure in the tanks is around 25.0 Kilo Pascal.

LNG in its liquid state is cryogenic. When it leaks, it will produce a white cloud. The white cloud is formed due to the condensation of water vapour in the atmosphere by the cold LNG. When LNG temperature is raised to -107℃, its density is the same as that of air. When the LNG temperature is higher than -107℃, its density is lighter than air. It will be able to spread easily in air to form an explosive mixture. Spillage of low temperature liquefied LNG will cause ductile-brittle transformation on the steel structure and the excessive thermal stress will cause it to brittle fracture. If liquefied LNG is in contact with the skin, low temperature burns of the skin will result due to the endothermic process of LNG when it vapourises.

1.3 Impact of Accident

After the accident, the LNG vessel had to go to the shipyard to repair its deck structure and gunwale. As the repair was quite substantial, a special survey had to be carried out before reinstating its certificates. Fortunately, there were no injuries and had not resulted in any environmental pollution. However, the vessel was off hire for more than a month and the direct economic loss was counted in millions of dollars. On top of this, the ship management company's reputation was adversely affected resulting in an unmeasurable indirect economic loss to the company.

2 Direct / indirect causes of accidents

2.1 Direct cause - defective equipment

Following the investigation of the accident, it was found that the positioning pointer on a valve CL100 did not synchronize with its actuator. The Integrated Automation System (IAS) and the valve flag were shown to be in a fully closed position. However, the valve was in fact fully open. It was found that the mechanical parts between the valve and the actuator that activates the positioner was corroded seriously. This had allowed the positioner to jump from where it should be to other positions. This malfunction had caused the valve positioner not to work correctly prior to the accident. It could be concluded that the malfunctioning of the valve CL100 was the direct cause of this accident.

2.2 Indirect cause - failure to notice the rising liquid level

During of the cargo discharging operation, the cargo operators did not check the changes of the soundings in the LNG cargo tanks. At 19:57, the Gas Engineer noticed the Custody Transfer Metering

System (CTMS) 99.2% Extreme High Level (EHL) alarm and also a drastic increase in tank pressure. He reported the increase in tank pressure to the Cargo Officer but did not report the CTMS status as he believed this was not his responsibility. None of the officers receiving the report took any action. And at this time, the deck watch reported that the safety valve was fluttering. The First Mate and Gas Engineer were ordered to go on deck immediately to investigate leaving the cargo officer alone in the Cargo Control Room.

The International Convention on the standards of Training and Certification and Watchkeeping for Seafarers (STCW Convention), Oil Company International Maritime Forum (OCIMF) and related regulations have clearly stated that during LNG cargo operations, the cargo operators shall always monitor the cargo tank level and any additional tank monitoring systems.

The basic procedure for the operator to always double checked that the cargo pumping system was operated correctly had not been carried out. If this procedure had been carried out, the cargo operators should be able to determine that related valves are in their correct working positions by inspecting the cargo pump discharging pressure and suction pressure. These are good practices in the LNG operations to countercheck that there are no errors in the electronic signals transmitted from the valve positioners.

2.3 Indirect cause - human error

The emergency shutdown (ESD) system and the ship-shore ESD link is a requirement of the International Maritime Organization (IMO) code for the carriage of liquefied gases in bulk and is also a recommendation of The Society of International Gas Tankers and Terminal Operators (SIGTTO). The ship and terminal's emergency systems are linked via a ship-shore umbilical cable which carries the ESD, telecommunications and data signals immediately after the ship is berthed at the jetty. This system is to protect the ship and terminal in the event of cryogenic leak or fire on the ship or at the terminal. The system will stop the flow of LNG liquid and vapor by shutting down the pumps and gas compressors as well as manifold and ship-side valves.

The vessel's ESD system was activated at all times irrespective to whether the vessel is at sea or in port. When at sea, all manifold and tank filling valves were held in the open position for drainage and the cargo and spray pumps were held in the off position. The cargo compressors may be operated as normal, but will stop if an ESD is initiated. The shore ESD input was blocked in the At Sea IAS condition when the vessel was at sea. The control and processing circuitry was installed in a Safety Link Cabinet in the cargo control room. ESD signals from and to the IAS and cargo control ESD system were fed to the Safety Link Cabinet as telephone signals. The IAS graphic screens would indicate the reason for the ESD situation by changing the color of the item from green to red that caused the ESD. Cargo pump and spray pump symbols would also change color, indicating that these pumps were block from immediate and subsequent operations.

The vessel's cargo plan had clearly stated that in the event of a venting situation, the ESD should be activated manually. This was in line with Company and Industry requirements.

Starting from 19:59, the LNG cargo was vented from No. 1 cargo tank vent mast until 20:12 after the Chief Mate pushed the ESD button in the cargo control room to stop the cargo operation. Thirteen (13) critical minutes had passed before appropriate action was taken to prevent or reduce the impact of the LNG overflowing accident. Both Second Mate and Gas Engineer were unable to activate the ESD on deck because they were unable to find it in the white LNG vapor cloud on deck. The fast development of the accident meant they did not have the time to stop and think what to do next. It was the requirement that when LNG cargo overflow was reported, nobody triggered the ESD system except the Cargo Officer. This was a serious human error in this accident.

2.4 Indirect cause - failure to supervise

On the 7th, when the LNG vessel left its loading port, the cargo officer had inhibited vessel's tank protection system (TPS). With reference to the Company's SMS checklist, if the tank protective system had to be inhibited or reinstated, such operation had to be approved and witnessed by the Master. However, the Master just signed the log book.

The unloading cargo plan also explicitly required that tank protective system must not be inhibited during the cargo operation. The Master did not verify the discharging plan. He only signed for the receipt of the plan. Many LNG vessel cargo officer believed that prior to discharging cargo, tank protective system should be inhibited to avoid the cargo tanks high-level or low-level alarm from triggering the tank protective system. This was a convenient practice to avoid cargo pumps or spray pumps tripping by the protection system during cargo operation. It was an "an unspoken rule" which had assumed that all cargo equipments were in good operating conditions. However, this practice had very serious consequences. The Master fully realized this practice but chose to leave it alone.

The Master had the responsibility to supervise cargo operations in situ or through other means, especially at the beginning and the end of the cargo operation to correct any inappropriate operation behavior promptly carried out by the cargo team to avoid the occurrence of potential accidents. The Master of this LNG vessel had neglected his supervision and management duties which had caused the line of supervisory mechanism to break down and the occurrence of this LNG cargo overflowing accident had become inevitable.

3 Root causes of the accident

3.1 Root cause – failure to test the functionality of ESD and TPS.

The vessel's TPS was not tested prior to its arrival at the discharge port, which was a noncompliance to the SIGTTO, ship inspection report (SIRE) program, International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code 18.10) and the company's Safety Management System (SMS) requirements. All of these requirements clearly stated

that cargo emergency shutdown and alarm systems involved in cargo transfer shall be checked and tested before cargo operations begin. However, the vessel only carried out the testing of TPS and ESD prior to the loading operation. A lot of LNG vessel senior officers had the misconception that LNG cargo sounding is unnecessary during the discharging operation because LNG cargo level in the tanks will continue to go down during the discharging period. LNG cargo in discharging operations would never overflow. At first sight, it appeared to be quite reasonable. However, this assumption had ignored the possibility that LNG cargo can be transferred to other cargo tanks if related valves on the tank has not been closed completely and the LNG cargo pump outlet pressure is higher than the tank pressure will caused the transfer to take place. The pressure difference will be even greater especially when the LNG carrier is fitted with dual cargo pumps in the tank.

3.2 Root cause – inhibition of cargo tank protective system.

Referring to the SMS, it is required that under no circumstances shall the cargo tank protective system be inhibited except authorized by the Master. Contrary to the SMS requirement, this LNG vessel's tank protective system had been inhibited after she departed from her loading port. The Master had not witnessed the operation even though he had signed the log book. The tank's first protective barrier had collapsed because the SMS checklist had not been followed prior to the inhibition of the cargo tank protective system. However, the Chief Mate did state that it was a routine for him to inhibit the TPS prior to cargo discharge. He was one of those who believed that the inhibition of the TPS is a normal practice during such discharges.

3.3 Root cause - improper processing of IAS alarms.

There were 15 IAS alarms before the LNG cargo overflowed from No.1 vent mast. These alarms were all neglected and were just acknowledged by Chief Mate casually without caring out any investigations. Company's SMS clearly stated that if the cause of an alarm has not been clearly investigated, all related operations must be stopped immediately. The proper and careful treatment of alarms was not only the requirements of the Company's SMS but was also a good seamanship practice. However, the cargo operators ignored the SMS requirements and disposed of the alarms carelessly.

No body in the cargo operation raised any objection to the noncompliance operation behavior of the Chief Mate. Needless to say, no one would assist the Chief Mate to investigate the causes of these alarms and reported it to the vessel's management team on the fact that many alarms had been raised by the IAS in the cargo control room. Thus, it could be seen that the vessel cargo safety operation supervising mechanism was not functioning and implementing properly at the time of the accident.

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4 Lessons learnt

4.1 Stop noncompliance operations would prevent accidents.

The root cause of this accident was the lack of compliance of the safe operation procedures of an LNG carrier. As a Master, I had many years' experience on gas carriers that strictly follow the safety operation procedures, which had been proven to be effective in preventing the occurrences of safety incidents or accidents. In the real world, many Masters and Chief Mates believed that they can change the cargo plan at will when SMS auditors or OCIMF inspectors were not looking over their shoulders during cargo operations. Loading and discharging plans were well thought through procedures compiled by many very experienced professionals. If these plans were not carried out properly, serious potential risks might occur e.g. the ineffective ballasting of the vessel might cause the vessel to experience a shearing force beyond its safety design limit and an accident might occur. The risk level of an LNG vessel was high. Any maloperation would leave very little the time to the operator to compensate. Therefore, safety of management should be strengthened to stop future mishaps.

4.2 Appropriate operation of TPS and ESD in LNG carriers.

The installation of TPS and ESD were signature to LNG carriers which distinguished them from other liquid cargo tankers. They are used to protect LNG cargo tanks and were particularly more important in the protection of membrane type cargo tanks. ESD could be activated on the cargo control console and at the manifolds when switching the ESD manually in these locations or when an ESD signal was received from the shore terminals via fiber optic, pneumatic hose or electric wire between ship and shore in port. ESD should be initiated in the event of fire (meltdown of melting plugs located at each tank dome, shore connections and the like), power failure (such as black-out, loss of hydraulic pressure for cargo valve remote control, loss of pneumatic air pressure to the ESD back-up), or very high level in any one cargo tank. An electric signal from ESD would activate the protective mechanisms of cargo machinery and equipment automatically, such as the tripping of all gas compressors, inert gas generators, cargo pumps, spray pump, and the emergency closure of manifold ESD valves and master fuel gas valves to engines.

4.3 Strengthen the LNG ship safety culture.

4.3.1 Strengthen team culture.

Team spirit of seafarers is very important in any international ship management company. This is especially so for those working on LNG carriers. Seafarer working on these vessels must know their duties and responsibilities. Forming a team culture to help each other out during their daily work will go a long way to reduce accidents. A strong leader is also important. If the Master should take the lead to enhance the team culture on this LNG vessel. This accident would have been prevented from happening. The fact that he took a "laze faire" attitude to his duties had set a bad example to those who were working under him. Each LNG vessel should strengthen the team work culture, the

Master should take the lead and coerce those officers who worked for him to contribute to the success and implementation of this culture.

4.3.2 Strengthen safety awareness.

Although it is a requirement for seafarers to undergo suitable safety trainings before they are assigned to a ship, refresher trainings are rarely conducted on board thereafter. Keeping seafarers vigilant at all times is now on the shoulders of the Master and the management team. It is not realistic to rely on seafarer to educate themselves while they are onboard. Therefore, strengthening of the seafarers' safety awareness and upkeeping their knowledge is a very important to the safe operation of LNG ships. Master shall consider organizing regular meetings to discuss the problems that seafarers are facing during their routine duties and conduct briefing sessions prior to the commencement of cargo operations. Through such discussions and briefings, seafarers are made aware of their duties and responsibilities and also refreshing their memories on what they are required to do to complete their tasks in conjunction with others in a coherent manner Identifying Risks and Establishing procedures for the "entire" SMS.

In the ISO 9001:2015 requirement, risk assessments should be made for all operations. A Plan-Do-Check-Act (PDCA) approach should be taken. In the planning stage, all operations of an LNG vessel are identified together with their associated risks. Acceptable risks and unacceptable risks are then identified. For those unacceptable risks, procedures must be set for detecting and addressing them when they occurred. All seafarers should participate in the Implementation of these procedures as a team. This is the core value of SMS. Staff should have a mindset of "I want to be safe" and not just "keeping me safe". Everyone on LNG ships must dutifully carry out the safety checks to monitoring, distinguishing, appraising the controls and procedures to discover any potential risk that are assigned to them. The results are then fed back in reviews to improve the procedures in addressing these risks. Risk assessments are just the beginning. Improvements are never ending. This is the only way to guarantee safety on LNG vessel!

5 Conclusion

The lack of safety awareness was an indirect but major cause on this LNG cargo overflow accident. The malfunction of valve CL100 was a direct cause that resulted in the increase in liquid level in cargo tank and pressure to an unacceptable level. The cargo team was negligent. They violated the regulatory requirements for the sake of their convenience. The inhibition of TPS/ESD had caused the LNG cargo to overflow from No. 1 vent mast to the main deck. To ensure the LNG vessel safety, the SMS should be implemented effectively and in full.

(*Submitted by Capt. Jack Shan Kai, CESM*)

News

Ballast Water Management Convention has entered into force on 8 September 2017. Many flag administrations have authorized the Classification Societies to issue Ballast Water Management (BWM) Certificates to all ocean-going vessels (including submersibles, floating craft, floating platforms, floating storage units (FSUs) and floating production, storage and offloading (FPSO) units) that have approved Ballast Water Management Plans (BWMP) and have kept their ballast water exchanges in their ballast water record books.

HKJB & HKIMT Coming Activities

Date	Event
14 Oct 2017	Reginal Arbitration Forum
8 Nov 2017	25th Boilers and Pressure Vessels Seminar
10 Nov 2017	HKJB-HKIMT Joint Annual Ball 2017
17 Nov 2017	Technical Workshop on Methanol
19-26 Nov 2017	Hong Kong Maritime Week
23-24 Nov 2017	Asian Logistic and Maritime Conference 2017
25 Nov 2017	Technical Seminar on Marine Engineering and Technology
Dec 2017	Career Talk at HK Polytechnic University
5-8 Dec 2017	Marintec China (Shanghai), PRC

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