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Embracing the Decarbonisation Drive – have we thought about incident management?

Introduction

The Paris Agreement set the world an ambitious target of limiting global warming and reaching net-zero between 2050 and 2100. The objective is to mitigate the catastrophic effects of melting polar ice caps, rising sea levels and the frequency of extreme weather events. Carbon Dioxide (CO_2) accounts for two thirds of Green House Gas (GHG) emissions, according to the Intergovernmental Panel on Climate Change (IPCC), mostly through the combustion of fossil fuels for transportation and energy purposes. The path to net zero emissions is therefore heavily dependent upon transitioning to clean, sustainable fuels.

As the world adapts to creating a carbon neutral future, emergency planners and responders will have to prepare for different hazards, risks, and scenarios. This paper will consider some of the new challenges, reflect how historic incidents have shaped conventional incident management and what this may mean for future standard practice.

Alternative Fuels

There is no silver bullet. Instead, a combination of alternative fuels will fill the void left by hydrocarbon. Domestically, renewables, primarily solar and wind, will play a major part but the heavy industrial demands will require other sources such as Hydrogen, Ammonia, Methanol, Carbon Capture and Storage (CCS), nuclear, battery power and Biofuels. One thing is certain, the transition will take decades, technology and infrastructure need to develop. Existing fuels like Liquid Natural Gas (LNG) and Liquified Petroleum Gas (LPG) are viable transition options, considerable global infrastructure already exists and expertise in its handling and transportation has evolved over half a century. Although capable of meeting global demand and lowering CO_2 emissions, ultimately they don't offer

the long-term gains needed, and in the case of LNG, is also a potent GHG itself. Ultimately the solution lies with less familiar fuels and the risks they may bring.

Scene Setting

The uncomfortable truth is much of today's incident management best practice and response capability have developed through past lessons. There have been many watershed moments, Torrey Canyon, Exxon Valdez, Deepwater Horizon, that have shaped international legislation and driven innovation. However, incidents involving new fuels will not have the benefit of such hindsight, although many existing practices may still be applicable.

Alternative fuel operations are currently small scale, but if ramping up to a global scale there will be a significant draw on this relatively small pool of expertise. Similarly, the financial investment required will be vast, introducing potential for cost cutting and the well-known associated risks by less ethical developers. Lack of training and cutbacks have long been recognised as a major cause of incidents.

Like transporting hydrocarbons, the safe and reliable movement of new fuels from production to market, will be one of the biggest challenges. Images of waves of crude oil from stricken tankers contaminating pristine shorelines and smothering wildlife are favoured by the press for their emotive value. Future tanker incidents will not have the same visual impact, the non-persistent nature of their cargoes may not demand the same level of public or media interest. To prove the point, mainstream reporting of the Elgin platform gas leak in March 2012, barely mentioned any environmental consequences and orders of magnitude fewer column inches than Deepwater Horizon.

Incident Manager mindset will need to prioritise emission-reductions, either through effective source control, developing cargo transfer capabilities and improved measurement of the atmospheric effects if there is a risk of thousands of cubic metres of GHG's being released.

Understanding the Emerging Risk

Consumer confidence and trust will be crucial. Emergency incidents or mis-managed response could severely harm their reputation and acceptance if not considered safe and reliable. The Hindenburg disaster in 1939 ended hopes for airship travel after scenes of the Hydrogen fuelled aircraft exploding and catching fire became etched in public conscience.

Transportation will remain the biggest risk and conventional methods, sea, pipeline, road, and rail will be the primary means. BIMCO predict the world LNG tanker fleet to grow the most of any shipping sector (2021 – 2026) with the 593 ships in 2021 growing to between 799 and 839 by 2026. Managing this risk will require new and enhanced response capabilities such as fire and explosion modelling software to safeguard the public and responders alike.

Environmental risks will also vary greatly from hydrocarbon spills. Although non-persistent, Incident Managers can't lose sight that a large release, for example, of LNG or liquid CO_2 will wipe out any emission gains or even have the potential to cause greater environmental damage.

Methane, the primary constituent of LNG, is a potent GHG with energy companies investing heavily to cut production losses due to venting, leakage, and flaring. Likewise, Carbon Capture Utilisation and Storage (CCUS) technology could play a major role, capturing combustion emissions before liquefying, and transporting the product to permanent storage in underground geological formations. Like LNG and liquid CO_2 many alternative fuels are transported pressurised as a cryogenic liquid, further complicating their handling, and introducing additional risks like metal brittleness in the event they contact ship's plating.

Scenarios

The combination of fuels and uses is too complex for the scope of this paper but some scenarios are worth considering. Within shipping, LNG leads the way in terms of infrastructure, current fleet size and new build orders. Unlike Ammonia, Methanol or Hydrogen, LNG is established technology having powered the relatively small global fleet of LNG tankers for over 50 years.

Its use in other vessel types though is relatively new and classification standards still evolving. Unlike LNG tankers, that use boil off from the cargo tanks, cruise liners, container ships or bulk carriers need specially designed tanks to store the cryogenic fuel.

In conventional emergency situations one of the first salvage operations, is removing the fuel oil from the casualty to reduce the risk of environmental damage.

However, currently there are no classification marks for de-bunkering LNG fuelled vessels, or for that matter, equipment hardware to conduct de-bunkering operations. Cruise lines are now accepting increasing numbers of LNG powered vessels into their fleets and promoting their green credentials. What would the effect on consumer confidence be should an LNG powered Costa Concordia scenario arise? One of the end results are that the shipowners and operators of LNG powered vessels should think beyond what classification approves. A salvage case with an LNG powered vessel has added another major complexity to providing a solution and to mitigate the risks.

When carried as cargo the risk remains. Port of refuge remains an issue, vessels in difficulty could require emergency ship to ship transfer to remove the cargo. Under normal conditions loading and discharge operations are carefully planned and controlled in purpose-built port facilities. In an emergency there may be structural damage, mechanical failure, or loss of power. Moreover transfers would likely be performed in unfamiliar locations, without the normal facilities and permitted by authorities with little or no experience in dealing with such situations. Historically LNG trading routes have been well established, but the market is growing globally opening new markets and remote locations e.g Arctic as there is no risk of an oil spill when sailing in those remote environments.

In addition to its focus on response solutions and port of refuge, we also have to look at training. LNG as cargo has a very high safety level, this due to the training, the daily involvement of handling LNG as cargo and the awareness that LNG has its risks. Crew onboard LNG cargo vessels are LNG specialists. Turning to LNG powered vessels, training is done as part of the onboarding, 2 weeks training and off you go. LNG as a fuel is not priority no.1 its part of the asset and whether you're a cruise, container,

car-carrier or general cargo vessel with LNG as fuel the focus goes out to other important areas e.g. EV as cargo, the safety to 5000 visitors on a cruise, 15000 TEU containers onboard.

Developing Capability

The first step is understanding the risks, in particular for marine salvage operations, and worst case scenario planning is key. For example, an LNG powered container vessel fire loaded with 15000 Twenty foot Equivalent Units (TEU) could mean the vessel isn't "salvable" until the fire is out. The fuel couldn't be stabilised or removed until the casualty could be boarded. To know these risks an extended risk analysis is needed coming from the specialists that have experienced such scenario first hand.

Consulting with the response community during the design phase would enable valuable input to the systems helping ship builders mitigate some risks before the actual building of the vessel. Questions such as can the LNG be discharged, is there access to the LNG operating areas help ensure the shipowner, operator and responder have mitigated the risks when an incident occurs.

Historically when new vessel designs enter service, the market resolves the response risk. In the case of LNG this may mean suitable discharge equipment, flaring systems, LNG de-bunkering solutions. The investment needed could be significant and prohibitive for the response community to fund. Forward thinking operators may decide to collaborate with emergency service providers to invest in the resources and expertise needed to re-assure themselves they are available when needed.

Conclusion

No single fuel can deliver the decarbonisation goals of the Paris agreement. A combination of energy sources and fuel types are needed, for which much of the technology and infrastructure isn't yet developed. As market share grows, different risks and consequences for Incident Manager to consider will be introduced and new response resources and mitigation measures needed.

Much of todays' spill response systems and hardware have evolved through the incidents and lessons learned over decades of emergency response. Some of these will carry forward, for example safety being the priority of any incident (the P of people, environment, assets, reputation (PEAR). Managing

the environmental reputational aspects though is likely to present completely different challenges and require new response capabilities.

International legislation will of course have a major role to play in prevention and preparedness. However, experience indicates a reactive more than proactive approach, begging the question what catalyst will be needed to instigate change? Ultimately industries failure to adequately prepare for emergency events in the energy revolution may adversely affect the reputation and goals of the Paris Agreement.