Enclosed Space Fatalities – Why?

Introduction.

CHIRP Maritime recently published an editorial comment in The Maritime Executive titled 'If Nobody Entered Enclosed Spaces…'. The article resonated with many in the industry and amongst the comments it attracted was the following:

"Good procedures for ventilation, tank entry, lock out / tag out and proper training make the procedures safe"

Whilst the statement is undoubtedly true if the procedures and training are followed, why are seafarers and others such as shipyard personnel or contractors still tragically dying in enclosed and/or confined spaces? At ***CHIRP*** Maritime we struggle to believe that people are deliberately ignoring their training and the plethora of checklists and permits required for entering such a space in order to play Russian roulette with their lives!

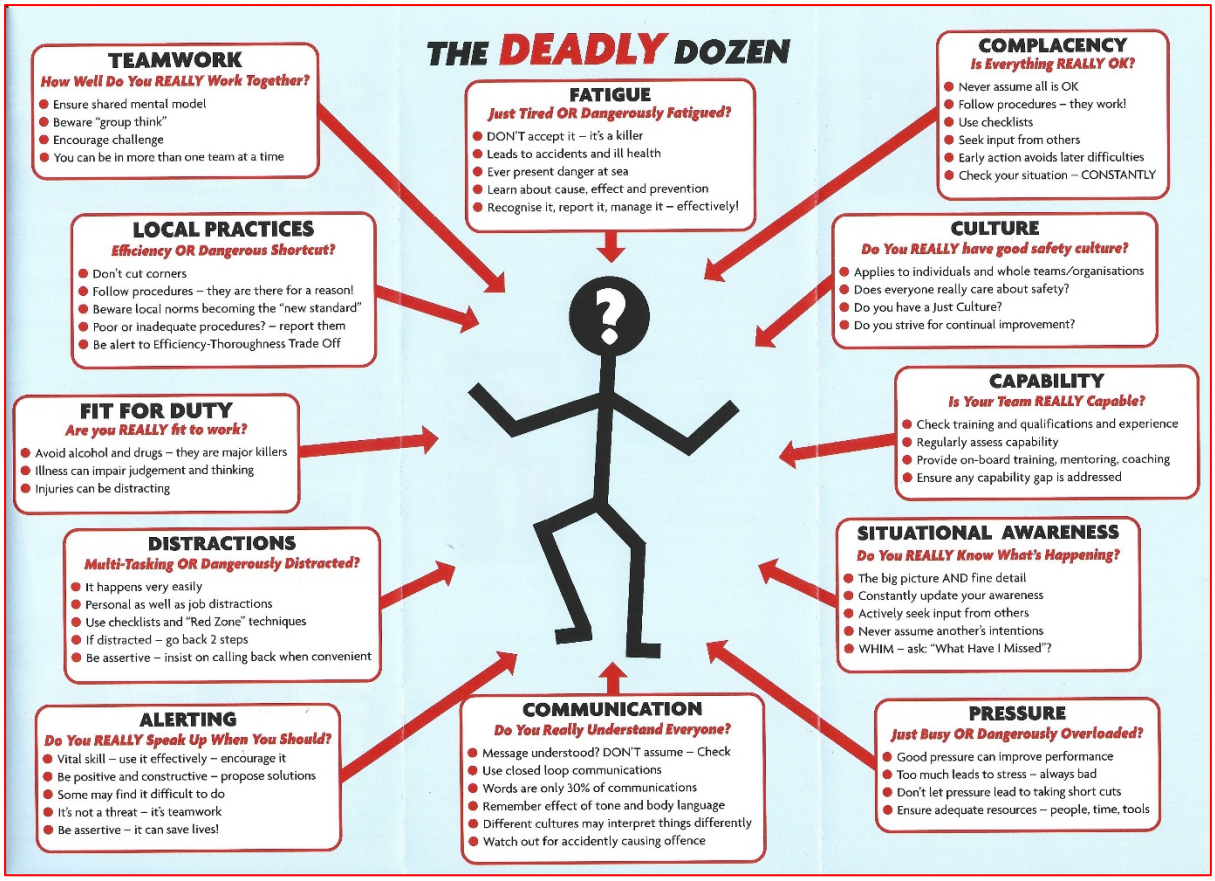
Perhaps a single word should be added to the original comment, "Good procedures for ventilation, tank entry, lock out / tag out and proper training **should** make the procedures safe."

Despite increased regulation and training, the fact is that mariners are still dying in enclosed spaces. It would appear that the training, procedures and supervision on vessels around the world may not be as comprehensive and thorough as first thought. This situation is a global problem and has occurred in every area of maritime trade, including commercial shipping, offshore operations and the fishing industry and it spans every quarter of the globe from the North Sea to the Gulf of Mexico and the Far East. An incident can potentially happen on any vessel anywhere in the world at any time and does so with a depressing regularity.

It is not ***CHIRP's*** intention to point a finger or cause offence but rather to highlight potentially simple solutions to those involved in the maritime industry including naval architects and shore-based legislators, vessel management and ship operators. Whilst the seafarer is always the victim, it is also incumbent upon those who have influence to take ownership of the problem and, by so doing, reduce the risk. The continued loss of human life is unacceptable and wholly preventable.

The Human Element:

Let us turn to the Human Element. ***CHIRP*** analyses all the reports that are published in our FEEDBACK magazine for both latent failures as defined by James Reason, and Human Element failings. The most common failings of human element are in situational awareness closely followed by communications, culture, teamwork, local practices and capability. If we take each part of the human element in turn and apply a few (non-exhaustive) ideas as to what might be considered for enclosed spaces then the following might form a part of a well thought out risk assessment, or toolbox talk prior to any entry into a confined or enclosed space:



The Human Element – Failings which can lead to disaster unless properly addressed.

Situational Awareness: Is everybody involved in the operation fully aware of **all** potential hazards involved when entering an enclosed space, whether it is an obvious confined space or not? Has there been a team briefing as to the potential for incident and the possible repercussions of neglect? Are there procedures in place to counter each perceived or potential hazard that might occur?

Alerting: Does everybody involved in the operation know how to raise an alarm about a situation, or more importantly how to raise a concern about a situation before it warrants raising an alarm? Equally important, are you confident enough to raise any concerns without any fear of repercussion? If you have a query or are not sure about any particular part of the proposed operation, then speak up.

Communication: Are people involved, especially those in supervisory roles, truly communicating information to others so that everybody involved understands the task and potential hazards involved? If you enter an enclosed space can you effectively communicate with those outside at all times – or are there "blind" spots. If so, what can you do to mitigate this risk?

Complacency: The expression 'familiarity breeds contempt' can be re-written as 'routine breeds complacency'. Are you sure that all aspects of the intended operation have been covered? Just because you have done it many times before does not mean that the answer is "Yes!"

Culture: There are some cultures that are reluctant to question or even interact with figures in authority or from other cultures. Conversely there are some cultures or individuals who are reluctant to accept 'interference' from others. This is often referred to as "cockpit culture" and refers to historical incidents within the aviation industry that resulted in the total loss of aircraft and crew because the assisting flight crew did not challenge the Captain's fatal decision even when they knew it to be wrong. Whilst it may sound incredible, this social psychology phenomenon is well documented. Does your system on board take this into account and actively challenge it?

Local Practices: People in supervisory positions need to be aware of local practices. Just because something is local practice doesn't in itself make it undesirable, but if local practice is in conflict with or

inferior to 'best practice', then the procedures **must** be improved. Is this a case of "We've always done it like this?" It can be a difficult cycle to break but is the cause of many incidents and thus should be thoroughly addressed.

Team Work: Ensure all team members are fully conversant with the task and any potential hazards, especially when the team involves multi-national personnel or when individual team members have been replaced. NEVER ASSUME. As investigators say, "To ASSUME makes an ASS out of U and ME!"

Capability: Are the personnel assigned to specific roles in the operation fully conversant with their duties and responsibilities and truly capable and competent to carry them out safely? If they were, we would not be having the tragic recurrence of incidents. Capability is not simply competence - other factors such as being physically able to do the required task need to be considered – this might apply, for example, to a case of tank entry in the Persian Gulf in summer.
The truth is, with reduced crew manning these days, the master has to rely on the personnel available and may face corporate pressure or bullying by his managers, but such pressures must be resisted.

Pressure: Is there realistically enough time and sufficient personnel to carry out the operation? Don't allow other factors to interfere with a safe operation. This includes peer pressure to "get the job done"

Distractions: Ensure personnel involved with enclosed or confined space work are not distracted - other personnel should be aware of the ongoing operation and instructed not to interfere. Highlight to those involved the hazards of allowing themselves to be distracted. Distractions can also arise from work overload or personal issues, and all must be considered to ensure that a task is undertaken safely.

Fatigue: Be aware of the debilitating effects of high humidity, high temperatures and high noise levels which might be encountered within an enclosed or confined space. Even wearing PPE (dust or respirator masks) can be tiring. Ensure personnel have adequate breaks, refreshment and rest periods. Ventilation is all important, and there must be no areas where there might be a build up of noxious gases, or a lack of oxygen – this should be assessed at the design stage of a compartment, but continuing incidents suggest that designs are not always perfect. This is why all areas of a compartment must be tested?

Fit for Duty: Are the people assigned to the task of confined space entry physically and mentally fit for the job in hand? A person may be fit for their 'routine' duties but are they equally fit for the additional, arduous nature of confined space entry? Is it physically possible for a human to undertake the required task under the prevailing conditions?

Other considerations:

Every confined and enclosed space is different. They come in all shapes and sizes from massive cargo holds or tanks through assorted void spaces to incredibly confined double bottom tanks, single frame width cofferdams and bulbous bow spaces. Some spaces may not even be immediately identified as being dangerous, such as chain lockers or deck houses containing ballast water treatment plant (the dosing machinery requiring periodic filling with sacks of chemicals has been known to produce a toxic dust atmosphere). Whilst the two basic hazards of oxygen deficiency and toxic atmospheres are potentially present in all confined spaces, many other hazards may be space-specific such as access and egress points, ventilation and ventilation blind pockets, communications and ambient background noise. Where applicable, a compartment should be fully protected with equipment lock-out, to isolate electric circuits or to prevent the ingress of gases / liquids.

On a VLCC, access through a tank lid at main deck level is quite easy but a slip from the ladder could lead to a fatal fall. However, rescue from the tank bottom can be relatively straight forward if the vessel is equipped with the right equipment and the crew has been competently drilled.

By contrast, access to some double bottom spaces can be a nightmare, with the access points too cramped, or lightening holes too small to facilitate passage whilst wearing radios; breathing apparatus, etc. In the event of an emergency, a rescue can be virtually impossible within a short time

period. Even rapidly exiting a space can be almost impossible if the seafarer is a long way into the space.

A well thought out risk assessment should address all the above points, and systems or procedures should be in place to reduce the risk to acceptable levels. If this cannot be done, then the obvious answer is “Do not enter!”.

Solutions or more problems?

CHIRP Maritime suggests a potential solution is to reduce the risk of an incident by reducing the number of human entries into confined spaces:

It is common sense that if the number of interventions between humans and confined spaces are reduced, the number of potential accidents are equally reduced and statistically the number of fatalities must go down. This might require a reassessment by legislators, classification societies, insurers and ship owners with regard to the frequency of inspection. However, it is not beyond the realms of possibility bearing in mind the realistic prospect of autonomous vessels operating in the near future. Who is going to inspect these spaces on autonomous vessels? If legislators and classification societies are prepared to license these vessels will an inspection regime be required, or will all inspections be carried out by specialists during dockings or maintenance periods?

Utilise specialists:

Other major jobs on board frequently involve teams of shore side contractors or riding crews, so why not apply the same solution to entry into confined spaces? Confined space work is not complicated, but the work is out of the ordinary and can be labour intensive, so why not utilise specialist teams? They can be third party or an in-house squad, arriving onboard with all the necessary equipment suitably calibrated and certified for the duration of a port call, maintenance period, short voyage or even an international passage.

Technology exists today whereby inspections can be conducted by robotic means or by drones, and this would completely do away with human intervention into compartments. If Amazon can deliver products to your doorstep via a drone, then the maritime sector could easily utilise the same sort of technology to conduct inspections of enclosed spaces and reduce or eliminate the number of incidents in this area.

We simply have to get the job done!:

For generations, seafarers have had a culture that the job must get done. In sailing ships, if a vessel encountered a sudden squall, the sails **had** to be trimmed or shortened to avoid the risk of being dismasted. If cargo broke adrift, it had to be secured or it might stave in the ships side with dire consequences. Seafarers’ tenacity, ingenuity and determination in urgent or emergency situations is legendary.

Nowadays, whilst there are still genuine emergency situations where those same traits of tenacity, ingenuity and determination can prevent an emergency becoming a disaster, there is frequently a work ethic of just getting on with it, even if the safety of the vessel is not at risk. Whilst this is commendable, it can have consequences if there is an incident and the subsequent inquiry criticises the people involved. Suddenly the strong work ethic translates in to a criminal violation of hours of rest, a circumventing of company procedures, or wilful neglect. Regardless of any commercial considerations and pressures, the wilful neglect by the ship’s crew will be highlighted by the shipowner/manager seeking to limit liability.

Whilst recognising that vessels today are operating in an intensely competitive market, if the resultant commercial pressures are contributing to the continuing loss of life in confined space accidents then it must be time to pause and radically reassess the situation. The solution should not be more legislation or another layer of permits and checklists to burden the already overloaded seafarer. There must be a fundamental review of the requirements for human intervention within confined spaces. We need a system that reflects the current operational requirements and is fit to evolve for the future, not a system that is built upon past practices.

Paperwork – or a thorough check to ensure the operation can be conducted safely:

Before any confined space entry is undertaken the normal risk assessment, pre-entry checklists, atmosphere checks and confined space entry permits should have been completed. In many cases these forms are conscientiously completed, but for some people it is treated as a paper exercise with boxes being blindly ticked by rote. Unfortunately, those responsible for getting the job done on board ignore the in-depth requirements, *"It's a load of unnecessary rubbish - just get on with it".* It is not unusual for the same rescue equipment and breathing apparatus sets to be used whether it is appropriate and useful or inappropriate and pointless – if it is a stated requirement in the procedure, then it is done.

There can be a tendency for seafarers to assume that because a document, form or checklist has originated from the office ashore then it must be correct, however learnings from incidents tell us that this is not always the case. Generic procedures should be tailored for the job and a specific risk assessment should be undertaken to identify specific hazards. Seafarers and others required to complete checklists should not accept things at face value, but should analyse individual cases and, if necessary, seek clarification or question documents, forms and checklists.

Shipboard SMS procedures often call for either three of four separate signatures on a confined space entry permit (e.g. performing authority, area authority / supervisor, gas tester, issuing authority). It is believed that multiple signatories will perform checks and balances **but** each of those three or four individuals have their own workload in their own workplace and it is unlikely they will all be in the same location at the same time. So, the person tasked with completing a permit is often seen scurrying about the vessel, permit pad in hand, seeking various signatures to endorse or authorise the permit. In small crew operations, who is there to carry out the checks and balances?
It could be argued that a single person dedicated to the task, trained and competent in the required disciplines could be a more conscientious and safer option than those three or four busy distracted individuals currently required to open a 'Confined Space Entry Permit'. This would be a commendable possibility. However, we know that the additional delays in implementing such a thorough procedure would most likely result in pressure from senior management to circumvent the proper process.

Logistical Support:

Most often a vessel's planned maintenance programme is originated and controlled by the owners or vessel managers ashore. These people have a duty of care to ensure that all of the necessary and required equipment is supplied to the vessel to support the marine crew in completing the assigned tasks. A simple example of this would be for the office to dispatch freshly calibrated gas detectors to their vessels as part of an exchange programme, in advance of the expiry of any current onboard units. That being said, a proper calibration of the instruments using a certified span gas by a competent person should be conducted prior to any tank entry. Gas detector sensors rapidly deteriorate when exposed to extreme heat and other damaging atmospheric conditions. How often do ships accept that a gas detector received onboard only requires an annual third-party calibration? If the unit has been sitting in the agent's car window in extreme heat for a prolonged period, it could be deficient before it even gets on board.

Onboard Supervision:

Some tragedies in enclosed spaces occur when vessels are in port and involve personnel who are not a part of the vessels complement – contractors for instance.

Port calls today are a nightmare of frantic activity, set against the time constraints of charterers requirements, daylight operations, tidal restrictions, pilot availability and many other factors. Vessels are inundated with people (port authority, management office staff, surveyors, agents, chandlers, shore gangs, service engineers, crew changes) all requiring attention, induction and supervision by ships staff. They may all know their own particular jobs and they may have been aboard the vessel before, but they may not be aware of the current situation on board unless properly advised by ships staff. This requires positive management and supervision by vessel personnel which may not be easy when some or all of the above groups consider they don't need or want supervision. Nevertheless, the vessel's ISM procedures should cover all of the above. Whilst the responsibility for carrying out these procedures effectively lies with the vessel, ensuring that it is possible to do so is entirely the responsibility of company management.

The Way Forward?

The following diagram gives some indication of a possible way forward. There is no simple solution since, if it were easy, it would have been done by now. Just because something is difficult however does not mean it should not be attempted.

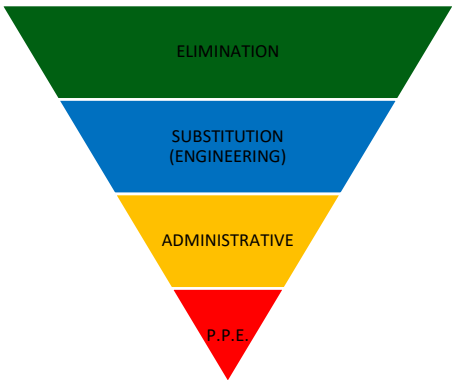
CHIRP Maritime would comment as follows:

If we do away with the need to enter enclosed / confined spaces then we completely remove the hazard. Current technology gives us the means to conduct remote inspections by drone or robot.

Reduce the number of enclosed / confined space entries and we reduce the number of hazardous situations that personnel are exposed to. At the design stage, scantlings and paint applications could be improved in order to extend the time interval between inspections. This should also reduce any potential maintenance.

At the design stage, engineer out ventilation dead spots and improve access to and access within confined spaces. In addition, engineer out any blind communication spots.

Checklists, permits and training programmes alone do not make enclosed or confined space entry safe without effective control, experience, conscientious diligence and sufficient manpower. This applies equally to company management as well as management on board and requires a robust safety culture to be in place.



Remove the need for tank entry. Extend inspection interval and align inspection interval with DD or in-port maintenance period. Revisit planned maintenance programmes and schedules.

Design out ventilation dead spots within confined spaces, build in permanent forced ventilation. Utilise remote technology (drones, robotics, endoscopic inspection)

Ensure checklists, permits and training regimes are applicable and fit for purpose. Ensure manpower demands are realistic.

Ensure sufficient, suitable and viable equipment is available onboard and personnel are trained in its use.

Preventing even a single fatality in a confined space makes any effort worth it.

CHIRP Maritime putting the Mariner ***FIRST***