IMCA Safety Flash 03/03

April 2003

These flashes summarise key safety matters and incidents, allowing wider dissemination of lessons learned from them. The information below has been provided in good faith by members and should be reviewed individually by recipients, who will determine its relevance to their own operations.

The effectiveness of the IMCA safety flash system depends on receiving reports from members in order to pass on information and avoid repeat incidents. Please consider adding the IMCA secretariat (imca@imca-int.com) to your internal distribution list for safety alerts and/or manually submitting information on specific incidents you consider may be relevant. All information will be anonymised or sanitised, as appropriate.

A number of other organisations issue safety flashes and similar documents which may be of interest to IMCA members. Where these are particularly relevant, these may be summarised or highlighted here. Links to known relevant websites are provided at www.imca-int.com/links Additional links should be submitted to webmaster@imca-int.com

1 Fatality and Serious Injuries During Heavy Lift Operation

Keywords: Lifting

One man was killed and nine others were injured at a construction site during the lift of a 300 tonne alternator. The lift, using hydraulic jacks and beams, was nearing completion when the equipment collapsed for unknown reasons.

This report has been issued by a company involved as a precaution against similar incidents, following up on the initial report given as item 5 of Safety Flash 02/03.

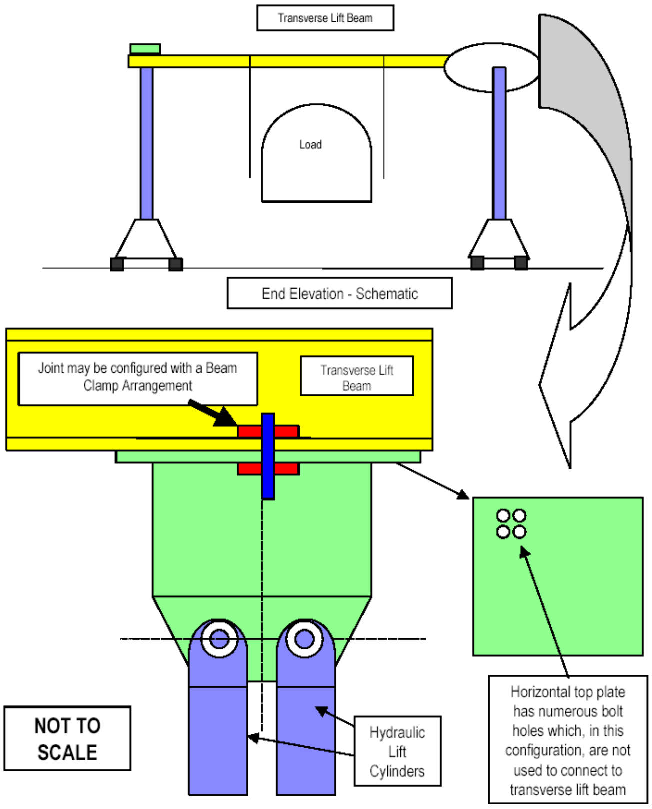


Figure 1 ¬– Schematic

The system may be assembled as shown schematically above in figure 1. In this configuration, the horizontal top plate, which forms part of the connection to the vertical lift cylinders, is connected to the flange on the underside of the transverse lift beam via a 'beam clamp' arrangement.

If it is configured in this way, the lifting arrangements may be represented by the structural idealisation shown in figure 2. In this case, the transverse stability of the system is derived from the moment generated by the difference in vertical reactions (at points R1 and R2) between the inner and outer guide rails. However, this may be limited as the supports may have no capacity to resist an uplift or tensile load.

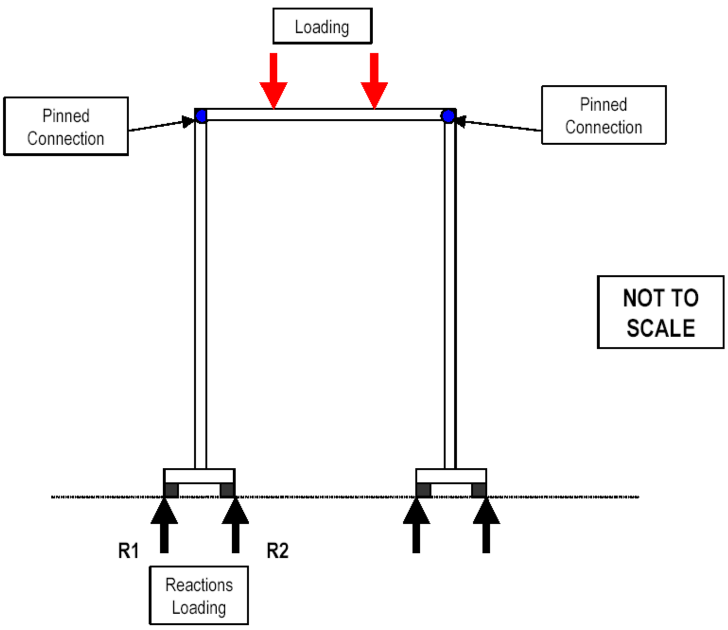


Figure 2 – Structural idealisation

When the inner and outer guide rails are level, the line of action of the force is between the guide rails, as shown in figure 3A. If there are differential levels between the inner and outer guide rails, this may result in the line of action of the force moving outside the base, which in turn may impact the stability of the entire system, as shown in figure 3B.

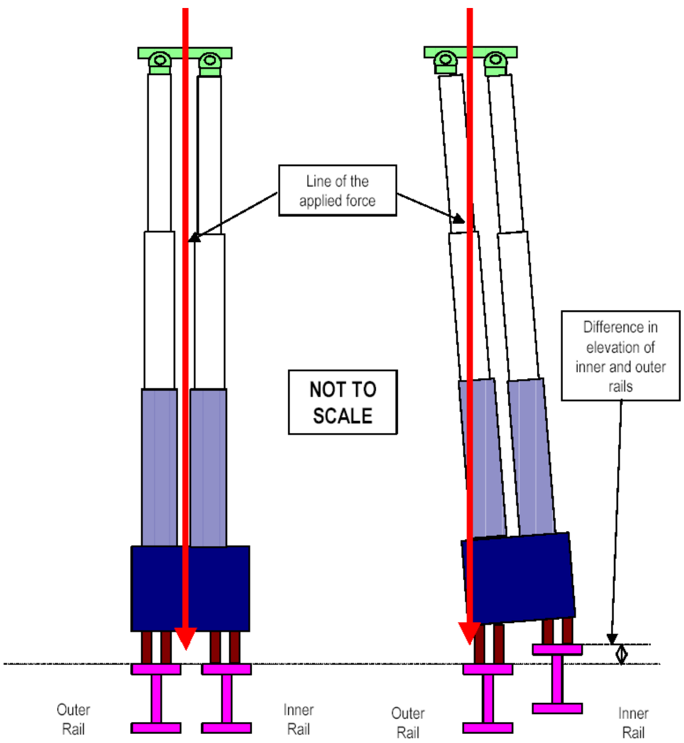


Figure 3A – Inner and outer rails level Figure 3B *Difference in elevation between inner and outer rails*

The company involved has made the following recommendations:

1 A suitably qualified and competent person should check the stability of any lifting arrangements which incorporates similar vertical lift systems. This review should address the following issues:

- All possible conditions which may result in a differential deflection between the inner and outer guide rails at the base should be considered and their impact on the overall stability of the system fully evaluated;
- The permissible out-of-level tolerance between the inner and outer guide rails and the permissible tolerance for the vertical alignment of the lift units should be derived by calculation for all stages of the operation;

- All permissible tolerances should be included in the method statement and clearly communicated to all those involved in the operation.

2 A system which is capable of monitoring the vertical alignment (in two orthogonal planes) of the hydraulic lift cylinders should be devised and used during the operation.

2 Security of Shipping in the Mediterranean and Middle East

Keywords: Terrorism/War

A member has forwarded the following from the NATO website:

> **Anti-Terrorism Measures – issued by the NATO Shipping Centre on 5 March**
>
> "*At present there is no intelligence of an immediate terrorist threat. In a press release (AP 03 Mar) it is announced that NATO intends to extend the anti-terrorist maritime patrols, surveillance and monitoring in the Mediterranean Seas ("Operation Active Endeavour") to cover the whole of the Med including the Straits of Gibraltar. As boarding of suspect merchant ships has now been authorised for all patrolling forces the operation can become more effective*
>
> *www.eastlant.nato.int/natosc/*
>
> ***"NATO Escorts Shipping in Gibraltar"***
>
> *"This week NATO warships have taken on a new mission to escort Allied civilian ships through the Straits of Gibraltar. The Alliance decided to expand its naval operations in response to recent assessments of terrorist threats to particular shipping lanes. This new mission is part of NATO's continuing support for the campaign against terrorism, and is a significant extension of the existing Operation Active Endeavour, which was launched following the September 11 attacks on the United States.*
>
> *"Under Operation Active Endeavour, NATO air and naval forces have been carrying out patrolling and surveillance activities in the Eastern Mediterranean. Apart from demonstrating NATO's resolve in the face of terrorist threats, Operation Active Endeavour has already played a significant role in enhancing security in the Eastern Mediterranean. This new mission will help further safeguard the ships of NATO's nations against the threat of terrorism.*
>
> *"News and information will routinely be posted on the NATO website: www.nato.int and the AFSOUTH website: www.afsouth.nato.int"*

Members whose operations involve shipping in the Mediterranean should also be aware of the NATO Shipping Centre website, which contains details for ships intending to transit the Suez Canal – www.eastlant.nato.int/natosc/ – including details on reporting shipping details, encouraging co-operation with NATO anti-terrorism measures in this area.

3 Incident During Core Drilling Operation

Keywords: Lifting

A member has reported the following incident, noting that it is aware of similar incidents and wishes to bring details to the attention of the wider IMCA membership to assist in preventing future potential incidents of the same nature.

During a recent subsea core drilling operation, a diver was injured on deck of the diving support vessel whilst handling and preparing to lower a drill string with a loaded core barrel to a working diver.

Three divers were in the process of moving the drill string toward the stern of the vessel for over boarding and sending down to the diver carrying out the drilling operation. To facilitate this operation, the divers had connected the lift rigging, and, in concert with the diver operating the work winch on deck, two divers had moved the drill string with the loaded core barrel to the point where they were to up-end it to the vertical prior to running down to the diver below.

The diver holding the lower end of the drill string began to set the drill string down gently onto the deck, the upper end of the string being held by the deck work winch wire suspended from the 'A' frame at the stern of the vessel.

When the diver had lowered the end of the drill string so that it was lying at an angle of approximately 30 degrees from the horizontal, the inner core barrel that was not latched slid downwards inside the core barrel itself.

At this point the diver had changed his grip on the drill string from one that had been on the outside of the string to one where two fingers of his left hand were inside the end of drill string. The position of his fingers was such that when the inner core barrel slid to the end of the outer barrel and hit the inner lip where the diamond bit was attached, the tips of two fingers were amputated in a guillotine-type action.

The company involved has noted and has implemented the following actions:

- a physical barrier in the form of a steel 'end cap' is to be fitted to the end of the drill string at all times when working with loaded core barrels;
- all personnel were aware of the potential hazard, but more emphasis is to be placed on the actual procedures for the loading and unloading of core barrels, as well as the correct procedures for handling of drill string in general.

4 Near-Miss Involving Oxy-Acetylene Cutting of Plate

Keywords: Explosion

A member has reported a serious incident where a plate was being supported on a small length of tubular, which was mounted vertically. The tube was sealed at the bottom, but open to the atmosphere at the top end. The plate was about to be cut using an oxy-acetylene cutting torch mounted on a jig. The torch had been positioned at the side of the plate and was energised by the gases, in preparation for being ignited. This arrangement is shown below.

Gas was allowed, inadvertently, to flow freely into the open pipe. When the spark was struck to ignite the torch, entrained gas at the top of the open pipe alighted, causing a small explosion which resulted in a burn to the operator's hand.

The member involved has noted that positioning a plate over a support which does not allow free dispersion of volatile gases "is not good practice". Normal good practice is to support the work piece on supports that specifically avoid the build-up of a volatile mixture by, for example, the use of open trestles with sacrificial lugs.

It has reminded all those involved in metal fitting activities that they should assess the arrangements they have in place for cutting metal, to check that volatile gases are allowed to freely disperse. The member concerned has instructed its personnel to replace any arrangements that do not allow this before further cutting operations are conducted.

5 Fatality – Fall from Rig of a Container

Keywords: Lifting

We have received a report of an incident where a man died when a refrigerated container fell from a mobile offshore drilling unit (MODU) to the sea.

The MODU was a jack-up drilling rig, jacked up in drilling operational mode. The container had been previously lifted from a supply vessel and placed on an elevated purpose-built landing platform. The container was longer than the landing platform, with the back of the container (which contained the refrigeration unit) overhanging the back of the landing platform.

Supplies were being unloaded from the container on the MODU at the time, with a worker inside the container passing the food cargo to personnel outside. As the unloading progressed, with load being removed from the front of the container, it appears that the centre of gravity changed, causing the container to tip backwards onto the deck below and then to the sea. The worker inside the container died as a result.

The company involved has re-emphasised the importance of ensuring that the potential risks associated with any containers (full, empty or partially full), whether or not they are supported and/or fully secure, should always be fully assessed and any concerns arising addressed.

6 Fatality During Diving Operation

Keywords: Pressure

A member has provided a report of a diving fatality that occurred during the installation of a 20" flexible hose (40m long) between a pipeline end manifold (PLEM) and a new buoy in a water depth of 35 metres.

According to the original approved operational procedures a top-hat flange with a valve for flooding was to be installed. Due to the absence of the top-hat flange, a modified blind flange with a valve and pull-eye was to be provided for floating transport and installation of the under-buoy hose. Eventually the sub-sea hose was delivered on location with a blind flange at the bottom end of the hose.

After complete removal of the blind flange prior to the installation, the risk of damage to the flange and O-rings during passage of the anchor legs and skirt of the buoy was recognised. As a quick solution, a solid wooden plate (10mm thick) was placed across the flange at the bottom end of the hose to protect the O-rings. The intention was to remove the wooden plate immediately after passage.

The flexible hose was then pulled down to the PLEM by a cable and winch (located on the buoy body) via a snatch block (located on the PLEM). At about 13m water depth the hose stopped due to the increased buoyancy forces in the flexible hose, which had not, or only partly, flooded due to the sealing effect of the wooden plate.

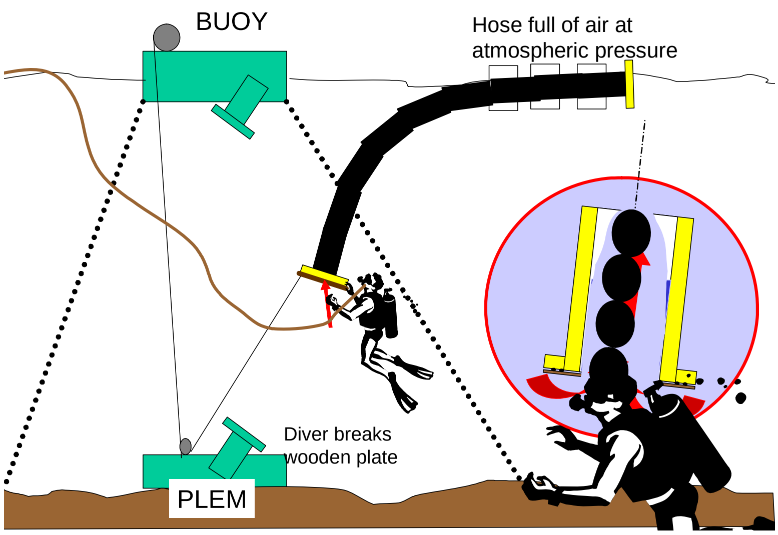
The diver, who had installed the snatch block and guided the wire at the PLEM, reported a lot of tension on the wire and noticed during the first in water decompression stop, that the wooden plate was still in position. The diving supervisor asked the deck-crew to make preparations for flooding of the sub-sea hose from topside.

After the first diver had entered the decompression chamber, another diver, who had placed the wooden plate on the bottom end of the sub-sea hose, asked permission to inspect the bottom end of the hose.

After reaching the bottom end of the hose, the diver tried to remove the plate with his knife, but due to the high suction forces involved, he broke his knife. The force holding on the wooden plate was likely to have been approximately 2 tonnes.

The diving supervisor, who was aware of the danger, told the diver that preparations were being made to flood the hose from the topside and in combination with slack on the wire the differential pressure would be eliminated. The diver was warned to stay well clear of the bottom end of the hose.

Meanwhile the diver took his broken knife blade and with his hammer he punched the plate. At this stage there was a loss of communication with the diver and there was a fast payout of his umbilical. See sketch.



The umbilical was recovered to the surface along with the diver's Kirby Morgan 18 bandmask. The bandmask was damaged but intact except for the video camera which had been smashed off. Also hooked to this equipment was the ring shaped remnant of the wooden plate. Diver rescue procedures were then launched. After a little time searching the diver was found. He had massive head injuries. Death was evident.

Management and SHE-Q representatives from the client group and the contractor immediately launched a detailed investigation into the accident, and produced a joint report. The immediate cause of the accident was the loss of integrity of the wooden plate which then allowed a sudden flooding of the flexible hose. The diver was sucked into the pipe end by the rapid inflow of water.

The basic causes of the accident were identified as:

- Deviations from the operational procedures (no flange with valve for flooding)
- Human error, such as the misperception of risk and the eagerness to correct an error, that caused a delay.

After the accident the company recommended that each affiliate review its current arrangements, as follows:

Diving Procedures:

- ensure that company and IMCA guidance are implemented as a basis of any local procedures and contractual arrangements;
- review current or recent diving practice against company procedures and the IMCA International Code of Practice for Offshore Diving. Modify current practices and procedures accordingly to be in line with these two standards;
- perform job safety analysis before all diving operations.

Management System:

- ensure that the modifications or changes to working procedures are covered by defined rules and steps;
- ensure that the level of supervision is adequate and well defined;
- that a culture of get-the-job-done on time and on budget does not exist to the detriment of safety.

7 Serious Crane Incident

Keywords: Lifting

IMCA has received a report of a roustabout being crushed during a lifting operation.

The incident occurred on a rig which was in the vicinity of a platform. During a lifting operation, a tank had been lifted from deck in such a manner that it swung towards the roustabout, who had been stationed as flagman. The crane operator did not have eye contact with the flagman.

The flagman was struck, receiving a crush injury to the hip.

The company involved noted that the roustabout had not been in the correct position, but that the lift should not have commenced until the clear signal had been communicated by the flagman, who had been out of the line of sight of the crane operator when the incident occurred. It has re-emphasised to its personnel the importance of following procedures and being safety-aware at all times, especially so during potentially hazardous operations such as this.

8 Fatality – Trapping in Machinery

Keywords: Trapping in machinery

A member has reported the following severe accident during the inspection of a generator engine resulting in loss of life.

The incident occurred in a large (12m x 3m) container, weighing 40,000kg and holding a Detroit Diesel V16 generating set, a compressor, welding sets and two electrode ovens. The container was normally used for providing independent power for welding operations, for which purpose it would be lifted onto platform jackets.

On this occasion, it was decided to use the container for testing winches, rather than trailing 440V cables across the deck from crane tubes – the usual source of deck power.

When the generator was running, it would be very hot and noisy inside the container, with a large throughput of air being continuously drawn in.

Operators understood from a fluctuating engine note that there was a problem with the engine of the power generator and a deck team was sent to investigate. The team comprised a mechanical assistant (the team leader) and two motormen. All were experienced personnel, having at least ten years' experience each on the semi-submersible crane vessel involved.

The team inspected the engine and decided to change the filters. This involved needing to shut down the generator and a deck electrician was called.

While one motorman and the deck electrician remained by the control panel, the other motorman and the mechanical assistant first adjusted the engine revolution using the remote control and then went to the side of the generator to check the fuel filters, as the filter bowls had shown evidence of water contamination (as had occurred on similar previous occasions). Changing the filters was considered a routine task and did not require a permit to work.

The mechanical assistant returned to the control panel to ask the motorman there to fetch new filters from the store. He then went outside to instruct the winch crew to stabilise the winches, as the generator was to be shut down so that the filters could be changed.

The second motorman remained inside, with the engine still running. As his colleague went to the store, the motorman inside the container was seen bending over with his hands on his knees, near the filters.

The deck electrician left his position by the control panel and went outside the container to see what was happening with the winches. On hearing some strange noises from the container, he went back inside and saw the motorman in a sitting position on the engine frame, with his back against the radiator mesh. He appeared to be looking under the engine. He again left the container, but a few seconds later, anxious about his colleague, went back in and saw the motorman in the same position. Knowing something was wrong, he shouted for help.

The deck electrician opened the circuit breaker whilst the mechanical assistant, who had re-entered upon hearing the shout for help, shut down the generator using the emergency stop.

In preparation for the filter change, the motorman had partially removed his jacket, releasing his right arm first. The suction created by the fan pulling air in from outside the container pulled the free part of the jacket and the motorman's left hand, which was still inside the jacket sleeve, was pulled into the unguarded balance wheel pulley assembly. He suffered a traumatic amputation of his left arm below the elbow and a fractured skull as a result of the contact of his head with the cylinder block or exhaust manifold. He later died from his injuries.

Those in charge took the following actions:

- medical intervention and treatment was performed by the on-board team with the client's support and the MEDEVAC procedure was then immediately activated;
- the engine was shut down, access to the container was restricted to authorised personnel only and specific stoppage signs were placed;
- the guard to the ventilation fan was removed in order to recover the clothing and any possible part of the injured person for passing to the MEDEVAC team. The area where the injured person was found was searched for the missing portion of his arm, in case it could be saved.

The subsequent investigation identified the following root causes:

- there was no specific written procedure for this kind of operation, other than the operating manual provided by the system and, in particular, engine manufacturers. It was considered a 'normal' inspection and maintenance operation, where common sense and normal operation required a shutting down of the system before any maintenance was started – an approach being followed by the team involved. In fact the incident occurred immediately before the engine was due to be switched off and the maintenance (filter change) carried out;
- the motorman had been wearing a jacket and safety helmet, as per the company's procedures, but it is likely that he removed them in order to prepare himself and be more comfortable, particularly in the warmer environment in comparison to the external weather, for the operation to be performed;
- as this was considered a routine maintenance job and with the motorman being very skilled and confident with the job, it is thought likely that he had not considered the hazards related to the removal of his personal protective equipment (PPE) and the suction from the ventilation system. In this particular case it is considered that the motorman may have misjudged the potential hazards and relevant risk;

- existing guards, warning or safety devices were in place in the area where the operation was to take place. However, the container was provided to the vessel over 15 years before, with no modifications having been made, and it is likely that the general safety device regulations and considerations of the manufacturer were less sophisticated than they would be today;
- the pulleys and belt used to transfer the rotating motion to the ventilation/cooling system were improperly guarded and nobody had noticed or reported to management the hazard the un-protected pulleys posed;

The following contributory factors and other hazards were also identified

- the container had not been properly provided with safety signs and had no indication that only authorised personnel were permitted to enter, although there was a warning system providing information to personnel outside on the running of the engine and any mechanical emergency situation that may have arisen;
- the high level of noise in the container created difficulties in communication between personnel inside the container, with main communication done by hand signals;
- personnel working within the access way were in close proximity of the engine exhaust, presenting hot surfaces requiring protection;
- the temperature inside the container was warmer than in the external environment;
- access and egress were restricted and the working area was cramped – operators had to walk along a corridor approximately 70cm wide to reach the fuel filters (where the incident occurred); a battery rack alongside the container wall adjacent to the engine further reduced access and egress.

The company involved has noted the following actions as a result of its investigation:

- protective devices to be fitted to the rotating parts on the generator and engine, in particular close to the ventilation/ cooling system;
- protective devices to be installed for the hot surfaces of the engine, such as the exhaust manifold, which may come into contact with operators;
- the battery package to be moved into a less congested area;
- safety signs, such as 'authorised personnel only' and 'hearing protection required' to be placed at the entrance of the container, along with the normal PPE requirements;
- access to the emergency stop for a standby person supporting the inspection operation to be checked;
- an overall verification of on-board equipment and machinery with regard to guarding or protection of rotating and moving parts to be performed by competent persons;
- vessel management to perform a survey identifying all operations and relevant PPE to be used;
- safety helmets to be kept on in all work sites, with chin straps utilised in order to avoid loss of helmet when changing posture or environmental conditions;
- management to emphasise the need to maintain a high level of attention when performing routine operations, noting that routine operations are normally those that create overconfidence.

It has also adjusted its procedures as follows:

- inspection operations beyond the control panel now require a standby person in attendance within the immediate area of the emergency stop and where they can easily see the inspection operators;
- lone working beyond the control panel or when the engine is in operation are not allowed and a review of other areas where lone working should not be allowed to be undertaken, in addition to existing permit-to-work areas;
- a weekly safety walk-through of the work site is to be implemented on-board, with the management team visiting different areas of the vessel in rotation to monitor equipment/safety conditions in work areas and a log of identified actions and subsequent implementation to be kept by safety personnel;
- safety personnel to ensure that 'normal' operations are adequately assessed, with job safety analyses available to maintain a high level of awareness and performance monitoring for such operations. All personnel to be involved in the identification of hazards and assessment of relevant risks for routine operations, other than project-specific operations;
- a safety observation system to be implemented on-board, with encouragement given to workers to report all situations which may lead to safety problems and management obliged to provide immediate feedback on proposed actions, but avoiding 'identification of breaches of procedures by other persons' in order to promote a "no blame" culture.

9 Incidents Submitted to IMO Relating to Vessels Carrying SMCs

A paper has recently been submitted to the International Maritime Organization (IMO) concerning vessels which despite carrying a Safety Management Certificate (SMC), had accidents on board in which the investigators found little evidence of established procedures for reporting non-conformities, accidents and hazardous situations in keeping with the procedures to be expected when an SMC is in place.

The following incident reports were included

9.1 Multiple Fatality – Explosion Related to Paint Solvent

Keywords: Explosion

Eight crew were spray painting a ballast tank using a two-part epoxy mix thinned with solvent. Excessive quantities of solvent were used. There was an explosion which severely ruptured the tank and resulted in the deaths of all eight crew members.

- Although there had been documentation on board with instructions for entry into confined spaces, there were no instructions for continuous work in such spaces.
- Ventilation was found to be inadequate and there was no evidence that the need to maintain a safe atmosphere was understood by the crew.
- No equipment was on board to test for an explosive atmosphere and none of the equipment being used for ventilation or other purposes in the tank was safe for such use.
- The ship management company had not ensure that adequate instructions were provided for the use of the epoxy paint.

The accident investigators found that the safety management system in place should have provided information on chemical safety and given proper guidance on risk assessment.

9.2 Operation of Machinery under Maintenance

A fitter welding machinery was seriously injured when the machinery he was repairing was inadvertently operated. The investigation carried out by the ship's classification authority found that, despite procedures being in place for energy isolation/lockout, there was little evidence to show that relevant verification and review processes were carried out.

9.3 Fatality – Working in the Proximity of Lifting Operations

Keywords: Crane

During the test of a crane wire after it had been changed, a bosun was dragged into the sheaves at the top of the crane by a lanyard attached to his belt. He was killed.

The investigators noted that the company's safety manual had no precautions or procedures in place for crew members working in close proximity to moving machinery on cranes.

9.4 Fatality – Blow-Out of Sight Glass while De-Scaling Evaporator

Keywords: Pressure

An engineer was killed when the sight glass of an evaporator he was de-scaling blew out and struck him. He was attempting to remove the sight glass while it was under pressure.

Although there were procedures from the manufacturer for de-scaling the evaporator, modifications had been made and the process for de-scaling had been changed, without any written record of the new process being made. The engineer had been given verbal, but it was evident that he had not properly understood them.

It was found that the management company had not ensured that the procedure for de-scaling was properly reviewed following modifications to the unit.

In all of these incidents it was clear to investigators that although relevant safety documentation was in place, it was not effective because it had not been subject to proper ship-specific review and internal audit. The IMO paper suggests that ship operating companies should do so and should train and encourage their crews to do so, thus properly making use of safety documentation as a valuable tool for accident prevention.