IMCA Safety Flash 01/03

February 2003

1 Follow-Up to Toxic Gas Emission from Transponder (Lithium Batteries)

Keywords: Battery

We previously publicised this incident in safety flash 05/02. Following a detailed investigation by the manufacturer, who intends issuing new guidelines for dealing with flooded transponders, the member involved has provided additional details on the incident and lessons learned on precautions to be taken in future.

To summarise the event, a transponder, which had been at 600m, was received to a vessel and, after two hours, the safety relief valve on the transponder opened and a whitish cloud became visible. It was discovered that a gas had been created by the chemical reaction of water leaking into the transponder coming into contact with the lithium batteries. The gas was toxic, comprising sulphur dioxide and hydrogen chloride.

The manufacturer involved has issued the following points in anticipation of its new guidelines:

1 Handling of a malfunctioning transponder

- Place the transponder in an open, safe place on deck, where there is plenty of free circulation of air. It should be able to be deployed back into the sea in case a hazardous situation occurs.
- The transponder should be left for at least two hours and monitored for points below.
- Check the transponder for external signs of water ingress.
- Check the transponder temperature. Temperature increase may indicate chemical reaction. Refer to 'Handling in case of temperature increase'.
- Always keep clear of the line of the end cap and never point the end cap towards people or vital equipment when the transponder is being opened.
- Use the correct PPE as specified in 4 below.

2 Handling in case of temperature increase in Lithium batteries

- For separate Lithium battery packs, immerse the battery in the sea.
- For transponders with an internal Lithium battery:
- Since there is a risk from toxic gases or explosion, all people not involved in the handling of the transponder should be cleared from the immediate area.
- Immerse the transponder in the sea. Check the temperature again after a few hours. The transponder must be cooled down in the sea until the temperature is around ambient and stable before it is opened.
- Cool down the transponder with sufficient water if it cannot be easily or safely lowered into the sea.
- Never point the end cap towards people or vital equipment when the transponder is being opened. Use the correct PPE as outlined in 4 below.
- The battery may then be electrically disconnected and separately deployed back in to the sea if appropriate.

3 Handling in case of Lithium batteries catching fire

- Extinguish/cool down with sufficient water.
- Class D LithX fire extinguishers are not suitable for extinguishing a fire in Lithium batteries. (Such extinguishers are only for pure Lithium metal fires).

4 PPE

- Opening a transponder with a defective battery: use goggles/rubber gloves/rubber or plastic apron/protective shoes.
- In case of sharp smell: use respiratory protection.
- Neutralise any reaction products and wash away with water.
- In case of fire: use respiratory protection with a full-face mask, fireproof clothing.

5 Storage

- The same rules apply for transponders with internal Lithium batteries or for separate Lithium battery packs.
- Transponders/battery packs must be stored indoors in operational condition.
- They should be stored so that they remain stable in a relatively secure area away from people or vital equipment.
- Ideally there should be a fire extinguisher in close proximity.

6 Transportation

- International transport regulations (the same regulations apply for transponders with internal Lithium batteries as for separate Lithium battery packs.

2 Near Miss involving Winch Failure

Keywords: Winch

A member has reported the following near miss incident involving the bell and the main bell winch – a Norson NP 12 – in which the hydraulic controls were found to be at fault.

The winch had been stripped down nine months before and the controls were newly built during the same period. One month prior to the incident, when the system was mobilised, the handling system and winch controls had been set up and tested by a reputable hydraulic company and had been given a clean bill of health. The brake system and all other functions were tested and passed.

Divers had been working at a depth of 270 feet (bottom depth being 460 feet) and had completed their bell run. They returned to the bell and secured for recovery for surface. The bell was cross-hauled at this time. As the bell was brought through the interface it appeared a little sluggish. However, it was retrieved out of the water. When it was about two feet from the bell catcher, the winch started paying out. The hoist lever was still in the 'up' position. However, the bell kept descending and the spring-loaded brake remained open. The technician turned the engine off, but the descent continued. The supervisor instructed the divers to blow the internal of the bell deeper, using onboard gas, while doing so himself. The bell ended up with an internal bottom depth of 390 feet.

At a depth of about 315 feet, the cross-haul wire checked the descent of the bell. The winch was restarted and the bell recovered to surface. Just below the surface, the deck crane was attached to the bell. The bell was then recovered, mated on and the divers locked through. All saturation operations ceased in order to determine the cause and rectify the problem. A hydraulic specialist consultant was dispatched to the site.

The investigation noted that the problem had been created over a period of time. One of the shuttle valves had an end cap on one side and oil was slowly seeping past the ball seal to the back of the shuttle valve and was trapped between the ball seal of the shuttle valve and the end cap. Eventually, this caused a build up of pressurised hydraulic oil, resulting in the ball seal being pushed against the opposite side of the shuttle valve, thereby sealing the return line to tank. This created a hydraulic line full of trapped pressure with no means of release and since both brakes were on a common line, it kept them open. Although there is a small vent hole in the counter balance valve, the "fail-safe" spring on the brake cylinder kept the hydraulic line pressurised and acted like an accumulator. This also caused the counter balance valve to remain open putting the winch in neutral.

The root cause was an error in the plumbing of the control system.

Corrective measures were taken to first correct the plumbing, run a bleed line from behind the shuttle valve to the tank and to isolate the shuttle valve and the spring loaded brake. As a precaution, the shuttle valve was changed out.

3 Punctured Aerosol results in Chemical Burns

Keywords: Grinding

A member has reported the following incident which occurred in a crane repair workshop, where pieces of lifting equipment are routinely inspected for cracks and/or deformities.

A large hook was being stripped of paint in preparation for inspection. Aerosol paint stripper was being used, with a technician then using a 6000rpm grinder with wire brush cup attachment. The work area is shown below, including the relative positions of the hook and the aerosol.

As the technician was brushing the bottom of the hook, hard particles or brush wires were projected, striking one of the nearly full paint remover aerosol cans sitting on the bench nearby. The particle punctured the can about 1" up from its base and caused the contents to violently spew from the can while it spun wildly on the bench. This happened so quickly that the technician was sprayed around his head, shoulders and back with paint remover before he could move away.

He moved as quickly as he could to the wash basin in the workshop and thoroughly rinsed himself off which, along with the protection of his safety glasses, hard hat and shirt contributed to him only experiencing slight chemical burns on the upper portions of his body.

Fortunately, the gaseous contents of the aerosol can did not ignite as they spewed from the can. If they had, the employee could have been engulfed in fire and suffered much more extreme injuries.

The company concerned has restated the importance of removing aerosol cans, returning them to proper flammable storage areas/containers when carrying out work of this nature. Returning to the picture above – to the right of the work bench is a yellow flammable container storage locker. Had it been used, this incident would not have happened.

4 Diving Fatality

Keywords: Helmet

A member has reported the following incident, which led to the death of a 34 year old diver with 12 years' experience.

The diver was carrying out routine burning and salvage, with approximately 45 minutes of bottom time in 103 feet of sea water. Visibility was noted as excellent and there was virtually no sea current.

The diver's helmet flooded, within 7-12 seconds. A heavy purge on pneumo was immediately initiated and the standby diver launched within 30 seconds, reaching the diver within one minute 25 seconds. The diver was recovered to the surface within six minutes.

The diver was found with his helmet off, with his umbilical and helmet attached to his harness. His neck dam was missing.

The company notified the diver's family, the local regulator authority, and the customer for the operation. It also notified all of its other operation sites of the fatality. Diving supervisors on every job were directed to inspect all helmets and bailout rigs.

Investigations, including those of the regulator involved, noted the following:

- The diving systems involved – compressors, umbilical/pneumo, manifold, gauges, volume tanks – had all passed local authority and relevant third party tests. The system had been tested thoroughly from the intake to the end of the umbilical;

- Historically, surface diving helmets, bail-out bottles and harnesses have been owned and maintained by divers themselves;
- The first stage regulator had leaked at 4 litres per minute. The side block had leaked. The free flow and purge had not functioned. The second stage regulator had not functioned properly and was found to be poorly maintained;
- The root causes were identified as:
  - Failure of the diver to follow emergency procedures;
  - Lack of proper care and maintenance by the diver of his personal dive equipment;
  - Lack of a manageable company system of control to ensure personal dive equipment was maintained by its divers in accordance with manufacturers' recommendations.

The company involved has advised of the following action plan it has implemented:

- Company-controlled emergency loss of air exercises to be made mandatory;
- Maintenance of personal dive equipment (while remaining owned by its divers) is controlled and ensured by the company;
- An enhanced pre-dive checklist has been introduced;
- Audits of compliance with the above actions are to be carried out by the company's quality assurance department.

5 Fatality during Helicopter Escape Training

Keywords: Heart

We have been advised of the following fatality, which occurred during a routine helicopter escape training course. A trainee had arrived for the course appearing normal. The class was provided with briefing and demonstration of the exercise to be undertaken and two other participants successfully completed the exercise.

The trainee mounted the trainer in preparation for the exercise. He appeared calm and signalled to the instructor that he was ready to being the exercise. He was rotated to the submerged position, unbuckled his seatbelt, escaped through the egress hole and surfaced.

On surfacing, he appeared to be in distress and gripped the side of the trainer. The instructors immediately proceeded to his side and assisted him to the side of the pool, where he was helped out. He laid down for a while, before attempting to stand. He then vomited and collapsed. CPR was administered by a trained emergency medical technician and a first aid instructor and continued until an ambulance arrived. The ambulance took him away, but he was pronounced dead on arrival at the nearby hospital.

It was subsequently discovered that the trainee had a pre-existing unknown heart condition and it was noted that his participation in the training course had most likely exceeded his cardiovascular capability.

The subsequent investigation noted the following:

- Emergency response by instructors and other participants was immediate and adequate;
- There had been a 1-1 ratio of instructors to students during the training.

While in this instance it was thought that they would have made no difference, the investigation team recommended consideration of the following:

- Fitness-to-work determination could be improved (through the use of medicals and enhanced self-declaration);
- Water orientation could be standardised (with an emphasis on non-swimmers);
- Emergency response capability could be enhanced;
- Medical protocols for emergencies at the nearby hospital could be improved.

Whilst appreciating that some companies have systems in place that would have subjected personnel to medical testing before they took part in such training, it is not clear whether standard tests would have revealed this particular heart defect.

The company involved has set out the following actions to be completed prior to recommencing the training programme:

- Development and implementation of a 'wellness management' programme (phase one) including fitness for work and a well-informed self-declaration of fitness;

- Implementation of enhanced emergency response capability, including people, equipment, the process and assurance of such;
- Improvement of the training course design, emphasising non-swimmers in the standard water orientation.

It has also set out the following actions of an ongoing nature:

- Phase 2 of the 'wellness management' plan to include encouragement of healthier lifestyles through education, diet and exercise;
- Working with the local hospital to review and, where possible, improve resuscitation and emergency response protocols and to develop a rapport with hospital staff.

6 Engine Start Air Fitting Incident

Keywords: Near-Miss

A member has reported the following serious near-miss which occurred in the engine room of one of its vessels. A high pressure air fitting (25 bar) failed and blew out, narrowly missing the face of an engineer.

The resulting investigation noted the following combination of factors which had contributed to the incident:

- A steel fitting had been sued to join the swivel hose end to the union fitted to the hard pipework. The constant engine vibration over time had caused the harder steel component to erode the threads on one side of the brass union, thus weakening the joint;
- It was thought likely that the 'male' fitting had not been properly aligned when initially tightened. This could have sealed adequately, as the steel fitting would have cut its own thread, but would also have resulted in an inadequate join;
- The pressure caused by the two previous situations, combined with the loading of the line with 25-30 bars of air pressure, was too much for the joint, which finally failed. This could have happened at any time that the engine was started.

The company also passed on another note regarding engine and fuel flexible lines – over time, hydraulic hoses can weaken and harden, resulting in cracking or disintegration when any attempt to bend or straighten them is made.

The vessel's other engine air start line fittings were inspected and nothing detrimental was found. However, concerned that the above combination of events could occur on other ships or barges, resulting in damage or injury, the company involved has circulated details of the incident to engineers on all of its other vessels. Its chief engineers have been instructed to check all such fittings on their respective engines and to advise maintenance staff of the need to be vigilant when dealing with high pressure fittings.

7 Wind Sensors Showing Incorrect Readings

Keywords: DP

A member reports a problem that occurred with two wind sensors on a vessel. One evening the starboard wind sensor (aft) was indicating an incorrect value. A few minutes later the port wind sensor (forward) was showing the same symptoms. The DP desk was giving a warning: Wind difference Speed of 1 and 2.

The weather at the time was freezing (-4°C) and there was a dense fog (visibility <100m) with a lot of icy patches on the quayside and roads (glazed frost).

The following morning a check was made of the wind sensors in both masts. The sensors were found to be covered in ice. After removal of the ice the indicators were back to true values.

Touching the sensors by hand indicated that there was no heating present. The sensors appeared not to have built-in heaters (which are optional).