SAFE EVACUATION OF DIVERS UNDER PRESSURE (Offshore operations local Emergencies)

Commander SA Warner

Legislation

The offshore Installations (Diving Operations) Regulations 1974 Schedule 1 para 4 (g).
The Merchant Shipping (Diving Operations) Regulations 1975 Schedule 1 para 4 (g).
The Submarine Pipelines (Diving Operations) Regulations 1976 Schedule 1 para 4 (g).

Introduction

History has shown that under rare, but often traumatic conditions, it is necessary to evacuate an offshore installation, a barge, structure, vessel or a ship. (During the period 1955-1974 there were 70 major mobile rig mishaps and 20 minor mobile rig mishaps worldwide).

Evacuation can be necessitated by fire, collision, extreme weather, blow-out, etc. It is essential that the possibility of such emergency be considered first with a view to minimising the risk, and second to develop a planned response to an emergency, should it arise. This paper is an appraisal of the possible emergency situations, and outlines some of the essential features which operators should consider.

THE RISKS

Fire

Fire can occur on board an installation or vessel at any time, therefore it is necessary to have the strictest fire precautions in operation at all times. Due to the particular risk to diving installations, consideration must be given to siting them with all essential equipment inside a deluge area, or in close proximity to fire hydrants. Consideration should also be given to the possible use of fire protection screens. In ships, consideration should be given to the siting of diving equipment in areas not generally recognised as high fire risk areas.

Collision

Even with sophisticated navigational aids, collisions at sea do occur. Strict adherence to the rules for prevention of collision are especially necessary and efficient patrolling of restricted areas is similarly essential. Special care is needed with ships coming alongside as part of their business when divers are under pressure.

Weather

It is well known that North Sea weather conditions are among the worst, most extreme in the world, and there is a very short weather warning. However, given a warning of impending bad weather, consideration should be given to delaying the commencement of saturation or long planned decompression dives. Good communication between diving supervisor and vessel or installation management is essential. Consideration should also be given to producing a procedure whereby decompression from saturation commences if the weather deteriorates to a given state and immediate meteorological forecast shows that rapid improvement is unlikely (ie. Sea State 7, Beaufort wind force 8, or when the vessel is forced to lay to weather anchors or head for a sheltered haven).

Blowout

In the event of a major blowout at the seabed it is possible that the surrounding

area will become so aerated that normally buoyant hardware could sink. Further, although a blowout presents a very high fire risk, providing a fire prevention system is maintained, a normal surfacing safely schedule may be possible.

Although blowout can represent a major risk to diving operations, throughout the history of offshore oil exploration and exploitation there has only been one occasion when it has been necessary to evacuate divers, either operating or under pressure. There have been at least 50 occasions when an installation or vessel has had to be evacuated. However a serious blowout represents an extremely hazardous situation.

Good communications between drilling operatives and the diving supervisors to ensure that diving is not undertaken during operations involving high risk is essential. (Such things as: ballasting of semi-submersibles, rig work-overs, drilling operations when entering known or suspected hydrocarbon zones, etc. should form the basis of communication between the drilling operatives and the diving supervisors).

Evacuation Techniques

It cannot be stated too often that a response to an emergency situation will never be as effective as prevention of the situation. However, an emergency situation could always occur and emergency procedures and possibly special hardware may save lives. The undoubted fact that all disaster situations cannot be catered for should not delay actions to cater for an appreciable fraction of the eventualities.

Several possible methods of evacuation under pressure are under consideration and a few general conclusions should be considered.

Evacuation by Diving Bell

It may be possible to evacuate 3 or perhaps 4 divers under pressure in a diving bell by transferring the bell to another vessel.

If a rescue vessel with the necessary lifting gear, with deck chambers and with compatible bell-mating systems, can be brought alongside, the transfer could be made relatively quickly employing the transfer under pressure technique.

In the absence of such a vessel it may be possible to float the bell away from the installation or vessel at risk.

For this method, the buoyancy and stability of the bell in the water, as well as the autonomous life support and temperature maintenance systems, are essential as well as means of recovery from the sea.

The technique of launching the bell into the sea and the actual position of entry, must be considered. (It is no good just slipping a bell into a moon pool, neither is it acceptable for the bell to be slipped from any height.)

The actual freeboard from the diving complex to the surface interface must be considered. For example some barges have only a few feet freeboard whereas a platform may well have over 100 feet.

Evacuation by One/Man Chambers

Under limited circumstances the transfer of men might be made in individual chambers. One might consider the possibility of a store of one/man chambers equal to the number of divers under pressure, being kept available so that with, the appropriate life support, these individual chambers could be evacuated together with other personnel.

A limited number of divers could possibly be transferred using the medical evacuation chamber currently being fabricated.

Evacuation by Purpose-Built Safety Chamber

It is clear that a major limitation of all rescue methods is the time required to operate the rescue system and the number of people involved in the operation.

Since emergency situations will frequently arise rapidly, the means of rescue must be capable of rapid deployment by the minimum number of people. This basic requirement has given rise to the concept of specially designed chambers with rapidly disconnected attachment to the main complex, the chamber accommodating the whole team of divers.

Consideration of sea state, launching technique, buoyancy, stability, life support, heating and means of recovery apply as for the diving bell.

The stability in a seaway of a purpose-built rescue chamber might possibly be achieved by the planned application of external buoyant insulation.

A “float-off” technique for such a chamber should be considered.

General Considerations

It is not intended here to develop the engineering concepts nor discuss the merits of the various evacuation techniques. Two overall points should, however, first be understood.

(a) There is evidence that increased attention to preventative measures may be more cost effective than special evacuation systems. This topic requires careful and systematic study.
(b) One effective evacuation technique is in effect a transfer from one compression chamber to another. An essential requirement for effective use of any evacuation technique is therefore that a dive system shall have compatible (standardized) locking-on facilities.

Pre-Planning before Emergency Evacuation

Legislation requires that provisions be made in diving rules in respect of evacuations. It is recommended that the following overall circumstances be separately considered in these diving rules and guidance on appropriate response be given:

Prevention

What are the particular risks in the diving operation from:

Extreme weather? Fire and/or explosion? Collision? Blowout?

What communication would vessel or drilling management or others have been established to communicate particular risk situations?

What measures can be established to minimise the risk from circumstances noted previously.

Will the proposed emergency action place the divers at even greater risk?

Items requiring continuing awareness

What is the weather forecast?
What support vessels are available and what time would be required for their arrival?
Where is the nearest compression chamber facility and is it compatible with the system on board?

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the services of a skilled dermatologist.

Future treatment requires the use of a hypoallergenic mask and mouthpiece. This statement requires a recommendation. While there may be others, I have been working with Dick Bonin, President of SCUBAPRO, who has been aware of this problem and has wanted to help, not to make money but to assist in making diving more comfortable and pleasant. We had talked about making these products from silicone rubber, since in my specialty I have seen this material (Dow Corning Medical Grade Silicone) used in thousands of cases and have never yet encountered an allergic reaction. (This is part of my speciality of Plastic Surgery). I had also talked with the president of a scuba equipment manufacturing firm about eliminating mercaptobenzothiazole and discovered that he already had in his inventory a gum-rubber mouthpiece that did not contain this clinical irritant. It was tried and found to be hypoallergenic and I recommend it. Other masks made of silicone rubber are available and I feel they are hypoallergenic and I recommend them.

In conclusion, I wish to observe that any individual with any kind of allergic history, who is diving or planning to dive should consider the purchase of silicone or gum rubber mouthpieces and masks.

The author of this article is a Plastic Surgeon with 13 years diving experience, NAUI Certified, Diving Medicine, and a member of UMS since 1968.

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The article by Dr John Alexander, which first appeared in PRESSURE (Feb 1976) is reproduced by permission of the author. It is one more reminder that nothing is entirely neutral and innocuous under all conditions. Divers are reminded of this fact whenever they hear the words 'Inert Gas' applied to Nitrogen, Helium, etc.

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Immediate response to local emergency:

Is the problem immediate?
How much time is available to make decision on evacuation?
What men are available to assist?
What power is available to assist?
Does the weather forecast suggest that a compression chamber can be safely launched into the sea?

Evacuation

Evacuation under pressure must be classed as the ultimate emergency, the emphasis being placed on "Prevention", "Continuing Awareness" and "Immediate Response".

This paper is circulated for consultation. The increased availability of diving ships in the North Sea may well help to improve the chances of safe evacuation under pressure. In turn this may lead to the need for standardised mating techniques in the long term. Constructive comments, proposals and recommendations will be very much appreciated. Address for correspondence: Commander SA Warner, Chief Inspector of Diving; Department of Energy, Petroleum Engineering Division, Thames House South; Millbank; London SWIP 4QJ; UK.