IRATA International Code of Practice for Industrial Rope Access

Part 3: Informative Annexes

Annex S: Working Over Water

1 INTRODUCTION

1.1 Scope and Purpose

Many industries and regions utilise rope access methods as an effective and appropriate means of access and egress when conducting operational works over water (any activity conducted on or above a body of water e.g. river, lake, sea or ocean). Regardless of the location that works are being conducted e.g. offshore on an oil platform into the sea, or onshore from a bridge into a river, the primary hazard remains unchanged, that being a fall from height into water, with the added risk of drowning. Taking this into consideration, working safely over water may require additional permits, environmental awareness, and specific safety measures, equipment and training due to the inherent risks associated with the environment.

This annex provides information and guidance on conducting industrial rope access works over water and is intended to assist with identifying associated hazards, risks and controls, and highlights the requirement for additional equipment and permits.

The information provided within this annex is intended as guidance and is non-exhaustive.

*Note: For further guidance refer to the relevant specialist publications listed in Section **S.12.***

2 TERMS, DEFINITIONS & ABBREVIATIONS

EIA	Environmental Impact Assessment
Exclusion Zone	designated area around a site or structure where entry is restricted or prohibited to ensure safety of the workers and third parties
GFCI	Ground Fault Circuit Interrupter
PFD	Personal Flotation Device
PFPE	Personal Fall Protection Equipment
PLB	Personal Locator Beacon
PPE	Personal Protective Equipment
SAR	Search and Rescue
Splash Zone	refers to a specific area that is intermittently exposed to water due to waves and spray

S.1 Water Characteristics and Safety Considerations

Prior to commencing works over water it is important to conduct a risk assessment, taking into consideration the potential hazards and characteristics of the water being worked over, thereby enabling the identification of appropriate controls to be implemented. The table below lists potential hazards and water characteristics and their associated safety considerations:

Potential Hazards & Water Characteristics	Safety Considerations
Depth	Working over water of any depth requires a rapidly implementable rescue plan, due to the high potential of drowning. Even in relatively shallow water, this hazard may be increased due to the additional weight of Personal Fall Protection Equipment (PFPE), tools and equipment associated with rope access operational works.
Temperature	Sudden immersion into cold water may cause a spike in heart rate and blood pressure, which may increase the risk of heart failure or stroke in some casualties. Commonly, sudden immersion into water can cause a casualty to panic, stress and hyperventilate, with continued exposure being likely to impair a casualty's movements, thinking and decision-making abilities.
Buoyancy	Historically, tests have demonstrated that highly aerated water (also known as white or non-buoyant water), has differing effects on a casualty's ability to stay at the surface of the water. Findings also indicate that air becoming trapped in a casualty's clothing may help keep them at the surface, however, highly aerated water has less resistance when a casualty tries to swim or orient themselves within it; this continuous water movement and increased effort will make it difficult for a casualty to become or remain calm.
Flow rate	Fast flowing water of relatively shallow depths can cause a casualty to lose footing and be swept along with the current, which may hamper a rescue as the location of the casualty may change very quickly. The risk of entanglement also increases with more movement.
Tides/Currents	Tides and currents should be considered when attempting to anticipate the movement and direction of a casualty who enters the water, e.g. the positioning of a rescue boat in a location that facilitates a rapid rescue as per the tide or current.
Contaminants	There may be risks associated with contaminants within the water, which would require a separate risk assessment and appropriate controls. Examples of risks include, waterborne diseases, Weil's disease, stagnant water, and certain types of algae which present known health risks.
Marine traffic	If the worksite (e.g. a bridge) is over a navigable waterway, prior to commencing work consent may need to be acquired from the relevant navigational authority to proceed, ensuring that the works will not obstruct waterway navigation and will not compromise the safety of others and the rope access technicians (e.g. dropped objects, rope entanglement etc.). Offshore wind farms, and oil and gas installations coordinate with various authorities, e.g. coast guard, International Maritime Organisation etc. and are required to comply with international and national regulations, to notify marine traffic about their respective offshore installations.
Flooding	Tidal rivers experience the effects of the tide from the ocean (rise and fall with the ocean tides, typically twice a day). The direction of the river's flow may reverse during incoming tide and be accompanied with a rise of the water level (flood). Such changes in conditions should be considered in the risk assessment, method statement and rescue plan when working over tidal rivers.
Other hazards	Submerged obstacles which may be struck or result in entanglement. Dangerous wildlife will need to be considered in certain regions.

S.2 Tools and Equipment

Risk assessments should consider the risks associated with using tools, equipment and materials over and around water, including the potential for contaminants (e.g. oils, paints, chemicals etc.) to be introduced to the water and their impact on wildlife. Controls and emergency containment plans should be considered to ensure that there is no or minimal impact to the environment from contaminants, in line with local and international regulations.

Considerations to help minimise equipment risks to personnel should include:

a) Limiting the amount of equipment

Reducing the amount of weight that is directly attached to the technician, will decrease the buoyancy requirement that is needed, to keep a technician at the surface, having entered the water. An example of this would be ensuring that where practicable any tools and equipment not related directly to the technician's PFPE are suspended independently of the technician.

b) Control of ropes and lanyards

Ropes and lanyards either trailing in the water or attached to a technician may result in entanglement during operations or in the event that they enter the water. The use of ropes and lanyards should be given due consideration during risk assessment to ensure appropriate control measures are put in place, e.g. keeping ropes bagged when working above water may prevent potential entanglement and could provide a buoyant connection to a technician entering the water. However, the use of a rope bag may result in additional weight that is not buoyant being connected to the technician, thereby increasing the risk of being pulled under water.

c) Using power tools near water

Water and especially salt water are effective at conducting electricity, therefore using power tools near water can be hazardous e.g. electric shock, short circuits, tool malfunction, burns and explosions. The additional risks of using power tools near water should be considered during risk assessment and mitigated against in preparation for the project.

List of considerations (non-exhaustive):

- corded (240V/110V) or cordless tools;
- Ground Fault Circuit Interrupter (GFCI) or equivalent should be used. GFCI outlets/breakers can detect electrical faults and shut off power to prevent a potential electrical shock;
- water-resistant or outdoor rated tools;
- power cords, plugs and electrical connections to be insulated (protected against water access) and undamaged; and
- appropriate PPE.

S.3 Personal Life-saving Appliances

A life jacket is designed to turn an unconscious person face up in the water, while a buoyancy aid is designed to assist a conscious person to swim to safety. This must be considered when selecting the right equipment for the task.

Note: The minimum of 275N buoyancy, twin chamber life jacket with 'crotch' straps may be a requirement on commercial offshore installations. This is to take the extra weight e.g. tools and harness, into consideration to ensure the casualty remains positively buoyant and to stop the life jacket from slipping over the wearer's head when entering the water.

Personal Flotation Device (PFD)

Offshore installations, oil and gas, offshore wind and the marine industry have specific requirements for PFDs.

There are PFDs available which are designed and manufactured to be used in conjunction with PFPE. Whilst the use of PFDs is not mandatory in certain industries, it is recommended that the use of life jackets for working over water, and their compatibility with PFPE should be assessed to determine their requirement and suitability for their intended use. Additionally, the decision to not use PFDs when working over water requires assessment and justification.

Standards

It is important to check the PFD requirements when preparing for a project, and when being issued with one, to ensure it meets site and local requirements, such as those defined by the:

- International Maritime Organisation (IMO, SOLAS)
- International Organisation for Standardisation (ISO)
- European Union (EN)
- United States Coast Guard (USCG)

Note: The above list is not exhaustive.
Note: SOLAS (International Convention for the Safety of Life at Sea, 1974), Chapter III 'Life-saving appliances and arrangements' includes information on the requirements for life-saving appliances and arrangements, including life jackets according to ship type.

Personal Locator Beacons (PLBs)

PLBs are devices to be equipped with when working at open sea. The purpose of the PLB is to aid with locating a casualty if they fall into water. It is important to ensure that the PLB is 'armed' when first received, and to check the battery status regularly (for further guidance on how to do this, refer to the manufacturer's instructions or ask the supervisor).

S.4 Suitable Clothing for Working Over and Around Water

Working over and around water can have its own environmental challenges. Working on bridges, dams and offshore installations can often leave a technician more exposed to the elements than in an urban environment. The extra elements of exposure include:

- the **ambient temperature** given by the weather forecast or measured at 'ground' level may not be representative of the perceived temperature at height, due to wind chill, humidity and even radiation from the water. This factor should be considered when selecting appropriate clothing for the task being conducted.
- working within the **Splash Zone** refers to working in a specific area, that is intermittently exposed to water due to waves and spray. Wet clothing can significantly increase the risk of hypothermia and negatively affect a technician's ability to concentrate. Waterproof clothing should be worn when working in or near the Splash Zone.

Note: Working in the Splash Zone may introduce other risks and hazards, e.g. using power tools in a wet environment, slippery structures and surfaces, and non-fatal/secondary drowning etc.

S.5 Locating a Casualty in the Water in Low Light Conditions or Reduced Visibility

To locate and recover a casualty from the water during the hours of darkness or in reduced visibility is challenging and can take considerably longer than during the daytime and under normal visibility, therefore increasing the risk of hypothermia, being swept away or into a structure, or losing sight of the casualty in the water. Working over water in such conditions should be avoided, where possible, however, when unavoidable extra safety measures should be taken, such as:

- using personally issued water activated lights;
- illuminating the immediate surrounding water surface;
- the issuing and correct use of a PLB by the technician;
- assigning a designated lookout/spotter;
- the implementation of a robust Search and Rescue (SAR) procedure and collaboration with local SAR teams; and
- conducting regular head counts.

S.6 Exclusion Zones & Marine Traffic

When working at height, a suitable Exclusion Zone below the work area should be present. Offshore sites and installations can implement Exclusion Zones when working over water, to stop unauthorised vessels from entering the area. The size and duration of the Exclusion Zone should be communicated over the radio to all the vessels operating in the area. Working over inland waters can make implementing an Exclusion Zone challenging, or even impossible if marine traffic cannot be disrupted. In such cases other safety measures e.g. safety netting, may be implemented to protect third party personnel, vessels, and rope access technicians and their anchor lines.

Note: An Exclusion Zone may be a third-party requirement or could be requested by the operating company. The need for an Exclusion Zone should be considered during the risk assessment.

S.7 Permit Requirements

Working over water operations may require multiple permits, from multiple authorities. These requirements should be assessed in the planning stage of the project and work should only commence when all the required permits are issued, to avoid fines and delays in the project.

Permit requirements may vary in different countries and regions. Below are examples of permit requirements and types:

- **Environmental Impact Assessment (EIA)**: As a prerequisite to obtaining a permit and depending on the scope of work, an EIA may be required to evaluate potential environmental impacts and control measures.

- **Permits for water and wetlands**: If a bridge spans over water bodies or wetlands, permits may be required to ensure the protection of aquatic ecosystems.

- **Marine permits**: When a bridge spans over navigable waters, permits may be required from maritime authorities to ensure that marine traffic is not disrupted (see Section **S.1**).

- **Permit to Work**: This type of permit system is commonly used and is a mandatory requirement for high-risk activities in the oil and gas industry. The offshore wind industry also requires a specific permit system to gain access to assets and to operate on them.

Note: For further information and guidance on Permits to Work refer to the ICOP, Sections 2.2.4.5, 2.11.7.1, 2.11.7.6, and 2.11.14.

S.8 Overboard Procedures and Standby Rescue Vessels

When working over water at a remote offshore location, a standby rescue vessel should be present or in the vicinity, to provide assistance and enable the retrieval of a casualty from the water. Additionally, in case of a rope access rescue scenario, a rescue party may abseil straight onto the standby rescue vessel without entering the water, therefore reducing the risk of drowning.

If using a standby rescue vessel on moving water, such as a river, the type used should be suitable for the water characteristics. All involved personnel need to know how to act in an emergency, how to raise the alarm and what their role is during a rescue.

For rescues using a standby vessel, further considerations include:
- the requirement for additional training, e.g. sea survival;
- the delivery of a toolbox talk covering the rescue plan, procedures and roles; and
- establishing effective coordination and communication with the standby rescue vessel crew.

In moving water such as rivers, a standby vessel may not be a viable option due to the nature of the water or associated costs. Therefore, other feasible options should be considered to retrieve a casualty from the water, such as deploying a brightly coloured and buoyant throw line to retrieve the casualty, or the use of a grab line that can be tensioned downstream of the worksite for self-rescue purposes. Suitable rescue methods should be considered and selected during planning.

S.9 The Effects of Water on Rope Access Equipment

The concentration of water vapor in the air (humidity) is closely related to the distance from bodies of water. Meaning the air over or near water is more humid than in-land. Sea water introduces higher salt content into the air (sea salt aerosol), which can have detrimental effects on rope access equipment that is submerged in, or used or stored in close proximity. For example, salt crystals can cause physical abrasion on the surface or inside manmade fibres, therefore affecting anchor lines (ropes), harnesses and fabric slings etc.

The table below details the effects of water and salt water on materials used in rope access equipment:

Material	Potential effects of water on the material
Nylon	salt can catalyse the hydrolysis of nylon, especially under humid conditions, leading to breakdown of polymer chains and a loss of strength
Polyester	relatively resistant to the chemical effect of salt; however, salt can accelerate the degradation caused by UV exposure
Metals	water, moisture in the air, and salt can cause corrosion of metal items and components of rope access equipment, leading to deterioration in strength and/or performance
Steel	the accumulations of salt residues on steel surfaces or being in high humidity conditions can promote corrosion of steel surfaces
Stainless steel	is resistant to corrosion due to an oxide layer on its surface. However, the oxide layer can be compromised under mechanical stress or by damage, exposing the steel underneath, allowing a route for corrosion to occur due to the accumulation of salt residue and/or exposure to high humidity
Aluminium and aluminium alloys	are resistant to corrosion due to an oxide layer on its surface. However, the oxide layer can be compromised under mechanical stress or by damage, exposing the material underneath, allowing a route for corrosion to occur due to the accumulation of salt residue and/or exposure to high humidity

It is important to conduct regular checks of materials for pitting, uneven or rough surfaces, discolouration, and changed or restricted functionality of metal items.

Discolouration and hardened or softened webbing of manmade fibres may be an indication of contamination or damage.

Reducing the time between thorough examinations of equipment and/or interim inspections may enable the early detection of corrosion or deterioration that, if mitigated against can prevent an incident. Having a scheduled equipment cleaning and maintenance regime can prevent against salt accumulation. Additionally, suitably environmentally controlled equipment storage spaces may provide an effective method for reducing the exposure to and detrimental effects of water, when equipment is not in use.

S.10 Rescue Planning and Requirements

Rescue from a working over water situation can be complex and requires extra considerations and preparation. ‘Rescue down’ is considered to be best practice and the most efficient way to get a casualty to safety, whether by means of a lowering system or a simple intervention rescue. However, this may not be a viable option in situations where moving water presents additional challenges, such as the current moving too fast for a rescue vessel to safely manoeuvre under a casualty, too shallow for it to operate and/or the local marine authority does not permit the use of the vessel due to marine traffic in the area. In such cases, rescue hauling or the diagonal deviation of the casualty when lowered should be considered as a means of rescue.

When compared to urban locations, working over water can increase exposure to the elements, which should be considered when planning for the protection of technicians against environmental conditions (see Section **S.4**). Exposure to environmental conditions may have negative effects on the affective implementation of a rescue plan, and this must be considered during the risk assessment and when setting environmental limits in documents.

Environmental considerations for rescue planning should include:

- the maximum workable wind speed considering a rescue;
- the effects of wind gusts on a rescue;
- the effects of wind shear on a rescue, and how it is related to the structure; and
- the effects of changing wind direction (natural or on the structure) on a rescue.

Note: More guidance can be found in Annex R: Rescue and Evacuation Planning and Considerations.

S.11 Disembarking or Transferring

Some examples of fixed structures in water include wind turbines, substations, meteorological masts and oil and gas platforms. Due to being exposed to harsh weather conditions, these structures require regular maintenance.

Rope access is often used on installations as the preferred method of working at height and boats and vessels are commonly used as means of transportation to such structures. Once the destination is reached, technicians will have to transfer from the vessel onto the structure to carry out rope access works. Transfer of technicians to and from the structure is considered a high-risk activity, that requires adequate risk assessment and documented procedures. Personnel involved in such operations should be physically fit, well rested and may require additional offshore operations related training.

Boats and vessels, like any other vehicle or machine, can break down or get damaged during operation. When a vessel breaks down or gets seriously damaged, technicians may be required to transfer over to another vessel. A vessel-to-vessel transfer is a high-risk activity and should be considered as a last resort, requiring thorough risk assessment and planning.

The table below provide examples of potential hazards and controls associated with disembarking and transfers:

Hazards	Control
Sea sickness (e.g. motion sickness). Even though it is not related to disembarking or transfers, it can have a negative impact on a technician's health. Sea sickness can develop during transportation on water and should not be disregarded. Symptoms may include frequent vomiting causing dehydration, inability to consume any food which may lead to nutritional deficiency, fatigue, weakness, and in some cases even impaired judgement and coordination. Transferring and climbing a structure in such condition can be dangerous.	Encourage people to speak up if they feel seasick. Sometimes when an individual experiences sea sickness the only solution is to return to shore or a solid structure, removing the elements that are causing the sickness. Sea sickness/motion sickness tablets should be used with caution as some have adverse side effects.
Being crushed by the vessel when transferring. Transferring between the vessel and a structure is considered high risk as a rogue wave, wind gust or loss of engine power may lead to the technician being struck or crushed by the vessel.	Weather and sea conditions should be closely and constantly monitored. If the conditions are not adequate or the technician doesn't feel safe to transfer, they shouldn't be forced to do so. Certain industries i.e. wind power generation, oil and gas, have strict rules regarding weather limits and procedures for transferring which must be adhered to.
Falling into the water or the possibility of it should always be avoided. If the technician falls into the water during transfer, they may not be visible to the person piloting the vessel, which may lead to the technician being struck by the vessel.	Stepping over to or climbing structures is considered as working at height, therefore working at height rules apply. Technicians should be protected against falls when climbing, which can be achieved by using permanent fall arrest systems (if the structure is equipped with it) or twin fall arrest lanyards. The possibility of the sudden movement of the vessel should be considered when climbing with fall arrest. The use of PFDs is highly recommended (may be mandated by the site) even if fall arrest equipment is used.

Vessel crews have extensive knowledge and experience of weather, sea conditions and sailing. Asking for advice and following the vessel crew's instructions, may help prevent incidents and accidents.

S.12 Useful Links

- International Maritime Organisation (IMO): International Maritime Organisation (imo.org)
- International Organisation for Standardisation (ISO): ISO 12402-2:2020(en), Personal flotation devices — Part 2: Lifejackets, performance level 275 — Safety requirements
- European Standard (EN): ISO 12402-4:2020 (en-standard.eu)
- United States Coast Guard (USCG): PFD Selection, Use, Wear & Care (uscg.mil)