16.3.4 Cargo offloading system

16.3.4.1 General

Floating structure cargo offloading systems comprise one, or a combination, of the following:

- riser and pipeline export system, and/or
- tanker transfer export system.

If no storage is provided, the system generally consists of one or more cargo pumps and a metering system. In the case of storage (e.g. monohulls) the tanks are often manifolded to a central pump room or, alternatively, individual pumps are provided within each tank, see 16.2.5. Consideration should be given to pump and metering locations and provision of an adequate structural foundation to support such equipment.

Riser and pipeline export systems can be a pipeline either to a remote facility or to a nearby offloading point. In the latter case, hydrocarbons are offloaded under low pressure from the floating structure to an export tanker through a separate mooring and offloading system (normally a single point mooring) connected to the floating structure via risers and subsea pipelines. The offloading system shall be located at a suitable azimuth and at a sufficient distance away from the floating structure to allow for safe approach, departure and weathervaning of the export tanker when moored. A risk assessment shall be conducted to consider suitable mitigation measures to avoid collision between the export tanker and floating structure.

Two types of tanker transfer systems may be used:

a) alongside transfer;

b) tandem transfer.

16.3.4.2 Alongside transfer

An alongside transfer system consists of mooring equipment to secure the tanker alongside, fendering to prevent contact between the two hulls and a fluid transfer system using hoses or mechanical loading arms. Consideration shall be given to location of this equipment and associated local actions imposed on the hull. Limiting conditions for safe operation shall be specified in the MOM.

16.3.4.3 Tandem transfer

Tandem transfer consists of a mooring hawser arrangement and a floating or suspended hose system. Mooring hawsers should be of suitable material and construction for the intended service and should be manufactured and tested in accordance with appropriate standards (see A.16.3.4.3).

The maximum peak mooring force anticipated in service shall be used to size the hawser. The maximum peak mooring force and set of metocean conditions likely to cause such a force shall be clearly specified in the MOM. An appropriate means of monitoring the hawser force should be provided in the control room, along with a readout and warning of a high hawser force.

A suitable hawser termination and supporting structure shall be provided. The strength of the hawser termination and its supporting structure shall be greater than the breaking strength of the hawser.

Provision shall be made for supporting the hose termination and any associated hose storage equipment such as a hose reel or horizontal storage tray.

16.3.5 Material handling

Material handling systems include provisions for supply vessels to moor against the floating structure's hull and/or DP adjacent to the structure, as well as lifting and transfer systems to transfer material to and from the structure and onboard the structure.

Due consideration shall be given to provision of mooring points and fendering arrangements for safe and efficient loading and unloading of material from supply vessels.

In arranging critical equipment, the risks posed by dropped objects shall be considered.

Material handling on a floating structure is inherently more dangerous than on land or on a fixed platform, due to the structure's accelerations/movements. This additional risk shall be considered when planning transport routes and designing lifting and transport equipment. Accelerations/movements of the platform shall be taken into consideration in all transportation of objects and in the design of transport equipment. Operational restrictions should also be considered depending on the type of platform, its motion characteristics, handling means involved and actual weather conditions.

Material handling "below deck" is complicated by transport routes through bulkheads and decks which are parts of the floating structure's watertight compartmentation. This shall be borne in mind when transport routes are being designed.

16.3.6 Lifting appliances

Lifting appliances can be split into two main groups:

a) offshore cranes used for material handling between the floating structure and another vessel, as well as internally on the floating structure;

b) other lifting appliances used solely for lifts internally on the floating structure.

The following considerations apply:

— lifting appliances should be designed to RCS rules or other recognized standards for offshore lifting appliances, see A.16.3.6;

— area layout shall be designed to allow the use of relevant handling equipment/facilities;

— all transport equipment shall have adequate brakes or other facilities to stop inadvertent motion;

— transport routes should lead to a lay-down area or at least to a point where pick-up by a deck crane is possible;

— lay-down areas shall have adequate fenders to stop swinging loads causing damage.

For further information on lifting, reference should be made to ISO 19902:—, Clauses 8 and 22.

16.4 Fire protection systems

16.4.1 General

Fire protection measures on a floating structure consist of structural fire protection, firewater systems, fixed fire-extinguishing systems and alarms.

Fire protection requirements are usually specified in national standards. Reference should also be made to ISO 13702 and RCS rules.

16.4.2 Structural fire protection systems

Systems for structural fire protection are either active (e.g. water spray), or passive (e.g. insulation or intumescent coatings). In selecting a system, the following points shall be considered:

— active systems can increase water system capacity requirements and require provisions for drainage for firewater runoff;

— passive systems provide protection but need not represent a minimum weight solution;

- requirements for access to structural components under passive coating system for inspection;
- testing requirements for active systems.

16.4.3 Firewater systems

All floating structures shall have a firewater system that supplies hose stations throughout the structure. The system shall have sufficient redundancy so that a fire in any space or open area would not render the system inoperative.

A minimum of two pumps, each capable of supplying 100 % firewater design capacity, with separate sources of power should be provided, supplying a fire main fitted with isolation valves so that, if a section fails, the failure can be isolated and the remainder of the system remains operational.

Other fire protection systems that can be supplied from the fire main include but are not limited to

- foam systems, typically installed to protect produced hydrocarbon storage areas and helicopter decks,
- a process deluge system, and
- active structural fire protection (water spray) systems.

When sizing the firewater system, all high-consequence fire risk scenarios shall be considered and the system shall be sized to be capable of supplying all systems that would be required to operate simultaneously in any single fire risk scenario.

16.4.4 Fixed fire-extinguishing systems

Fixed fire-extinguishing systems are usually installed in machinery spaces, electrical equipment rooms and control stations. These systems include gaseous systems, sprinkler systems, water mist systems, foam systems and dry chemical systems, and can be manually actuated or automatically actuated by a fire detection system.

RCS rules and applicable national/international standards should be consulted for fixed fire-extinguishing systems for protection of the marine component of a floating structure.

Fixed fire-extinguishing systems for the industrial component of a floating structure (process facilities) shall be provided to address hazards associated with the process facilities in enclosed spaces containing process equipment, process-related machinery, hydrocarbon storage areas, electrical equipment rooms and other areas or spaces constituting a fire hazard.

16.4.5 Alarms

Flag and national administrations often have specific requirements for general alarm systems. In the absence of specific requirements in RCS or equivalent rules, IMO requirements should be complied with, see A.16.4.5.

17 Stationkeeping systems

17.1 General

A floating structure shall be provided with suitable means of keeping its position at the specific site of intended operation. These means typically consist of a stationkeeping system connecting the floating structure physically to the seabed, or a DP system whereby the floating structure is kept in position by means of thrusters, or a combination of both.

The design of stationkeeping systems shall be in accordance with ISO 19901-7.

The type of stationkeeping equipment involved depends upon the type of floating structure and the chosen system solution.

17.2 Mooring equipment

17.2.1 Winches

Monohulls, semi-submersibles and spars use mooring winches of the same type. Alternatives for mooring winching equipment are covered in ISO 19901-7. One winch per mooring line should be used if the mooring system is to be continuously adjustable. An alternative is to have a group of mooring lines served by one common winch; this alternative should only be used if continuous adjustability is not required. The winch pulling power should be specified when designing the mooring system, based on the worst allowable installation and/or adjustment weather conditions.

Mooring systems with fairleads should be capable of moving the chain/wire system sufficiently to make critical inspection of the moorings at the fairleads. Sufficient capability in terms of chain lockers or alternative means to secure the chain should be provided for this possibility.

The chain-bearing surfaces (e.g. winch chain wheel or chain jack latches) should be formed to suit the chain to be used.

17.2.2 Fairleads and chain stoppers

Chain stoppers on each mooring line shall lock the mooring line to the mooring attachment point once the required installation tension is reached.

Various types of fairleads or bending shoes should be considered and employed for routing of the mooring lines from the winches to the point where they leave the floating structure. Intermediate fairleads should be direction-fixed and the last fairlead before the line leaves the structure should be rotatable in at least one plane.

The chain-bearing surfaces (e.g. guide roller in wheel-type fairleads or chain-stopper latches) should be formed to suit the chain to be used.

Chain stoppers and fairleads and their supporting structures should be designed for a force equivalent to the minimum breaking strength of the mooring line, see also ISO 19901-7.

17.2.3 Monitoring and control equipment

Monitoring of mooring line tension or line angle should be performed to detect line failure, for example, by instrumentation, remotely operated vehicle (ROV) inspection or underwater cameras.

Local winch and chain-stopper control shall be specified, and can involve remote control and monitoring of winch, chain stopper and line parameters.

17.2.4 Disconnectable mooring

The mooring system may be designed for disconnection of mooring lines and risers to limit exposure to foreseeable design situations that would exceed specified mooring system design limits (e.g. severe metocean or ice conditions). In this case, the ability to forecast the limiting conditions, the frequency of such conditions and the time required for the disconnection should be considered at the design stage when setting the disconnect criteria.

Clear criteria for disconnect shall be established and stated in the MOM. Consideration shall be given to providing means and/or specifying procedures for verifying operability of the quick disconnect system throughout its operating life. If the structure is neither self-powered nor classed as an ocean-going vessel, seaworthiness (stability and motion response) of the structure in design situations that exceed the disconnect criteria shall be checked and procedures for manoeuvring shall be established.

17.3 Turret

17.3.1 General

A turret mooring system allows a monohull structure to rotate or weathervane around a geostationary turret that is physically moored to the seabed with a multi-line spread mooring system. A suitable bearing system shall be provided at the interface between the floating structure and the turret. A means for locking the turret to the hull and controlling the relative rotation should be considered, if relevant.

17.3.2 Turret structure

The turret structures supporting the mooring lines shall be designed for the maximum combined actions to which they can be subjected during service, including combinations in which one mooring line is missing.

Fatigue damage due to repetitive actions shall be assessed.

Wave slamming effects shall be considered, where appropriate.

Suitable access arrangements shall be provided to allow inspection and maintenance of the turret structure during its design service life.

17.3.3 Bearing system

17.3.3.1 General

The function of the bearing system is to transfer the forces between the turret and the hull. The working conditions of the bearing system depend on the type of system, but unless the turret is of the disconnectable type, the system shall be designed for actions resulting from the ULS design situation, exposure to salt water and ambient temperatures. If roller bearings are used, the bearing shall be adequately protected from seawater ingress by a suitable sealing arrangement and suitable lubrication arrangements. Contamination of the grease with dust should be expected.

17.3.3.2 Forces on the bearing system

The forces on a turret bearing system include, but are not limited to, the following action effects:

— mooring line and riser actions;

— buoyancy of the turret (varying with draught);

— inertia of the turret due to vessel accelerations;

— weight of the turret (inclination due to roll and pitch to be considered);

— global deformation of the structure;

— friction-induced bearing and swivel torques;

— hog/sag vessel deflections resulting in moonpool ovalization;

— effects due to entrapped water and added mass;

— effects induced by assembly tolerances and fabrication tolerances.

The bearing should be designed for the maximum combination of such actions as expected in service.

Local support structure shall be designed for maximum action effects and allowable deflections as specified by the bearing manufacturer.

Fatigue damage to bearings and local support structure due to repetitive actions shall be assessed.

Bearings shall be designed according to an internationally recognized standard, see A.17.3.3.

17.3.3.3 Alternative bearing designs

A number of different bearing types are used. The most common are

a) roller bearings based on rollers in sealed grease-filled units,

b) roller systems based on rails and large-diameter steel “bogie” wheels, and

c) sliding bearings based on low-friction pads on spring supports sliding against a machined stainless steel surface.

A lower bearing system based on a rubber fender is installed as a back-up system for extreme mooring forces (this bearing is normally not in contact).

On some turret systems, all the force is transmitted by one bearing and on others there may be upper and lower bearing systems with the lower bearing typically transmitting horizontal forces only.

Where self-lubricating sliding bearings are used, expected wear rates and maximum total wear over the design service life shall be assessed using appropriate test data.

17.3.3.4 Inspection, maintenance and repair

The bearing system is vital for the safety and functionality of a turret-moored floating structure; therefore, the bearing function shall be maintained during the whole operational life of the structure. Where possible, access for inspection and maintenance shall be built into the systems; alternatively, a monitoring system shall be specified. In harsh environmental conditions, the bearing system should be designed with redundancy to secure the function of the turret (force transfer and structure rotation) in any weather conditions. The system should be designed to facilitate inspection, maintenance and repair activities at location, with a minimum of downtime.

17.3.4 Turning and locking systems

Some turrets have a turning system for controlling the rotational position of the turret relative to the floating structure. For naturally weathervaning structures with roller bearing systems, the system may be omitted. Generally, systems based on sliding bearings have a turret-turning system to avoid twisting the mooring lines and risers as the structure rotates to minimize the weather exposure. The system can be based on hydraulic cylinders and grippers, a rack and pinion system, etc.

The system performance is characterized by a turning force and a rotating velocity. The necessary force is determined as the maximum calculated turning resistance plus a safety factor. The necessity for a redundant system should be evaluated.

The necessary turning velocity depends on the maximum required rotational speed of the structure. This is a function of the expected heading change rate of the environmental actions. Normally, a full rotation (360°) in one hour should be sufficient, but this shall be determined for each structure based on a site-specific analysis.

18 In-service inspection, monitoring and maintenance

18.1 General

Clause 18 defines the requirements for structural integrity management of floating structures.

The extent of structure covered by these requirements includes

a) the main structure, which can conveniently be divided into three zones — atmospheric, splash and submerged — bearing in mind that draught changes can occur for many floating structures,

b) all structural attachments such as turrets, helidecks, flares, cranes and process decks, and their interfaces with the main structure,

c) structural interfaces between main structure and riser system,

d) non-structural attachments, i.e. any structural component that interfaces with the main structure and/or structural attachments whose deterioration can be detrimental to the integrity of the structure to which it is attached, including appurtenances and their connections (e.g. anodes or hydrophones), and

e) CP systems.

Other major components of a floating platform (mooring systems, lifting equipment, riser systems, etc.) should also be subject to a similar regime of structural integrity management as that proposed here for the hull structure.

18.2 Structural integrity management system philosophies

18.2.1 General

Structural integrity shall be managed through a structural integrity management (SIM) system.

The designer has an important role in the initial specification and development of the SIM system, including the identification of how the structure is expected to respond and any limitations inherent in the design, whether in the form of loading limitations or environmental restrictions that apply to weather-sensitive operations. Effective implementation of a SIM system throughout the lifetime of the structure shall be the responsibility of the owner.

The owner shall ensure that suitable arrangements are in place for monitoring and maintaining the integrity of a floating structure throughout its life cycle. Such arrangements include

— planned maintenance and inspection of the structure,

— periodic assessment taking account of conditions in relation to original design expectations,

— assessment of damage or suspected damage, and

— arrangements for repair work in the event of damage or deterioration.

Periodic assessments should reflect current good practice and incorporate advances in knowledge and changes in risk level, as appropriate. The frequency, scope and methods of inspection should be sufficient to provide assurance, in conjunction with associated assessments, that the integrity of the structure is being maintained.

The purpose of the SIM system is to provide a formal process for ensuring the integrity of the structure throughout its intended design service life on a fit-for-purpose basis.

Implementation of a SIM system can benefit significantly from the effective design for access for inspection, maintenance and repair both internally and externally.

Approaches to dealing with structural integrity management vary depending upon field life, type of floating structure and sophistication of local infrastructure. In turn, these factors can influence the philosophical approach to the specification of a SIM system which can vary from one involving emphasis on the use of monitoring equipment to one with a preference for the extensive use of inspections. Irrespective of the philosophy, the resulting SIM system shall aim to maintain the integrity of the structure throughout its design service life.

Stages in the development of a SIM system are

a) database development and data acquisition,

b) evaluation, and

c) planning.

In addition, while developing the SIM system, the designer should take into account the owner's intentions for its

d) implementation.

National and regional regulations can require a SIM system to be documented in a form suitable for verification or for review by a regulator.

The activities within each stage are not necessarily mutually exclusive and overlap of activities between the various stages occurs.

18.2.2 Database development and data acquisition

The database shall consist of appropriate information relating to the life cycle of the floating structure. Typical examples are the following:

a) appropriate details of ownership, delegated authority, chains of command both onshore and onboard, operational procedures, emergency procedures, standby vessel arrangements, and other information consistent with IMO requirements;

b) details of the location (latitude, longitude, water depth), metocean details (wind, wave, current, tide, temperature, etc.), interpolated/extrapolated metocean parameters for design;

c) design information, including the design basis and premise, the standards to which it was designed and other details (calculations and drawings, corrosion allowances, etc.); ideally, much of this should be in electronic format; areas, elements, components and other aspects of the design that were of concern to the designers or needed special attention during design should be well documented for ready appreciation and easy access by those developing and implementing the SIM system;

d) results of any risk assessment, FE analysis, etc., in which integrity- and safety-critical elements have been identified;

e) fabrication records including drawings, material certificates (including cross-referencing to location of the material within the structure), construction tolerances and compliance records, weld inspection records (ultra-sonic, x-ray, etc.), anomalies, defects, rectifications, repairs, baseline survey;

f) for structures converted from other service, conversion records including structure surveys, structural inspection data, thickness measurements, condition of coatings and CP systems, weld inspection data, retrieval of design and fabrication information, service history, quality assurance (QA) records, materials datasheets, etc.

Particular attention shall be paid to special areas (see 3.39), such as turrets, helideck supports, fatigue sensitive zones, and areas where stress raisers or "hard termination" points exist. To ensure effective transfer of knowledge relating to special areas, the designers and construction supervisors shall prepare a structural critical inspection points (SCIP) report to be provided to the owner. Interfaces between major structural components and assemblies usually fall into the category of SCIPs (e.g. erection butt welds, topsides supports).

The database shall be stored in a readily retrievable format. A copy of the database should be kept onboard the installation, in addition to a master copy kept ashore by the owner.

18.2.3 Evaluation

Evaluation shall be floating-structure-specific and site-specific and be based on a fit-for-purpose philosophy. This shall centre on the intended design service life of the structure but shall, as a minimum, be reviewed by the owner annually and following changes in ownership, statutory regulations and location, and following accidents, repairs, modifications and reviews of inspection data. The review shall ensure that data gathered since the previous review, e.g. by general visual inspection, have been reported, assessed and incorporated in a comprehensible form.

Evaluation shall involve risk assessment, detailed analysis (including FE and cumulative damage analyses), and other forms of assessment as necessary — either of the overall structure or parts thereof where damage has arisen or occurred, or of special areas as appropriate. Risk-based inspection approaches can usually be of considerable benefit in the evaluation process and in the scheduling of inspections. Such approaches enable probabilities and risks to be explicitly evaluated and related back to target values.

Where a “safety case” regime is in effect through applicable national regulations, such safety cases can form part of the evaluation.

Evaluation shall consider continuing compliance with national regulations and standards or RCS requirements, as appropriate. If any of these regulations change during the structure’s life cycle, consideration shall be given to any appropriate corrective action.

In the case of a major conversion, typically involving a change of functionality or replacement or addition of new topsides modules, or even a complete mission change of the whole structure, the design of the structure can be subject to the national regulations in effect at the time of the conversion.

18.2.4 Planning

Planning shall identify the processes, procedures and techniques required to be implemented as a result of evaluation to ensure that the objectives of the fit-for-purpose assessment are realized. Failure mechanisms, deterioration rates and the consequences of failure shall be considered, in order to determine the methods, frequency and scope of inspections, and possible repair and change-out procedures.

A “walk-through survey” can often assist in the pre-planning stage. This helps identify departures from the as-built drawings (the drawings shall be updated accordingly), locations for attachment points, etc.

It is important to identify and examine all damage situations for each floating structure system and subsystem.

Some detailed aspects to be considered in the planning stage are discussed in 18.3.

18.2.5 Implementation

Implementation refers to the detailed execution of the processes, procedures and techniques identified during planning and should normally include programmes concerned with inspections, maintenance and monitoring, as well as identifying the need to effect repairs and/or change-outs.

Some detailed issues to be considered in the implementation stage are discussed in 18.4.

Data gathered during this stage, as well as information issued during the planning stage, should be incorporated into an update of the database, which itself should be undertaken at least once per year, unless justification is presented to extend this period.

The properties of crude oil can have an important influence on the structural performance of a floating production system, particularly if modest-to-large quantities of crude oil are stored onboard. Since the properties of crude evolve as the field is depleted, the effects of these changes should be monitored and assessed throughout the life of the field.

18.3 Planning considerations

18.3.1 General

Structures and structural connections, the failure of which would incur serious consequences in respect of safety, environmental or economic loss, shall be subject to particular attention in the planning of inspection, monitoring and maintenance.

The inspection plan shall incorporate any applicable requirements in national regulations and those of the RCS, as relevant. Appropriate provisions for underwater inspection shall be incorporated into the inspection and maintenance programme, as necessary. Methods of inspecting and maintaining the corrosion protection systems should be identified.

The inspection programme shall specify and describe all inspection activities to be undertaken during the design service life of the structure.

Particular attention shall be given to special areas, any known fabrication anomalies and defects, areas of suspected damage or deterioration, and repaired areas. The inspection schedule shall take into account locations highlighted by service experience and the design assessment. The scope of structural inspections shall include inspection of welds and parent material in critical areas.

18.3.2 Inspection categories

18.3.2.1 General

Inspections usually seek to identify symptoms and tell-tale signs that are evident on the surface and that originate from defects. In most cases, signs of damage are obvious before the integrity of the structure is impaired; however, it should not be assumed that this is always the case.

There are two categories of inspections:

a) scheduled inspections;

b) unscheduled inspections.

18.3.2.2 Scheduled inspections

Scheduled inspections are undertaken as a direct consequence of developing and implementing the SIM system.

A baseline inspection shall be carried out and recorded before the structure leaves the fabrication yard or before the structure is put into service. This shall establish the as-built condition of the structure. In practice, much of the inspection can be performed when the structure is in its final stages of building, conversion or outfitting. Inspection conducted on-site can be limited to quantifying the effects of installation.

Scheduled inspections shall be performed on a regular basis to monitor the condition of the structure and are normally performed during the implementation stage of the SIM system. Scheduled inspections basically aim to record departures of the structure from its condition at the time of the baseline survey. They can also record data that strictly form part of the baseline survey but which were missed or not collected at the time. Furthermore, they can record information relating to structural deterioration, accidents or significant occurrences of design situations that were not previously recorded, e.g. marine growth, coating deterioration, CP polarization and obvious damage.

Following the execution of modifications and/or repairs, they, together with any directly or indirectly affected elements or components of the structure, shall be inspected in order to record the details of such modifications and/or repairs and the effects on the structure. Such inspections shall record details and information consistent with the requirements of the baseline inspection.

18.3.2.3 Unscheduled inspections

Unscheduled inspections occur as a result of an unexpected event (e.g. an accident), exposure to a near-design-level event (e.g. a hurricane) or a change in ownership or platform location.

All accidents shall be assessed to identify appropriate inspection requirements. The extent of structure inspected shall be consistent with the severity of the accident. This shall, as a minimum, include the structure local to the contact or impact position as well as those more remote sections of the entire structure liable to be directly or indirectly affected. This requires recognition of the consequences of the local and overall dynamic response of structures to transient actions. Analysis can be necessary to identify the location and extent of such consequences.

In special circumstances, emergency repairs are necessary shortly after an accident has occurred and before any inspection has been conducted. In these cases, the emergency repairs can mask some consequences of the accident or induce further damage. Such consequences shall, if relevant, be documented, in addition to those arising from the accident itself.

Damage can arise as a result of a floating structure experiencing actions at, or near, the level of those considered in the design, such as the passage of large waves and/or wind gusts. In the case of such events, an inspection shall be conducted to identify the location and extent of any possible damage and/or other form of deterioration. Where damage is detected, an assessment shall be conducted to confirm the adequacy of the original design models and update these as required.

A change of ownership is likely to precipitate a revised approach to the way in which a SIM system database is evaluated, planned and implemented. The new owner shall verify the existing condition and establish an appropriate philosophy for inspection, maintenance and repair, taking into consideration the requirements of any statutory authority and those for the purposes of independent third party verification, as appropriate.

A change in the location of a structure can lead to the conduct of a revised baseline inspection or part thereof. In such a case, the database shall be updated to reflect, primarily, changes to the details of the location, the metocean data, and the metocean parameters for design. This then usually leads to a rerun of the evaluation stage of the SIM system to account for the effects of the transit from the previous site. Both of these can result in alterations to the conclusions of the planning phase of the SIM system.

18.4 Implementation issues

18.4.1 Personnel qualifications

All evaluations and the development and maintenance of the inspection strategy shall be performed by an appropriately qualified team of personnel who are

— familiar with relevant information about the specific structures under consideration,

— knowledgeable about corrosion and erosion processes and prevention,

— professionally competent in structural engineering, and

— experienced in offshore inspection tools and techniques.

These personnel should also be involved in any other phases of the structural integrity management cycle for the floating structure, for example, in subsequent risk assessments, where practical.

Only suitably qualified personnel, such as supervisors, inspectors, divers, ROV operators and data recorders, shall be assigned to perform inspections.

These persons shall be

a) qualified to relevant standards, and

b) trained, qualified and experienced in inspection and safe working procedures.