HSE

Health and Safety Executive

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Hazardous Installations Directorate

Offshore Division

Strategy for KP4: Ageing and Life Extension Inspection Programme, 2010 - 2013

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1. Introduction

This document describes OSD's strategy for Key Programme 4 (KP4), the Ageing and Life Extension Inspection Programme for the period 2010 - 2013.

The Ageing and Life Extension Inspection Programme is a key element of OSD's work on ageing infrastructure in OSD's business plan [1] and whose aim is to promote awareness and management of the risks associated with ageing plant in the offshore oil and onshore major hazard industries in support of four identified priority areas, i.e.

- Asset integrity;
- Safety culture;
- Leadership.

The strategy identifies the basis for OSD's inspection programme on ageing and life extension, the methodology to be applied, priority areas on ageing and life extension issues for offshore installations in the scope of the programme, the activities to be undertaken, the approach to stakeholder engagement and describes the management of the programme.

2. Background

The ageing infrastructure of offshore installations presents the industry with a constant and growing challenge. Ageing is characterised by deterioration which, in the severe operational environment offshore, can be significant with serious consequences for installation integrity if not managed properly. In the extreme case, failure could cause the total loss of an installation, with little chance of survival.

The establishment of a suitable asset integrity management (AIM) system provides the principal barrier safeguarding those working offshore. The integrity management of ageing installations and the successful implementation of an asset integrity management plan for life extension depends on understanding the degradation processes, accurate knowledge of both the condition of a structure and the response of the structure in the aged condition and an implementation strategy to deal with the increasing risk of failure with time which enables the greater likelihood of deterioration to be predicted, detected and assessed.

The basis of the AIM system is provided by risk-based goal-setting offshore regulations [2 - 6], supporting guidance (e.g. [7 - 9]), industry standards, risk assessments and performance standards from which owner / operator policies can be developed.

The related issues of ageing and life extension were addressed explicitly for the first time in the 2005 revision of the Offshore Installations (Safety Case) Regulations (SCR05) [2]. SCR05 requires the duty holder to carry out a 5-yearly thorough review of the safety case to confirm that it continues to demonstrate the effective identification, management and control of major accident hazard risks on the installation. SCR05 also requires the submission of a revised safety case to the HSE where material changes to the previous safety case have occurred, including extension of use of the installation beyond its original design life. In general, the duty holder needs to consider current industry practice / standards / guidance, which may be more onerous than the corresponding documents at the time of the design, the condition of the installation and changes in operating conditions that may limit the life of the installation or its safety critical elements (SCEs) and provide evidence that foreseeable damage to the installation, escalation potentials and all likely scenarios have been considered. This includes the demonstration that major hazards arising from ageing processes have been identified, that they are adequately controlled and that the relevant statutory provisions will be complied with.

3. Aim and objectives

The overall aim of the Ageing and Life Extension Inspection Programme strategy is to ensure that the risks to asset integrity associated with ageing and life extension are being controlled effectively by the offshore industry, in support of OSD's strategic priority on asset integrity.

The specific objectives of the strategy are:

- to raise awareness within the offshore industry of the need for specific consideration of ageing issues as a distinct activity within the asset integrity management process and, in particular, of the need for senior management to demonstrate leadership on and commitment to this matter;
- to define a programme of inspection of individual duty holder approaches to the management of ageing and life extension to ascertain the extent of compliance with the regulatory requirements;
- to identify shortcomings in duty holder practices on the management of ageing and life extension and enforce an appropriate programme of remedial action;
- to work with the offshore industry to develop a 'best practice' common approach to the management of ageing installations and life extension, including the development of long-term plans, for implementation in safety cases and thorough reviews, to ensure the continued safe operation of all ageing offshore installations on the UKCS.

4. Methodology

OSD's frontline activities (i.e. assessment, inspection, standards development, guidance development and associated research) are fundamental to the Ageing and Life Extension Inspection Programme strategy. The programme entails the following inter-related activities:

(1) a programme of onshore and offshore inspections of the asset integrity management systems in all relevant hazard areas of all duty holders operating ageing installations on the UKCS to:

   (a) establish whether the risks to asset integrity associated with the challenges from ageing and life extension of the UKCS offshore infrastructure are being managed satisfactorily by duty holders;

   (b) enforce improvements, where appropriate, to ensure the continued safe operation of all UKCS installations at all times.

(2) raising awareness within the offshore industry of:

   (a) the need to recognise ageing / life extension as a specific activity within the asset integrity management process; and

   (b) ageing issues (including benchmarking, good practice, etc.);

   through the inspection process and various dissemination routes (e.g. HSE publications, seminars / conferences / workshops, liaison with industry bodies etc.).

(3) the establishment of an industry network on ageing and life extension (including the thorough review process) to provide a forum for discussion and exchange of information and experience between stakeholders (including Norwegian, Dutch and Danish regulators), with a view to establishing best practice in the North Sea.

(4) review of incident, accident and failure rate date to identify trends associated with ageing and life extension, where possible.

(5) a supporting programme of research on ageing / life extension aspects of asset integrity to inform both HSE and the offshore industry on the safe operation of ageing installations and for the development of standards and guidance.

(6) reviewing and updating HSE guidance on ageing and life extension and the thorough review process in the light of the findings of the inspection programme, relevant research and stakeholder interactions.

5. Priority areas

5.1 Overview

The strategy covers the key ageing and life extension considerations for all relevant hazard areas, namely:

- organisational factors
- structural integrity;
- materials (including corrosion);
- maritime integrity;
- mechanical integrity;
- process plant integrity;
- fire and explosion integrity;

- electrical and control systems integrity;
- wells
- offshore pipelines.

5.2 Organisational factors

The management of ageing and life extension is an integral part of AIM and it is essential that recognition of the importance of this subject is reflected in the organisational safety culture. This requires;

- demonstration that the organisation is aware of ageing challenges at all levels, including senior management / board level;
- demonstration that the workforce has adequate understanding / knowledge, experience, competence and training to manage ageing issues;
- definition of key responsibilities, management structure, communications and resources associated with the management of ageing and life extension;
- the specification of management measures that differentiate life extension from day-to-day problem shooting.

It is essential that the offshore industry's safety culture recognises the barrier to the catastrophic loss of integrity that risk-based management systems, standards and technical specialists provide. Leadership is needed to ensure suitable and sufficient resources are deployed and OSD will work in partnership with industry to ensure that leadership on ageing matters becomes embedded in the safety culture.

The maintenance of asset integrity of the UK ageing offshore infrastructure, as reserves decline and the nature of companies in the market changes, presents significant challenges. Maintaining and building competence are vital. The ageing profile of the specialist workforce within the industry also presents particular challenges for the foreseeable future. There is a need to ensure that the competence that exists is captured to create a new generation of competent engineers.

5.3 Structural integrity

The risk of loss of structural integrity of ageing fixed and mobile installations is controlled by the implementation of a structural integrity management (SIM) strategy which entails full consideration of the management of physical deterioration and damage, including the possibility of the occurrence of deterioration in uninspectable components**.** The SIM process comprises assessment of the structural integrity and an inspection strategy, both of which address explicitly both ageing processes and the extension of operation beyond the original design life.

A key aspect of any SIM strategy for ageing installations is consideration of the increased uncertainty associated with their structural integrity and its assessment. These may be due to:

- changes in ownership and cycles of contracting out structural integrity management activities which have contributed to a loss of corporate knowledge, e.g. on the design criteria, the history of inspection and repair (including accidental damage).
- the uncertainty about the presence of fabrication defects whose relevance may be of increasing relevance in ageing installations as small defects may become more significant under the sustained impact of the harsh environmental loading to which installations in the North Sea are subjected.
- detailed information on the condition of the structure due to the limitations of current inspection techniques (e.g. GVI and FMD).
- the development of offshore engineering, codes of practice and environmental criteria.

The need for a good understanding of the structural integrity performance of ageing installations containing potentially significant deterioration is paramount. The successful implementation of a structural integrity management plan for ageing and life extension depends on:

- understanding of the degradation processes;
- the availability of an appropriate level of data on the actual condition of the structure;
- the use of suitable inspection techniques at appropriate intervals;
- reliable assessment methods;
- an implementation strategy to deal with the increasing risk of failure with time.

Offshore installations are designed generally to codes and standards based on limit states, typically ultimate, serviceability, fatigue and accidental. Ageing is most likely to affect the fatigue limit state but the presence of cracking can also affect the reserve strength of an installation, thus affecting the ultimate limit state for the system. Such cracking can also affect the ‘after-damage’ state of an installation following an accidental event, e.g. boat collision.

Where structures have come to the end of the design life or suffered significant damage, reassessment of the structural integrity should be performed to demonstrate that existing installations continue to meet regulatory requirements. The principal sources of guidance on reassessment are API RP 2A [10, 11], ISO 19901 [12], ISO 19902 [13] and NORSOK [14]. When performing a reassessment of structural integrity, the duty holder needs to consider whether there is or could be any existing damage or local failure and how this is accounted for to ensure appropriate integrity.

The current practice of relying on global inspection techniques, namely flooded member detection (FMD) and general visual inspection (GVI), as the principal inspection methods applied to primary and secondary members in steel jacket structures does not allow for the detection and management of the occurrence of small cracks with the potential to cause accumulating and accelerating structural damage which is likely to be associated with ageing structures. The use of structural monitoring methods has the potential of providing continuous information on the condition of the structure and should be included in a SIM plan for ageing structures.

A further consideration associated with the reliance on GVI and FMD in maintenance strategies for offshore installations is that the remaining fatigue life on penetration of the wall thickness may be rather limited. Member loss could lead to load redistribution which would affect both fatigue life and reserve strength, thus affecting the ultimate limit state for the system. It is therefore important that due consideration is given in the development of the structural integrity management plan to the consequences of total member failure to structural integrity. Additionally, the interaction of failure modes, including those arising from accidental damage, needs to be considered. This requires the use of systems strength analysis to quantify the reserve and residual capacities and the identification of critical components in the structure, to assess load redistribution and its effects on fatigue life.

5.4 Materials

A number of factors can cause materials to age, including erosion, corrosion (external and internal), hydrogen effects (embrittlement, hydrogen suphide stress cracking), deterioration of material properties from exposure to the environment (temperature, pressure, loading), mechanical wear and accumulated plastic deformation from overloads and cyclic loading. Whilst materials issues are relevant to the installation as a whole, the above degradation mechanisms are particularly relevant to topside process equipment, pipelines and risers, subsea production systems and wells.

HSE's materials inspection focus for the Ageing and Life Extension Inspection Programme will be on internal corrosion in hydrocarbon-containing process plant and equipment which are major accident hazard risks.

The management of ageing assets and the life extension of piping, vessels, structures and other equipment requires a detailed knowledge and understanding of the factors causing internal corrosion and of the methods required to control the risks associated with it. Internal corrosion is caused by a wide range of chemical agents (e.g. water, chlorides, hydrogen sulphide, carbon dioxide) and is affected by the temperature and partial pressures of acidic gases. Furthermore, corrosion damage can be accelerated by other factors, including the effect of fluid dynamics.

Significantly, there is the potential for long-term changes in the process fluids and the associated corrosivity profiles. This needs to be taken into consideration in the management of ageing plant and equipment to anticipate the corrosivity and degradation changes and prepare for adapting the corrosion management strategy in advance.

Thus, corrosion mechanisms and their assessment in the context of historical damage and potential future damage in a dynamic environment need to be understood and taken into account in the management process which should include:

- the performance of a corrosion risk assessment (CRA);
- the development of a risk-based inspection programme (RBI);
- the development and implementation of a corrosion management strategy (CMS).

These three processes are dynamic and should be reviewed annually to ensure they are capturing the corrosion processes and managing them appropriately.

5.5 Maritime integrity

The relevant ageing issues for maritime integrity, with the potential to cause loss of stability and position, are:

- deterioration due to fatigue, corrosion and wear
- modifications resulting in additional topsides weight and loading
- new / updated standards - review of original design basis
- obsolescence (e.g. marine systems – ballast valves, actuators)

OIS 5/2007 [9] sets out the key issues that affect the management of maritime integrity and clarifies the need for the reassessment of integrity (e.g. fatigue life and redundancy) and review of the management arrangements, including the inspection strategy and plans for replacement or repair of structural components and marine systems. An important aspect of the process is review of the input parameters (e.g. environmental criteria and loading) and the effect of changes in knowledge concerning technology / standards.

It also clarifies the need for additional considerations and requirements with respect to inspection and maintenance due to extended life for marine systems such as:

- weather and watertight closing appliances
- systems for ballasting and stability
- systems for mooring and positioning
- related safety systems which depend on emergency power or hydraulics.

5.6 Mechanical integrity

The principal ageing mechanisms for topside mechanical systems are corrosion, erosion, fatigue and obsolescence. The issue of ageing of mechanical systems is closely linked to the adequacy and effectiveness of the inspection, testing, maintenance and calibration regimes of the installation. These need to reflect the potential for accumulating and accelerating deterioration, particularly when operating close to and beyond the original design life, and advances in knowledge and technology.

The adequacy of duty holder integrity management to cover the following mechanical systems will be the main themes for KP4:

(1) static equipment;

(2) machines and rotating equipment;

(3) cranes;

(4) non-metallic (i.e. composite) piping / vessels;

(5) seals.

5.6.1 Static equipment (hydrocarbon containment)

For static equipment, ageing is more likely to be an issue in the following situations:

- a high cycling rate of extreme temperatures, pressures loads or flexing (which may lead to fatigue);
- a history of operating at the limit of, or beyond, its original design envelope;
- a demanding pressure and / or temperature envelope (high or low extremes);
- aggressive chemicals (corrosive or abrasive);
- use of many different materials of construction (indicator of aggressive conditions and potential for interface corrosion issues);
- aggressive environmental conditions (e.g. salty atmosphere, hot and/or humid conditions, fumes, standing water);
- insulated pipe work and equipment with potential for corrosion under the insulation;
- key parts of the plant difficult to access or inspect;
- a history of poor maintenance and inspection.

5.6.2 Machinery, and rotating equipment

Loss of containment from machinery and rotating equipment can occur from similar deterioration mechanisms to those for static equipment except that the effects are exacerbated by the dynamic forces.

5.6.3 Cranes

Deterioration mechanisms include corrosion, fatigue, waer and mechanical damage. In addition, technology may become outdated. Critical spare parts; winches, gearboxes, hydraulic components and control systems can become obsolete and difficult to obtain on older models.

5.6.4 Non-metallic piping / vessels

Composites are susceptible to a number of degradation mechanisms in service, including physical ageing, mechanical ageing and chemical ageing.

These can result in a reduction of 20 - 40% or greater in the strength characteristics of the polymer during the lifetime of the component and the introduction of damage which may not necessarily be predicted accurately by existing procedures

5.6.5 Seals

Elastomer materials used in seals may lose their properties over time, particularly when exposed to heat, oil, chemicals, etc..

5.7 Process integrity

In the management of ageing there are considered to be three key factors or performance indicators that provide a clear view of the consequences of ageing. The adequacy of attendance, by duty holders, to the following topics will be the main themes for process integrity in the ageing installations management project:

- loss of containment incidents;
- operational risk assessment (ORA);
- process modification / additions.

5.7.1 Loss of containment incidents

Loss of containment incident rate is a key measure of the onset of wear out and as it is an exponentially increasing failure period containment failure events should be identified, recorded and analysed to determine if a particular type or region of process equipment is beginning to loose integrity so that the necessary measures can be determined to re-establish integrity to the intrinsic failure period expectations.

Following the ‘weep before leak before break’ philosophy, it is essential that all loss of containment events are recorded to enable adequate analysis and remediation.

5.7.2 Operational Risk Assessment (ORA)

Operational risk assessments are considered to be deviations from an installation’s design intent and, as such, provide an indication of where the design and / or design intent may be flawed, plant is not adequately maintained or is used outside of its intended operating envelope or design parameters. It is essential that ORAs are produced, verified, controlled, applied, monitored, audited and liquidated to the highest standards.

Risk management involves making the chances of failure, injury or loss as small as reasonably practicable, balancing the risks against the benefits to be gained and then selecting the most effective course of action to achieve ALARP.

As with all risk management, it requires the application of appropriate methods by personnel with adequate breadth and depth of knowledge, competence and experience. It is also necessary that the inputs to and outputs from the risk management process are subjected to adequate and appropriate audit and review.

5.7.3 Process modification / additions

Successful safety management in plant / process change or modification begins at the concept stage and must be maintained for the remaining life of the plant.

As an installation ages, well fluid properties may change to such a point where the original process design is no longer valid. Examples include a reducing pressure profile where several stages of high pressure to low pressure process operations are no longer necessary or water cut increases render it difficult to reduce the hydrocarbon content of produced water. Under such circumstances, large sections of the process facilities (and utilities) may become redundant and a revision of the process train and the removal of equipment is deemed appropriate. Alternatively, life extension may occur as a result of the development of new resources that tie in new well fluids to existing process equipment.

In both cases, there is the potential to expose the process train to conditions of hydrocarbon, composition, pressure or temperature where such plant is approaching or operating in its ‘wear out’ phase or may be exposed to parameters outside its design specification.

It is therefore necessary to ensure that the design specification is revalidated for all existing equipment where such changes are proposed or have been carried out and adequate control of change and project development procedures are established and operated.

5.8 Fire and explosion integrity

Ageing of process equipment (entailing physical deterioration through wear and tear, external corrosion and, in particular, internal corrosion of hydrocarbon containment and damage) increases the possibility of hydrocarbon leaks and may reduce the reliability of systems to prevent, control and mitigate events. An installation’s process hazard profile changes (generally reduces) due to reductions in flammable fluid flow rates and pressure reductions. However, plant and equipment tend to degrade over time, resulting in a reduction in integrity, reliability, etc., and hence the assessment of risks to persons on mature installations needs to take account of these two competing situations.

These changes have a different and progressive effect on the risks to persons on each facility. It is necessary to identify and monitor these changes, including the development of new assessment procedures with advances in technical knowledge. It is also necessary to determine when they are significant by performing a formal reassessment of the risks to ensure the effective management of the risks presented by fire and explosion hazards.

The management of fire and explosion hazards in the integrity maintenance of ageing offshore oil and gas platforms requires the identification and demonstration of:

(a) ways in which the risks can change due to modification, deterioration and reservoir / process evolution;

(b) methods of assessing these changes and developing future strategies for their management;

(c) changes to a platform structure or its process that may be necessary to maintain risks as low as reasonably practical (ALARP);

(d) items that should be given priority consideration when modifications are planned; and

(e) robust arguments for continued operation beyond an installation's original design life.

Additionally, areas of particular concern relate to mitigation measures, i.e.

- leak and fire detection – substantial technology advances have been made in recent years and older systems may be inadequate or deficient.
- active fire protection (AFP) - when considering asset life extension, it is likely that the existing system will need to be reviewed against current knowledge on the effectiveness of AFP systems against the fire scenarios identified.
- passive fire protection (PFP) - the type and amount of PFP needed depends on the fire type and duration and the failure criteria of the item being protected.
- heating, ventilation and air conditioning (HVAC) – temporary or permanent blockage due to, for example, the introduction of additional plant which can limit natural ventilation and increase explosion overpressures.

Further guidance can be found in [15].

5.9 Electrical and control systems integrity

The scope of the electrical and control system aspects of KP4 is safety critical elements whose safety critical functions are solely or primarily dependent on electrical and / or control and instrumentation systems and equipment.

A typical offshore installation in the UKCS has many such safety critical elements. Some systems have design life expressed in terms of number of operations, some have a design life related to hours of operation, whilst many systems have no explicit design life or means by which the design life can be determined.

Ageing and life extension of such safety critical elements requires consideration of:

- degradation mechanisms that may reduce integrity;
- environmental, equipment and system changes that challenge the original design concept;
- changes in the way equipment and systems are operated, or expected to operate;
- developments in technology and understanding resulting in the need to change equipment or systems in order to maintain risks ALARP;
- obsolescence of hardware and software;
- changes to personnel competency requirements;
- design and management flaws exposed by ageing processes;
- equipment maintenance procedures and schedules;
- maintenance of documentation including procedures;
- experience of faults and failures.

Dutyholders' approach to the management of ageing and life extension of relevant safety critical systems, including obsolescence, in relation to the relevant regulations, will be examined.

5.10 Wells

Failures in well integrity can arise from problems associated with:

- tubing;
- casing;
- cement;
- annulus safety valves;
- wellheads;
- X-mas trees;

principally from leakage in seals (e.g. between tubing and annulus and in wellhead between annuli).

Mechanical wear is considered to be the most common cause of failure in wells and drilling equipment, followed by corrosion and fatigue damage which result in wall thinning and fatigue cracking, respectively. Other causes include erosion, buckling, hydrogen cracking, overloads and temperature and pressure changes which can cause further degradation by burst, collapse, physical deformation and coating breakdown.

The maintenance of well integrity requires a suitable programme entailing:

- monitoring of process and operational parameters
- inspection of the well completion system, with recognition of uninspectable areas (e.g. subsea wellheads)
- repair / replacement of casing, production string

- pressure testing to verify repair of well completion systems
- the review and use of new technology where appropriate.

Difficulties with the management of ageing can arise from a lack of knowledge associated with a range of factors, e.g.

- material properties and material degradation.
- methods for downhole inspection and monitoring of material behaviour.
- fatigue performance of subsea wellheads and X-mas trees due to weight and movement from BOP, riser and rig from well intervention and from side track drilling.
- leakage frequencies, especially for X-mas trees.
- wear, especially in the production tubing and wellhead and risers (subsea wells) from the drill string.
- loads during drilling, production and workover - the critical sections below the wellhead are inaccessible.
- the availability of new equipment and methods or alternative operational procedures to reduce loads and fatigue of subsea wellhead and X-mas trees.
- geological effects from subsidence, such as ‘slippage’ between layers (faults).

5.11 Pipelines

Pipelines ageing issues fall into three categories:

- time-dependent processes;
- exceedance of design life;
- pipeline management.

5.11.1 Time-dependent processes

Time-dependent processes include:

- mechanical defects and damage;
- corrosion – internal and external;
- material degradation;
- fatigue.

The accumulation of defects and damage is a key consideration as this can reduce pipeline integrity substantially. Similarly, internal corrosion can have a very detrimental effect if not predicted or controlled adequately. Established pipeline materials can suffer degradation from exposure to severe environmental conditions whilst embrittlement is an issue for flexible pipe systems. Finally, fatigue is a particularly significant threat to pipeline integrity and needs to be predicted accurately and monitored closely – this is more difficult under conditions of variable cyclic loading.

5.11.2 Exceedance of design life

Operators need to demonstrate awareness of the design life limits provide justification for the continued operation of their pipelines. This requires the review of the design parameters to identify those that are significant or critical and which will become more significant or critical in future.

5.11.3 Pipeline integrity management

Additionally, the operator needs to have developed and maintained a Pipeline Integrity Management System to capture inspection and maintenance activities, condition monitoring, incidents and repairs, etc. and established a system of monitoring and recording pipeline operational data, i.e. flowing parameters, hydrodynamic loading.

[16] and [17] provide operators with guidance on the demonstration of suitable integrity when considering operation beyond the design life.

6. Duty holder inspection programme

Information on the overall KP4 inspection plan is presented in Table 1.

	Fixed platforms		**Semi-submersibles & FPSOs**		**Jack-ups**	
	Onshore inspections	**Offshore inspections**	**Onshore inspections**	**Offshore inspections**	**Onshore inspections**	**Offshore inspections**
Year 1	8	4	-	-	-	-
Year 2	8	4	4	2	4	2
Year 3	8	4	4	2	4	2

Table 1: Number of duty holder inspections

The plan will be reviewed during the first year and modified if necessary.

7. Stakeholder engagement

A key aspect of the Ageing and Life Extension Inspection Programme is engagement with offshore industry stakeholders, i.e. duty holders, contractors, other regulators, industry bodies, technical and standards making bodies and verifiers. An essential outcome of the stakeholder engagement activity must be that the importance of ageing and life extension management is understood and appropriate measure implemented at all levels within organisations and across all organisations comprising the UK offshore industry.

The Ageing and Life Extension Inspection Programme will be publicised via:

- press releases;
- the HSE website;
- key industry bodies, e.g. Step Change In Safety, Oil and Gas UK, IADC, BROA and the Energy Institute;
- HSE events.

These channels, as well as industry workshops, seminars and conferences, will be used subsequently to disseminate information on progress and key findings.

An HSE webpage dedicated to the dissemination of information on the Ageing and Life Extension Programme and relevant supporting information (e.g. HSE's strategy, guidance, research, inspection findings, industry events and links to external sources of information), has been created - see http://www.hse.gov.uk/offshore/ageing.htm - and developed as the programme progresses. It is anticipated that this will provide a primary source of information on the subject of ageing and life extension for offshore structures.

It is also intended that an industry network on ageing and life extension be established to facilitate the exchange of information between stakeholders so that awareness of the significance of the management of ageing is raised and the development of best practice and a common industry approach to ageing is encouraged.

8. Development of guidance

The guidance in Offshore Information Sheet 4/2009 [8] and Offshore Information Sheet 5/2007 [9] will be updated, as appropriate. OIS 4/2009, which covers structural integrity and fire and explosion integrity at present, will be expanded in due course to include all relevant hazards – see section 5.1. Additionally, the Thorough Review Guidance and the recommendations in GASCET [18] and associated technical policies will be reviewed and updated where appropriate. A review of the need to update these documents will be performed in April 2011, on completion and review of the Year 1 inspections, and consideration given to the need for any other documentation.

9. Research

Ageing and life extension considerations may require new information and / or the use of new technology to resolve complex issues. Indeed, SCR05 identifies the need to consider the application of new technological developments in making the case for life extension. To this end, a number of research projects on structural integrity and fire and explosion aspects are being funded by OSD. It is anticipated that the inspection programme will be supported by research on identified topics to inform both HSE and the offshore industry on the safe operation of ageing installations and to assist with the development of standards and guidance. It is expected that OSD will need to take a lead in this area in the absence of a single UK industry body providing a focus for research. However, the formation of an industry network on ageing should facilitate this objective.

10. Programme management

10.1 Programme organisational structure

KP4 will be overseen by the Programme Review Team (PRT) which will report to the Head of Division and the Divisional Management Team (DMT) via the team leader to the Head of OSD4, the DMT's Programme Champion.

The PRT will:

- co-ordinate the development and revision of technical policy and strategy documents on ageing;
- monitor the progress of the Ageing and Life Extension Inspection Programme;
- review the inspection findings;
- determine research requirements;
- co-ordinate the development of guidance on ageing;
- review and develop the Ageing webpage;
- disseminate information both within HSE and to external stakeholders
- arrange meetings with industry stakeholders, as appropriate.

Topic specialists for each topic area will provide technical input, including development of the inspection templates, informed technical opinion for each hazard on the inspection findings, assistance with / the provision of advice on the development of guidance and the identification of relevant research.

10.2 Programme schedule

The programme will run from August 2010 to September 2013. On completion of the inspections, the findings will be fully evaluated, reported and disseminated. This task will be completed by the end of December 2013.

11. References

[1] *Offshore Division (OSD) Business Plan 2010/11,* Health and Safety Executive, http://www.hse.gov.uk/offshore/busplan1011.pdf.

[2] SI 2005/3117, *The Offshore Installations (Safety Case) Regulations 2005*, HMSO, http://www.legislation.gov.uk/uksi/2005/3117/contents/made, ISBN 0 11 0736109 X.

[3] SI 1996/913, *The Offshore Installations and Wells (Design and Construction etc.) Regulations 1996*, HMSO, http://www.legislation.gov.uk/uksi/1996/913/contents/made, ISBN 0 11 054451 X.

[4] SI 1995/743, *The Offshore Installations (Prevention of Fire and Explosion and Emergency Response) Regulations 1995*, HMSO, http://www.legislation.gov.uk/uksi/1995/743/contents/made, ISBN 0110527518.

[5] SI 1996/825, *The Pipelines Safety Regulations 1996*, HMSO, http://www.legislation.gov.uk/uksi/1996/825/contents/made, ISBN 0110543734.

[6] SI 1998/2306, *The Provision and Use of Work Equipment Regulations* 1*998*, HMSO, http://www.legislation.gov.uk/uksi/1998/2306/contents/made, ISBN 0 11 079599 7.

[7] *Successful Health and Safety Management*, HSG65, 1997, HSE Books, ISBN 9780717612765, http://www.hse.gov.uk/pubns/books/hsg65.htm.

[8] OIS 4/2009, *Guidance on Management of Ageing and Thorough Reviews of Ageing Installations*, Offshore Information Sheet No. 4/2009, Health and Safety Executive, http://www.hse.gov.uk/offshore/infosheets/is4-2009.pdf.

[9] OIS 5/2007, *Ageing Semi-submersible Installations*, Offshore Information Sheet No. 5/2007, Health & Safety Executive, http://www.hse.gov.uk/offshore/infosheets/is5-2007.pdf.

[10] API RP 2A, American Petroleum Institute, *Recommended Practice for Planning, Designing & Constructing Fixed Offshore Platforms – Load and Resistance Factor Design,* 2003, American Petroleum Institute, Washington DC, USA.

[11] API RP 2A, American Petroleum Institute, *Recommended Practice for Planning, Designing & Constructing Fixed Offshore Platforms - Working Stress Design, 21st Edition,* 2007, American Petroleum Institute, Washington DC, USA.

[12] ISO 19901, *Petroleum & Natural Gas Industries - Specific Requirements for Offshore Structures,* International Standards Organisation, 2003 - 2009, Geneva, Switzerland.

[13] ISO 19902, International Standards Organisation, *Petroleum & Natural Gas Industries – Offshore Structures, Fixed Offshore Structures*, International Standards Organisation, 2007, Geneva, Switzerland.

[14] NORSOK Standards, http://www.standard.no/.

[15] Dalzell, G, Roberts, G. A, Jagger, S and Walsh, P, *Guidance on Fire and Explosion Hazards Associated With Ageing Offshore Installations*, HSL report PS/07/06, 2007.

[16] ISO/NP TS 12747, *Draft ISO Recommended Practice: Petroleum & Natural Gas Industries - Pipeline Transportation systems - Pipeline Life Extension*, International Standards Organisation, 2008, Geneva, Switzerland.

[17] Draft NORSOK standard, *Life Extension for Transportation Systems*, 2009, http://www.olf.no/getfile.php/Dokumenter/HMS%20og%20Drift/Levetidsforlengelse/2%20090331%201230IVB-9%20National%20Standard%20R2.pdf.

[18] *GASCET: Guidance for the Topic Assessment of the Major Accident Hazard Aspects of Safety Cases*, 2006, Health and Safety Executive, http://www.hse.gov.uk/offshore/gascet/gascet.pdf.