HID Specialised Industries Unit 3 (SI3) Pipeline Integrity Management Delivery Guide for Onshore Pipelines

1. Purpose

1.1 The aim of this Delivery Guide (DG) is to provide information and guidance to SI3 Pipeline Inspectors to support the delivery of consistent and effective onshore pipeline integrity management interventions. It does this by highlighting current key areas to be covered during inspections and providing a framework for inspectors to judge compliance, assign performance ratings and decide what enforcement action to take should they find legislative breaches. In doing so it complements HSE's Enforcement Policy Statement and Enforcement Management Model (EMM).

1.2 This DG can also be used by onshore pipeline operators to prepare for inspections and better understand the intervention plans drawn up for their operations by HSE. In addition it can be used as a tool to help operators assess their own performance, for example by carrying out gap analyses against the success criteria listed and using them to identify safety performance indicators (SPIs) for pipeline integrity management. This will enable operators to proactively identify and take steps to rectify any potential weaknesses in their arrangements for maintaining pipeline integrity.

1.3 A separate DG exists for offshore pipeline integrity management.

2. Scope

2.1 Effective asset integrity management should be a priority for industry. A key objective for SI3 (Gas & Pipelines Unit) is to ensure that the integrity of transmission pipelines and associated equipment is maintained to an adequate standard by industry.

2.2 SI3 will do this:

- by encouraging industry to take proactive steps to manage the integrity of safety critical assets such as pipelines effectively;
- via a targeted, proportionate and consistent programme of inspection as shared with pipeline operators in their intervention plans;
- by sharing lessons learned from investigations; and
- by promoting the development and sharing of improved health and safety practices in the industry sectors we regulate.

2.3 The inspection of pipeline integrity management involves looking at a broad range of elements. These include pipeline design, risk of failure and consequence assessment, safe operating parameters, hardware/equipment and the wider management systems put in place by the dutyholder.

2.4 This DG describes current key topic areas that inspectors will consider when they are inspecting onshore pipeline integrity management. It also sets out the success criteria against which pipeline operator performance will be rated for each of these areas. Reference is made to technical standards and other sources of guidance and information that inspectors will use to judge compliance with the law.

2.5 This DG follows HSE's existing pipeline integrity management inspection practice which breaks the topic down into the following four core intervention issues:

i. Pipeline design compliance and the identification and assessment of integrity management arrangements

ii. Pipeline safety management system (SMS)

iii. Implementation of the pipeline integrity management process

iv. Emergency planning and preparedness

2.6 Success criteria are also listed, these cover the key issues that inspectors will consider when carrying out inspections against each core intervention issue. In some instances not all of the success criteria will apply so inspectors will make a judgement regarding which are relevant in each case. If relevant success criteria are not met, inspectors will assess how serious the consequences of failure to comply could be. This will inform their decision making in terms of the performance ratings that they assign and the enforcement action they take (if any) based on the findings of the inspection.

3. Justification

3.1 For pipelines transporting hazardous substances, the consequences of poor integrity management may be catastrophic and could affect third parties (including members of the public) over a considerable area. Pipeline integrity management is therefore an obvious priority for HSE and pipeline operators.

3.2 Pipelines are subject to a range of degradation mechanisms, the relative significance of which will depend upon factors such as the fluid(s) being transported (including any contaminants), the external environment, operating parameters, materials of construction etc. The progressive deterioration of plant such as pipelines is referred to as 'ageing'. Pipelines can also fail through damage mechanisms which are not age-related, e.g. accidental overpressure, third party damage. All potential pipeline threats need to be identified and assessed by operators, otherwise their pipelines may be at risk of failure.

3.3 Knowledge and understanding of pipeline failure mechanisms is constantly evolving. At the same time, improved techniques to allow pipelines to be inspected and monitored for damage and deterioration are being developed. One of HSE's important roles as a regulator is to ensure that pipeline operators harness this knowledge and make use of available technology to ensure ongoing control of risk to a level that is as low as reasonably practicable (ALARP). In practice, this means that HSE expects

pipeline operators to have arrangements in place to stay up-to-date with new techniques, technologies and systems and where appropriate to apply these to existing, as well as to new, pipelines and associated plant/equipment.

4. Relevant Legislation

4.1 The Pipelines Safety Regulations 1996 (PSR) create a range of duties on pipeline operators, many of which relate directly to onshore pipeline integrity management. Of these, the following are key requirements which have been the subject of HSE enforcement activity or where failure to comply has been a significant factor in the causation or escalation of pipeline incidents.

- various requirements of Regulations 5 - 11 relate to pipeline design aspects which will be critical for subsequent pipeline integrity.
- Regulation 13 requires the pipeline operator to ensure that a pipeline is maintained in an efficient sate, in efficient working order and in good repair.
- Regulation 16 requires the operator to take reasonable steps to inform persons of the existence and whereabouts of the pipeline in order to prevent third party damage.
- Regulation 23 requires the operator of a major accident hazard pipeline (MAHP) to prepare a major accident prevention document (MAPD).
- Regulation 24 requires operators of MAHPs to establish and record organisation, arrangements and procedures for emergencies. These need to be subject to revision and testing.

4.2. Regulation 6 of the Provision and Use of Work Equipment Regulations 1998 (PUWER) imposes duties relating to the inspection of work equipment (including pipelines) and maintaining records of these inspections.

5. Core intervention issues

5.1 Core intervention issue 1 - pipeline design compliance and the identification and assessment of integrity management arrangements

5.1.1 The design of the pipeline and any modifications to it must be appropriate for its use. The operating regime for the pipeline, the conditions under which the fluid is to be conveyed and the environment to which the pipeline will be subjected must all be taken into account in its design.

5.1.2 Pipeline design is the starting point for establishing effective arrangements for ongoing inspection, testing and maintenance activities. For example, maintaining the integrity and demonstrating the fitness for service of a pipeline that isn't designed to be pigged can be a significant challenge. If fitness for service can't be demonstrated this may reduce the operational life of the pipeline.

5.1.3 Another key design consideration is the pipeline's safety features e.g. those provided to prevent overpressure.

5.1.4 The route taken by an onshore pipeline requires careful consideration, in particular proximity to occupied buildings. Pipelines that pass close to populated areas may require design enhancements such as increased pipe wall thickness or physical means of reducing the probability of third party damage or the consequences of leakage. Pipeline operators should liase with local planning authorities (LPA) to ensure the pipe route is appropriate and the necessary consents are in place. This should also ensure that the consequences of any planned developments near the pipeline are properly considered before planning approval is granted.

5.1.5 Success criteria:

- Pipeline designed to an appropriate recognised standard
- Pipeline designed for inherent integrity e.g. suitably selected materials and methods of construction
- Pipeline route assessment carried out including identification of building proximities and population density calculations
- Design of pipeline incorporates suitable safety, pressure management and overpressure protection systems
- Design allows pipeline and associated equipment to be adequately maintained, inspected (inline inspection or ILI is considered to be industry good practice) and tested
- Where applicable, appropriate reassessment of design life carried out
- Reaffirmation of maximum operating pressure (MOP)/maximum allowable operating pressure (MAOP) of pipeline carried out to demonstrate continued fitness for purpose
- Pipeline design covers cathodic protection system including consideration of potential interaction issues with other pipelines in the vicinity
- Quality assurance arrangements in place during construction and commissioning to ensure design intent achieved

5.2 Core intervention issue 2 - Pipeline Safety Management System (SMS)

5.2.1 For MAHPs, PSR defines 'safety management system' (SMS) as the organisation, arrangements and procedures established by the operator for ensuring that the risk of a major accident is as low as is reasonably practicable.

5.2.2 The pipeline SMS needs to consider the interfaces between pipeline design, construction, operation and maintenance. Key elements of SMS are leadership, commitment, accountability and competence. Both adequate organisation and sufficient resources are necessary to implement the operator's policy with respect to the effective control of major accident hazards.

5.2.3 Traditional SMSs tend to focus on occupational health and safety and are unlikely to be fit for purpose for delivering safe pipeline operations. The MAPD required by Regulation 23 of PSR for MAHPs must demonstrate that the pipelines SMS is adequate. Verification that this requirement is being met is an important element of HSE's regulatory approach.

5.2.4 Success criteria (for ease of reference these are subdivided under the headings 'Plan-Do-Check-Act' as described in HSE publication HSG65 'Successful safety management')

Plan:

- Effective leadership and commitment to continuous improvement in management of major hazard risks
- Up to date MAPD that identifies risks to pipeline and control measures and describes arrangements, behaviours and systems that exist in practice (NB: only required for MAHPs)
- Organisational responsibilities documented e.g. via an organogram
- People with key responsibilities in the SMS understand their role and are resourced to carry it out effectively
- Competency management system in place
- Effective communication and co-operation at pipeline operator interfaces
- Ownership and responsibilities for all lengths of pipeline clearly understood and documented
- Arrangements in place to ensure that pipeline regulatory notifications are made as required by PSR

Do:

- Pipeline operated to an appropriate code e.g. BS 8010, IGE TD1
- Procedures exist for: safe operation of plant; permit to work; management of change and modifications; safe isolation of plant and equipment; selection and control of contractors; non-routine operations.
- Human factors considered and steps taken to minimise human failure

Check:

- SMS includes process to test and review the performance of the management system and keep senior management informed regarding safety performance, e.g. via safety performance indicators (SPIs)
- Accidents/incidents/near misses investigated, lessons learned and shared within the organisation
- Programme of SMS audits carried out

Act:

- Audit findings, SPI data and other information regarding safety performance reported to a senior level and acted upon

5.3 Core intervention issue 3 – implementation and maintenance of the pipeline integrity management process

5.3.1 This issue concerns the ongoing routines, processes and procedures that need to be in place to successfully deliver pipeline integrity. A range of equipment, instruments, devices and techniques have been developed for the

protection, operation, inspection, testing and maintenance of buried pipelines. Inspectors will expect pipeline operators to consider and, where appropriate, utilise improved techniques and technologies.

5.3.2 Accidental damage, such as third party damage (e.g. caused by construction or agricultural work), is a continuing risk to the integrity of pipelines. Inspectors will expect operators to take steps to minimise the risk of accidental damage occurring to their pipelines, e.g. installation of pipeline marker posts, use of Linesearch to facilitate third party access to information about pipeline locations.

5.3.3 Success criteria

Corrosion management:

- Suitable corrosion management programme implemented with suitable monitoring and review, e.g. taking into consideration cathodic protection, interaction issues, A/C mitigation, corrosion probes, inhibition, corrosion within sleeves, corrosion coating performance etc
- Performance of cathodic protection is monitored, levels of protection maintained to an appropriate standard and prompt remedial action taken where problems identified e.g. where transformer rectifiers in impressed current systems are found to be faulty

Inspection

- ILI regarded as the norm but if not used, alternative arrangements in place and (e.g. CIPS, current attenuation surveys) and feasibility of future ILI considered (including sample ILI)
- In line inspection (ILI) protocols justified by previous ILI data and degradation assessment
- Results of ILI feed into remedial action plans
- External coating inspections carried out e.g. Pearson coating defect surveys, close interval protection survey (CIPS) or combined surveys
- IPressure Systems Safety Regulations (PSSR) inspections carried out on relevant equipment e.g. pig launchers, isolation valves
- Pigging and other maintenance activities carried out to suitable safe procedure e.g. covering purging, proving isolations etc
- If nitrogen sleeves are present, regular monitoring and top ups carried out with prompt remedial action taken where problems identified
- Water crossings and exposed crossings are surveyed in accordance with a designated programme

Testing

- Pipeline emergency isolation systems inspected and tested
- Associated site equipment (e.g. at above ground installations) adequately maintained and tested, suitable maintenance management system in place e.g. to cover vibration, PSSR compliance (protective devices etc), corrosion including corrosion under insulation etc
- Leak detection systems, where fitted, to be tested

Damage prevention

- Pipeline equipment protected from fire, impact and explosion

- Reasonable steps taken to prevent third party damage to pipelines e.g. regular communication with landowners, replacement of damaged marker posts, aerial/vantage point surveys, effective infringement reporting system, use of Linesearch/Linewatch

Other

- Risk assessments carried out in relation to areas of non-compliance with current pipeline standards, e.g. high consequence areas, and any special precautions (e.g. more frequent monitoring) implemented
- Key operating parameters (e.g. operating pressure and temperature excursions) monitored, logged and acted upon where appropriate
- Effective integrity and damage assessment and appraisal process in line with industry good practice
- Coherent and ongoing mechanism for ensuring effective oversight and decision making in relation to the integrity management arrangements, e.g. reaffirmation of MAOPs for pipelines operated to TD1

5.4 Core intervention issue 4 - emergency planning and preparedness

5.4.1 MAHP incidents can be very serious and warrant a carefully planned and rehearsed multi-agency emergency response. Planning for emergencies at MAHPs is therefore an explicit requirement of PSR.

5.4.2 PSR requires that the operators of MAHPs prepare adequate emergency procedures for dealing with the consequences of a major accident involving a pipeline. These procedures need to cover a range of issues, from safe shut down of operations to liaison with emergency responders and communication with the media. These procedures must be tested by the pipeline operator to ensure that individuals with a role in emergency response are properly prepared to respond to a real emergency. The emergency procedures also need to be reviewed and if necessary revised in the light of any lessons learned from tests.

5.4.3 For MAHPs, PSR also requires Local Authorities (LAs) to prepare offsite emergency plans, and places a duty on pipeline operators to supply the information to LAs that they need to draw up these plans. Offsite emergency plans need to be reviewed and if necessary revised by the LAs.

5.4.4 Success criteria

- Adequate pipeline emergency arrangements in place (required for all pipelines, not just MAHPs)
- MAHP emergency plans and procedures tested, reviewed and revised periodically and in the light of lessons learned from tests
- Competence of key personnel in emergency procedures is assured e.g. via pipeline emergency response officer (PERO) course
- Adequate consideration of emergency response in control room design e.g. alarm handling
- Operator carries out checks on the effectiveness of emergency shutdown procedures, including operation and testing of shut off valves

6. Judging success and moving on

6.1 Inspectors should use the HID SI generic performance descriptors (see Table 1) to determine the appropriate performance rating for each of the four core intervention issues covered by this DG. Table 1 also gives guidance on the initial enforcement expectation and should be used alongside the Enforcement Management Model (EMM). The local factors that apply in each case will ultimately determine the whether there should be any enforcement action. Consideration also needs to be given as to how and when the issues raised during an inspection should be closed out. Inspectors must adhere to the relevant operational guidance (e.g. on use of the COIN issues tab).

7. COIN IRF Scoring

7.1 The operator's performance ratings should be entered on the Inspection Rating Form (IRF) tab of the relevant PSR Intervention Plan Service Order. Separate ratings should be entered for each of the four core intervention issues against descriptions on the IRF tab as follows:

Core intervention issue	**Description of topic on IRF rating tab**
Pipeline design compliance and the identification and assessment of integrity management arrangements	Pipeline Design Compliance
Pipeline safety management system (SMS)	Pipeline SMS
Implementation of the pipeline integrity management process	Pipeline Integrity Management
Emergency planning and preparedness	Emergency Response