Management Procedure for

Maintenance of Pipelines Operating Above 2 Bar

CAD/PM/MAINT/5

Issue Date: Feb 2021

Version Control

Implementation date

Feb 2021

Review date

Feb 2026

Document owner

Engineering

Management approval

Head of Engineering

Disclaimer

This safety and engineering document is provided for use by Cadent Gas Limited and such of its contractors as are obliged by the terms and conditions of their contracts to comply with this document. Where this document is used by any other party it is the responsibility of that party to ensure that this document is correctly applied.

Mandatory & Non-Mandatory requirements:

In this document:

Shall: Indicates a mandatory requirement.

Should: Indicates best practice and is the preferred option. If an alternative method is used then a suitable and sufficient risk assessment must be completed to show that the alternative method delivers the same, or better, level of protection

The Company: Any reference in this document to 'the Company' shall be taken to mean Cadent Gas Ltd.

Document History

Description	Date	Reference
Last published	June 2014	T/PM/MAINT/5 Part 1 T/PM/MAINT/5 Part 2
• Review of T/PM/MAINT/5 Part 1 and Part 2 to resolve both documents into a single management procedure. • Removal of NTS references • Incorporation of 2 to 7 bar elements of MAINT/1 • Updated to reflect business changes.	February 2021	CAD/PM/MAINT/5

Comments and queries regarding the technical content of this document should be directed to:

Cadent

Ashbrook Court

Prologis Park

Central Boulevard

Coventry

CV7 8PE

Contents

Document Summary

Purpose

This Management Procedure was approved by the Head of Engineering, in June 2020 for use throughout The Company.

Users should ensure that they are in possession of the latest edition and related bulletins by referring to the document library of Safety and Engineering documents available on the company Infonet.

Compliance with this safety and engineering document does not confer immunity from prosecution for breach of statutory or other legal obligations.

Responsibilities

This document applies to all those working directly for The Company e.g. employees, or under the direction of The Company, e.g. contractor mate working in a direct labour team.

1. SCOPE

This procedure covers all aspects of maintenance of pipelines and associated installations operating above 2 barg. Its purpose is to ensure that all maintenance tasks are identified and detailed for this specific asset group in order to ensure compliance with both The Pipeline Safety Regulations 1996, Pressure System Safety Regulations 2000 and company policy. All reporting formats determine a minimum level of guidance and content. **This procedure is mandatory.**

2. REFERENCES

This Management Procedure refers to the documents listed in **Error! Reference source not found.**. Unless otherwise specified the latest edition of the documents, including all addenda and revisions, shall apply.

All faults shall be reported in accordance with CAD/PL/FAULT/2

All defects shall be reported on and prioritised in accordance with CAD/PM/DEFECT/1

All defects shall be assessed in accordance with CAD/PM/DAM/1

Inspection and assessment of results for pipelines suitable for internal inspection shall be in accordance with CAD/PM/PS/3 – (ES-94-01) and CAD/PM/OLI/8

Inspection and assessment of results for pipelines suitable for overline inspection shall be in accordance with CAD/PM/PS/3 – (ES-94-02) and CAD/PM/OLI/4

All visual inspection shall be carried out in accordance with CAD/PM/NDT/1.

All field coating shall be carried out in accordance with GIS/CW/5.

All factory coating shall be carried out in accordance with GIS/CW/6

All painting shall be carried out in accordance with CAD/SP/PA/10.

Cathodic Protection Maintenance shall be carried out in accordance CAD/PM/ECP/2

All marker posts and CP posts shall conform to the specifications in CAD/SP/TR/29

All marker posts shall be sighted and installed in accordance with CAD/PM/TR/28

All Third-party protection activities shall be carried out in accordance with CAD/PR/DP/1 and CAD/PR/DP/5

Inspection and repair of damaged steel pipelines shall be carried out in accordance with CAD/PM/P/11 and CAD/PM/P/20.

All work on pipelines containing defective girth welds or girth welds of unknown quality shall be carried out in accordance with GDN/PM/P/18.

The effects of ground movement on pipelines shall be considered in accordance with CAD/SP/GM/1

The effects of mining and quarrying shall be assessed in accordance with CAD/SP/GM/4 and CAD/PM/GM/10 respectively

Protective slabbing requirements shall be in accordance with CAD/SP/CE/12 - PART 12 Pipeline Protection Slabs.

Each pipeline shall have its own pipeline file. All records shall be maintained in accordance with CAD/PL/RE/1.

3. DEFINITIONS

SMYS: Specified minimum yield stress of the pipe.

MOP: The Maximum Operating Pressure at which a pipeline shall be operated.

SOL: The Safe Operating Limit is the limit beyond which the system should not be taken as failure is liable to occur.

RTP: Reinforced Thermo-Plastic pipe. A reinforced PE pipeline material rated for HP LTS system use

Pipeline:
A pipe or system of pipes, together with associated installations for the conveyance of a fluid, (Natural Gas) across the boundaries of premises.

Above ground pipeline crossing:
Section of pipeline which comes above ground as part of the pipeline route, for example; pipe bridges. This does not include general AGI above ground pipework.

Above ground pipeline (Including pipeline in pits):
Section of pipeline which comes above ground, typically within an Above Ground Installation (AGI) prior to the Pig Trap or sections of pipeline which can be accessed via a pit for inspection and maintenance. This does not include general AGI above ground pipework.

Associated installation:
An installation which has a purpose of supporting the safe operation of a pipeline. Examples include block valves sites and PIG trap sites. Refer to section 4 for typical pipeline limits.

Pig trap:
A pressure vessel with the specific purpose of launching and receiving internal inspection devices within the pipeline.

Block valve:
An inline full-bore isolation valve to isolate a section of pipeline which includes a point of entry or offtake, with a purpose of limiting inventory loss in the event of an incident or to facilitate maintenance.

Intermediate block valve:
An inline full-bore isolation valve to isolate a section of pipeline not including a point of entry or offtake, with a purpose of limiting inventory loss in the event of an incident or to facilitate maintenance.

Sleeve:
A casing installed at the point of construction to mitigate the risk of a pipeline failure at a specific location, to protect the pipeline from external interference or to facilitate construction. There are three classes of sleeve:

- Class 1 - Sleeves required to protect the public, or judged desirable to protect some other installation, from the consequences of failure of the pipeline. Also serve to protect the pipeline from external interference

- Class 2 - Sleeves provided in order to protect the pipeline from external interference
- Class 3 - Sleeves installed only to facilitate the construction of the pipeline.

The design and application of the sleeve is specific to the duty that it is required to perform.

Cathodic protection system (CP):
A method of protecting a metal structure (buried pipeline) from corrosion by causing a direct current to flow from its electrolytic environment into the entire metal structure. This can be achieved in the following ways:

- Impressed Current CP System - Normally comprising one or more Transformer Rectifiers (T/R's) and Ground-beds (GB's), providing cathodic protection to a buried steel structure (pipeline)
- Sacrificial CP System - Normally comprising of one or more sacrificial anodes, connected to a buried steel structure (pipeline) to provide cathodic protection. These may include bracelet type anodes attached directly to the pipeline or cabled anodes buried in close proximity to the pipeline and connected to the pipeline via a test post
- Mixed CP System - A combination of Impressed Current and Sacrificial CP Systems.

Cathodic protection test post:
Typically, a concrete or plastic post incorporating a cabled connection to the buried steel structure (pipeline) for the purpose of taking a cathodic protection reading.

Aerial marker post:
A visual marker for the purpose of identifying the location of a buried pipeline, typically a plastic post with an coloured (Red, orange or Yellow) cap/label with emergency contact details

Field boundary marker post:
Typically, a concrete or plastic post providing a visual marker for the purpose of identifying the location of a buried pipeline with a yellow label with emergency contact details

Watercourse crossing:
A location where a pipeline has been constructed in the bed of a watercourse which may include streams, rivers, navigable waterways, estuaries, large expanses of water, shore approaches and other shallow waters affected by adverse water and associated ground conditions.

Critical valve (LTS HP systems):
- All remote operated valves, with the following exception - remote operated valves currently not required to operate but may be needed for future applications.
- All valves which are required to isolate sections of pipe or plant to allow continued supply to customers, e.g. at a pipeline spur with a valve bridle arrangement

  Note: certain block valves may be re-classified as non-critical, provided an appropriate risk assessment is carried out.
- All off-take primary pipeline isolation valves
- Station inlet and bypass valves for major installations (i.e. terminals, multi-junctions, and compressors).
- In-line block valves for which the sole purpose is isolation of sections of pipeline that contain a specific risk area (e.g. major river crossings).

- Any other valve that would not normally be defined as critical but is nominated to be critical by the Responsible Engineering Manager on the grounds of strategic importance or maintenance history.

Non-critical valve (LTS HP systems):

- Valves that can be operated at any time without affecting the overall flow of gas.
- Valves that form a bypass to the main flow of gas and serve no further isolation purpose.
- In-line block valves for which the sole purpose is isolation of a specific section of pipeline that contains no other equipment or specific risk area.
- Pig Trap isolation valves which serve no further isolation purpose.
- Valves which are currently not in use but may be required for future applications,
- Any other valve defined as non-critical by the Responsible Engineering Manager.
- Valves which are only required for isolation of plant for routine maintenance.

  Note – Stream isolation valves are included in this category because they do not directly affect the flow of gas to the customer, although they are critical with respect to the isolation of equipment for routine maintenance activities. These valves will be checked at the same time as the equipment they are designed to isolate, see table in Appendix B.
- Plant isolation valves which are not normally operated during routine maintenance will require checking at the same frequency as a non-critical valve.

Redundant valve (LTS HP systems):

- Valves identified by the Responsible Engineering Manager as no longer having any operational function.

M1 operational valve (IP systems):

- These valves are installed primarily to control and manage a local gas supply emergency but are also available to support network isolations for major gas supply emergencies
- All line valves installed within IP pipelines are classified as M1 operational valves
- Valves shall be maintained at a five yearly interval in accordance with work procedure CAD/PR/V/1701, except for the following types of valves which shall be maintained as follows:
  - Audco plug (Serck) valves and Cameron Ball valves shall be maintained annually
- See CAD/PM/V/17 for more information

Pipeline Limits:

Typical pipeline limits as per The Pipeline Safety Regulations 1996

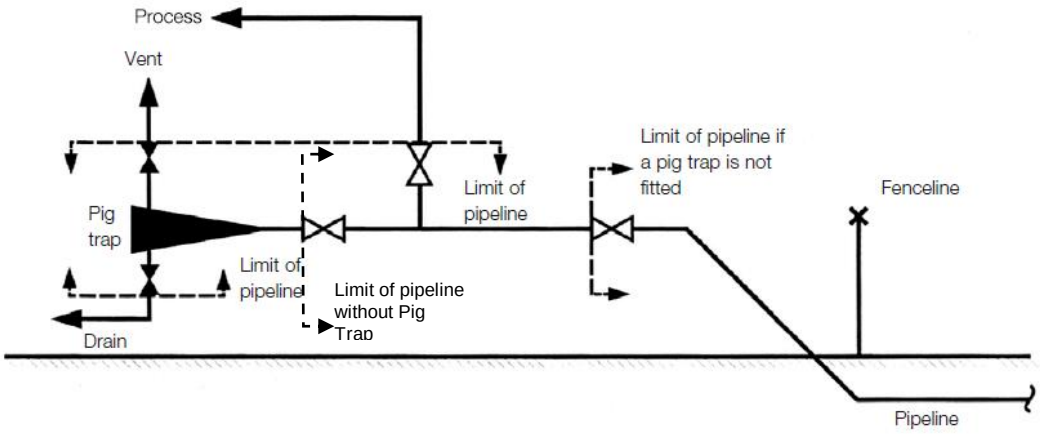

Figure 1: Limit of pipeline at AGI

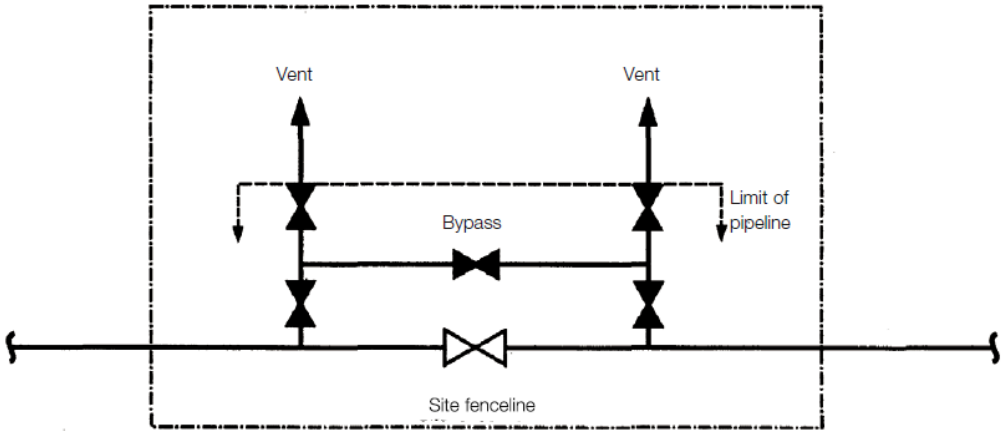

Figure 2: Limit of pipeline at a block valve site

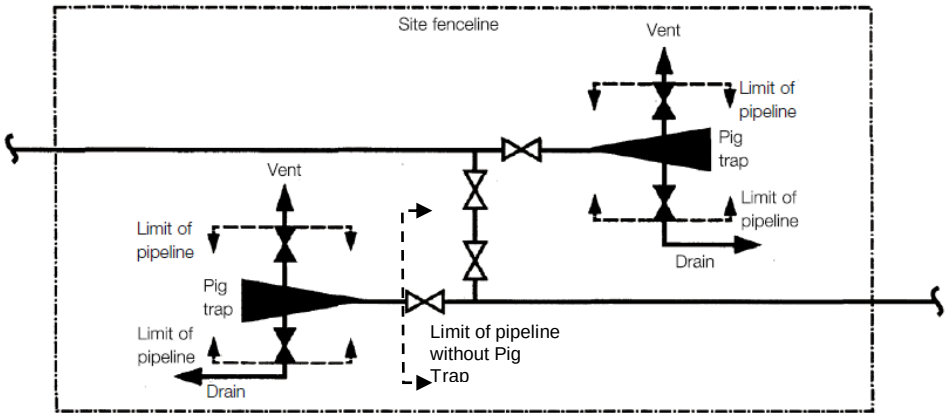

Figure 3: Limit of pipeline at a mid-point pig trap site

- Figures 1 to 3 are intended to show the typical boundaries between pipelines and installations.
- The pipeline includes the pig trap and fittings as shown.
- Maintenance of portable pig traps is included.
- All block valve sites are included as part of the pipeline.

4. HEALTH, SAFETY AND ENVIROMENT CONSIDERATIONS

Maintenance and Third-Party activities undertaken may have an impact on integrity of the pipeline and the safety of the general public, the company's staff and contractors and in turn may affect the local environment. The company's policy on Health, Safety and the Environment shall be followed at all times to reduce this impact to a minimum. Further references can be found in CAD/PL/GR/8 and CAD/PL/GR/9.

All persons engaged in the design, construction, testing, commissioning, operation, maintenance and alteration of pipelines, mains, services and related plant shall be competent to carry out such work. This may be achieved by an appropriate combination of education, training and practical experience. Reference shall be made to CAD/PM/STC/1 – Management procedure for Safety and Technical competencies.

All maintenance activities will be conducted in accordance with The Companies relevant policies and engineering and safety procedures and requirements. Maintenance activities will be planned and scheduled with appropriate tolerances as defined in accordance with the appropriate Resource Management Procedure

5. ROLES AND RESPONSIBLITIES

Network Engineer Responsible manager for Pipeline and/or AGI activities for a defined Distribution Network.

Network Supervisor - First Line Manager for all activities completed by Technicians within defined Distribution Network

Technician - Person responsible for completing both routine maintenance, non-routine maintenance and third-party preventative maintenance within a defined Network.

Central Engineering Team – Responsible for the provision of 2nd line technical support to Operations and, where applicable, maintenance service providers.

Plant Protection Team – Responsible for the initial response to any third-party enquiries including planning applications and third-party letters to Landowners.

Pressure Systems User - of a fixed pressure system is The Company and the duties are carried out by the nominated manager.

Aircraft Observer – Responsible for reporting and recording any on ground activities (e.g. encroachments) which, if allowed to develop might affect the integrity of the pipeline.

6. PIG TRAPS

The maintenance, isolation, purging and recommissioning of pig traps shall be undertaken in a safe manner. The mechanical and safety procedures for pig traps are presented in CAD/PR/MAINT/5029. This includes the basic maintenance for all pig trap closure types.

Records should be kept of all pressure cycling on portable and temporary/mobile pig traps in accordance with Appendix C.

The records shall be maintained in accordance with the requirements of CAD/PL/RE/1.

Note: *IP Pig Traps are not included in the PSSR inspection regime; a majority of this classification of asset has been removed. The remaining assets shall be maintained in line with HP requirements until a decision is made on their future.*

7. MAXIMUM OPERATING PRESSURE (MOP) – LTS pipelines

A procedure shall be in place with system control to monitor and record the pressure for each pipeline section.

7.1 Pressure Monitoring Management

The network shall be managed to control any potential pressure transient to within the nominated MOP and protection devices shall be set to prevent the Safe Operating Limit (SOL) being exceeded.

7.2 Pressure Excursions

The sustained operating pressure of a pipeline system shall not exceed MOP. This sustained operating pressure is the maximum set pressure for the pressure regulating devices.

However, when operating at or near the MOP, this pressure may be exceeded by no more than 2.5% of its value due to variations of pressure regulating devices.

An incidental pressure rise is admissible, but facilities shall exist to limit automatically, by relieving or shutting off, maximum incidental pressure (MIP) to 10% above MOP.

Any incidental pressure rises greater than 2.5% above MOP shall be individually limited to 5 hours or 20 hours in total in any 12-month period.

Any excursion greater than 2.5% above MOP shall be recorded and reported to the Pressure System User and the maintenance staff managing the system for investigation to NGUK/PM/INV/1 and may require to be reported to the HSE.

For pressure excursions greater than 2.5% above MOP, which are outside of the IGEM/TD/1 limits for any given pipeline (i.e. individual excursions greater than 5 hours or excursions that are greater than 20 hours in total in any 12-month period) shall be recorded and reviewed by the relevant control room, who shall also notify the Pressure System User and the nominated Competent Person. In addition, it shall be reported to the maintenance staff managing the system and shall be reported as an event for investigation as per the requirements of NGUK/SHE/INV/1.

All pressure excursions shall not exceed the SOL.

7.3 Pressure Monitoring

DNCC shall monitor all pressure excursions above MOP.

Action shall be taken to prevent reoccurrence of these pressure excursions.

Pressure excursions which exceed the Safe Operating Limit (SOL) shall be managed in accordance with the Pressure Systems Safety Regulations 2000 requirements.

The location of pressure monitoring points shall be agreed between the control room and the Pressure System User to ensure that the monitoring points are situated at the locations which would see the highest pressure.

7.4 Annual Declaration of MOP

Each year the relevant control room shall provide the Pressure System User with the maximum pressure that each pipeline has seen within the previous 12 months and details of any pressure excursions as specified in section 7.2. An annual declaration of the MOP for each pipeline/associated installation (excluding compressor stations) shall then be carried out by the Pressure System User.

The annual declaration of MOP of a pipeline/associated installation shall be based on the most recent audit (see section 8), the pressure history (see clause 7.4 c) and all relevant information arising from surveillance, inspection, maintenance and operation.

An appropriate form is included in Appendix D, although other equivalent forms may be used. This shall be completed by the pipeline user and retained in the pipeline file to provide supporting information for the affirmation survey.

Each pipeline shall be re-declared at its current MOP unless:

a) There are operational reasons for re-declaring at a lower MOP

b) Up-rating of the pipeline has been agreed

c) Records cannot be produced to show that the pipeline has experienced a pressure within 7 bar of the declared MOP at any time within the preceding five years, in which case a formal statement confirming the pipeline/associated installations are fit for operation at the declared MOP shall be prepared and certified by the Pressure System User. This statement shall be supported by the results of the pipeline audit and an integrity assessment confirming the inspection and condition monitoring for the installations are acceptable. Otherwise, the MOP shall be re-declared at the highest pressure actually recorded in the preceding five years.

In order to avoid 7.4 c, it is recommended that once every four years, at a time agreed with the relevant control room, the pressure in each pipeline normally operated below its MOP should be raised for an hour to such a level that the pipeline experiences a pressure within 7 bar of the declared MOP. Where this cannot be done without some points on the pipeline experiencing a pressure above the MOP, the pressure shall be raised to the MOP.

Where the pressure in a pipeline has been significantly below MOP, 50% or more, for the relevant time, consideration should be given to the risk of pipeline failure during the pressure-raising operation, and the operation carried out in such a way as to mitigate against the consequences of this risk.

Checks shall be made to ensure consistency between the declared MOP and the SOL/MOP in the Written Schemes of Examination (WSoE) for the pipeline. If the MOP is to be changed, the WSoE shall be updated to reflect this with the agreement of the Competent Person as defined in CAD/PM/PS/3. Any changes to the declared MOP shall also be reflected in all the other pipeline systems/databases i.e. UKOPA Fault database, Intervals and the PSR notification database.

7.5 Records

An annual declaration of MOP shall be made for all pipelines in accordance with Appendix D or equivalent.

The records shall be maintained in accordance with the requirements of CAD/PL/RE/1.

8.0 PIPELINE MAXIMUM OPERATING PRESSURE AFFIRMATION REPORTS

In order to complete the pipeline maximum operating pressure (MOP) affirmation reports it shall be necessary to complete an IGEM/TD/1 audit report of the pipeline section.

Affirmation of the MOP of a pipeline/associated installations (excluding compressor stations) requires a formal assessment of integrity of the pipeline and its associated installations, and an assessment of the risks posed on the surrounding population.

A full survey of the pipeline route (e.g. aerial photography/ video or full line walk) shall be carried out in order to determine in conjunction with strip maps, the state of development along the pipeline route. Measurement of population density shall then be based on this survey. The method of calculating this is described in IGEM/TD/1.

Infringements from changes in proximities, population density or traffic density identified in the Affirmation of MOP report (as required by IGEM/TD/1) should be evaluated as soon as possible after completion of the report by quantitative risk assessment (see also section 8.10). Any measures identified by the assessment as reasonably practicable in reducing the risk should be subsequently implemented.

A copy of the Executive Summary and signatory cover of each report should be submitted to the respective Pressure System User for both Gas Transmission and Gas Distribution.

The full history of the complete MOP affirmation reports for the pipeline should be retained for the asset life of the pipeline plus 5 years.

8.1 Choice of Edition of IGEM/TD/1 (and IGEM/TD/3)

The primary purpose of a pipeline audit is to check compliance with the Edition of IGEM/TD/1 or IGEM/TD/3 (for pipelines running below 16 bar and built after 2008) to which the pipeline is currently being operated. However, when an audit of a pipeline takes place, it is recommended that consideration should also be given to the possibility of upgrading the pipeline to operate to the most recent Edition of IGEM/TD/1 with which the pipeline complies. However, where it would be necessary to perform physical works before a pipeline could be upgraded, the pipeline shall continue to be operated in accordance with the earlier Edition.

The pipeline report shall explicitly state the Edition of IGEM/TD/1 or IGEM/TD/3 to which the pipeline is currently being operated. (See Section 8.2.3)

8.2 Written Report Format

The following headings are for the actual details that need to be included in the written report, and statements are required under each heading to ensure that all considerations on the fitness for purpose of the pipeline have been addressed, references shall be made to the Original Design, Construction, Maintenance and Operational parameters of the pipeline.

8.2.1 Executive Summary/Introduction

An executive summary/introduction of the full report shall be provided, outlining the basic pipeline details, and areas of non-compliance together and recommendations on the future operating status.

8.2.2 IGEM/TD/1 Considerations/Parameters for Pipeline at Current MOP

The written report shall address the Design and Testing, State of Development, Operation, Inspection, Surveillance and Maintenance details of the pipeline with entries to cover the following:

a) General Pipeline Information / History, to cover pipeline construction details, i.e. diameters, wall thickness, grades, hydro-static testing pressures.

b) Weld Quality

c) Transmission of Towns (manufactured) Gas

d) Line walking data;

Depth of Cover

Marker post condition

Leakage survey

River erosion etc.

e) Traffic Route Crossings: Road, rail, water, exposed, other special crossings

f) Sleeves

g) Additional Impact Protection

h) Actual Pipe Details/Abandonments/Modifications/Fittings.

i) Environmental Issues/Protection

j) State of Development: Building proximity, population density (R / S type areas), population clusters, sensitive areas, traffic densities and wind farm installations.

k) Inspection Activities: Exposed Crossings, Watercourse Crossings, Sleeves.

l) Surveillance Activities: Aerial, Route Walk, Vantage, Pinch Point (UKT only), Third Party Survey, Liaison with Owners/Occupiers, Ground Movement and Mining.

l) Maintenance Activities: Nitrogen Filled Sleeves, Valves, Pig Traps (test certs)

m) Condition Monitoring

r) Corrosion Control / Cathodic Protection

s) Annual / 5 Year MOP Records.

t) Fatigue Life

8.2.3 Establishing the Operating Status of the Pipeline

Non-compliance issues from each of the above considerations/parameters shall be further considered with each Edition of IGEM/TD/1 and assessments made for the continued operation of the pipeline within any constraints identified. Results of these assessments (risk assessments etc.) shall be concluded with acceptances of deviations and/or contingencies for any necessary remedial works, to allow continued operation at the current MOP.

8.2.4 Recommendations

Recommendations shall be made against each of the headings listed in section 8.2.2 above for continued safe operation of the pipeline at its current MOP and for compliance with IGEM/TD/1 and include record deficiencies.

8.2.5 Calculations

Calculations shall be included for all relevant combinations of pipe diameter, wall thickness and material grade to show Design Factors (% SMYS) for current MOP and at design and hydro-test pressures, building proximity distances (BPD) and population densities. Calculations shall be undertaken to the relevant Edition of IGEM/TD/1 for the pipeline under consideration.

8.2.6 Appendices

Additional information shall be included as necessary to support the main report in the form of Appendices.

The number of Appendices is not fixed, but as a minimum should include;

- Extracts from records/databases.
- List(s) of where information/data has been sourced.
- Map extracts and photographs of any infringements where identified.
- Pressure System diagram(s).
- Any other details considered as necessary for a full record of the pipelines fitness for purpose or areas of non-compliance that need to be resolved, as recognised by the author/competent engineer.

Additional information such as 'Tabulated Details', witness testimonies etc., can be included for more detailed reports as required for up-rating or similar projects if deemed necessary.

This procedure shall be considered as the minimum requirements for undertaking both the first and subsequent pipeline MOP affirmation reports and it is intended that reference to all aspects of the pipeline shall be contained in one concise document. Further references shall be made to other records/databases and sources of information.

The following sections (8.3 to 8.6) are included to assist in the preparation of the above reports and in particular should address some of the main areas of concern when compiling reports for any "older" (i.e. pre-1972) pipelines.

8.3 Availability and Quality of Original Records

In order to compile the written report a detailed investigation/demonstration of the availability and quality of any pipeline records held by the pipeline operator is necessary. Where any element of the above audit requires demonstration of design or operational parameters this investigation and/or demonstration shall be based on either the availability and quality of Primary or Secondary records as identified in 8.3.1 and 8.3.2 below:

8.3.1 Primary

The following list denotes what has been recognised as primary records and should the original certified document. If a copy only is available which is certified as a bona-fide copy, approved by the responsible engineer, then this would be considered acceptable.

- Design Certificate
- Design Brief
- Original BGQA material release notes
- Purchase requisitions/orders
- As built records
- Welding Bar Charts
- Material take- off sheets
- Site delivery/acceptance sheets
- Project record forms
- Handover/completion certification
- NDT reports

- Original test certificates including charts and graphs
- Original testing schematics/schedules
- Original site reports
- CP records
- OLI1 reports
- Modification and repair documentation
- Maintenance records

8.3.2 Secondary

The following list is a sample of other records that may be available but are considered as secondary records as they are not considered as adequate proof of the actual design/as-built records of the pipeline under audit;

- Historic database(s) information.
- Contract documentation extracts.
- Historic policies and procedures that were in place at the relevant time.
- Sworn Statements
- Tender data/material stock references
- Previous/historical IGEM/TD/1 reports
- Sufficient other records, entries in correspondence files, site log books etc., and other further evidence considered as useful

Where it is not possible to satisfy the primary records, a file note shall be retained in the appropriate pipeline record file together with the justification.

Subject to the preparation of such a file note, the absence of original certification should not prevent the upgrading of a pipeline to operate to a more recent Edition of IGEM/TD/1.

8.4 Weld Quality

Where the quality of any girth weld on a pipeline is of unknown quality, such that procedure GDN/PM/P/18 applies, this shall not be a reason for limiting the MOP of a pipeline below its present value. In such cases it shall be ensured that the applicability of GDN/PM/P/18 is prominently displayed on all pipeline record files, and communicated to all appropriate personnel, to ensure that it is recognised before any work is performed on such a pipeline.

Weld quality should not prevent the upgrading of a pipeline to operate to a more recent Edition of IGEM/TD/1.

Spigot and socket joints require special consideration for any work to be carried out on them, and the files shall be marked up appropriately.

8.5 Pipelines with Town (manufactured or reformed) Gas Service

Where a pipeline has experienced town (manufactured) or reformed gas service, irrespective of pressure, this shall not be a reason for limiting the MOP below the current value. However, it shall be ensured that this is noted in the pipeline operational file. Specialist advice shall be sought regarding pressure and pressure cycling limits of these pipelines. Operations shall be made aware of any limits for affected pipelines by the Pressure System User.

A review of the threat of internal stress corrosion cracking is provided in GL Noble Denton report 7572.

Past town (manufactured or reformed) gas service should not prevent re-declaration of a pipeline to a more recent Edition of IGEM/TD/1.

8.6 Depth of Cover

Where the depth of cover is not greater than 0.91m (satisfies IGEM/TD/1 Edition 1) this shall not prevent the pipeline from being operated to a later edition which requires a greater depth of cover. Where this is the case a file note shall be prepared and retained in the pipeline file.

8.7 Fatigue

The Pressure System User shall be provided with information from the relevant Control Room relating to the pressure cycling that each pipeline has seen in the previous twelve months in the form of the number of equivalent hoop stress cycles of 125 N/mm^2. The location of pressure monitoring points, which shall be agreed between the Pressure System User and the Control Room, should be at the points on each pipeline where the maximum swing in pressure occurs and hence the fatigue cycling is at its greatest. The number of equivalent hoop stress cycles in the connected pipeline systems should be calculated from those at the pressure monitoring points.

An assessment shall be made of the fatigue life for each transmission pipeline as part of the audit detailed above. A fatigue assessment shall be performed to determine the number of cycles of a hoop stress range of 125 N/mm^2 that the pipeline is capable of withstanding, and a record kept of actual cyclic loading. When the actual cyclic loading is approaching or has exceeded 80% of the fatigue life, i.e. 15,000 cycles or the fatigue life stated in the design life, then, the Pressure System User shall be notified, and the appropriate action agreed.

Fatigue assessments shall be performed in accordance with CAD/SP/TR/19.

A fatigue assessment is not required if the maximum daily hoop stress range is less than 35 N/mm^2.

Where the pipeline has been subject to a high-level hydro-test in accordance with Table 8 of IGEM/TD/1 Edition 3 or Edition 4 or Table 11 of IGEM/TD/1 Edition 5, the simplified approach to fatigue design in IGEM/TD/1 should be used, i.e. as presented in clause 6.6.2.1 of IGEM/TD/1 Edition 4 or clause 6.6.2.2 of IGEM/TD/1 Edition 5.

Where the pipeline has not been subject to a high-level hydro-test in accordance with Table 8 of IGEM/TD/1 Edition 3 or Edition 4 or Table 11 of IGEM/TD/1 Edition 5, a detailed fatigue assessment should be undertaken, i.e. as presented in clause 6.6.2.2 of IGEM/TD/1 Edition 4 or clause 6.6.2.3 of IGEM/TD/1 Edition 5.

Note: *At the time of writing TD/1 Edition 6 was being developed. It is anticipated that upon publication of Ed. 6 this section of MAINT/5 will be reviewed to incorporate any significant changes.*

8.8 Re-Surveys

Re-surveys shall look at the changes that have occurred to the pipeline and its surroundings since the time of the original survey. All re-surveys shall be undertaken in accordance with section 8.2.

8.9 Records

A written report shall be prepared in accordance with section 8.2 and a copy maintained in the pipeline file.

The records shall be maintained in accordance with the requirements of CAD/PL/RE/1.

8.10 Identified Infringements

Records of identified infringements and the required quantified risk assessments should be maintained in the pipeline file.

8.10.1 Re-assessment of Infringements that have been Risk Assessed as part of a previous audit

The following notes summarise the parameters when a re-assessment of the risks will be required.

The hazard range (maximum of the escape or building burning distance) can be obtained from the original risk assessment report.

A further re-assessment of the risks will normally (see exceptions below) be required where:

- There are new BPD infringements.
- There are new or additional occupied buildings or extensions to commercial premises or new houses within the hazard range of an existing infringement.
- There has been a change in ownership of any of the properties considered in the previous risk assessment resulting in a significant (>5%) increase in the total occupancy of the buildings identified within the hazard range of the infringement.

Roads and Rail have to be considered for reassessment where:

- The TD/1 traffic density classification has increased
- For roads where there has been a major modification to the road that has led to a significant increase in road traffic e.g. increase in the number of carriageways, or a change in the road classification.

However, a further re-assessment of the risks will be not required unless:

- The increase in the total occupancy of the buildings identified within the hazard range of the infringement is greater than 5%.
- The traffic flow on any road or rail infringement has increased by more than 5%.

When comparing the risk, it is necessary to consider the road and traffic classification and the proximity and number of buildings in the vicinity of the road crossing (8 BPD along the pipe or 4 BPD perpendicular).

Note that when risk assessments are carried out, rather than assessing every infringement along a section of pipeline, a ‘worst case infringement’ is often chosen, that is:

- Representative of a number of similar infringements in terms of size and development type.
- Considered to be the worst case, because it is the highest risk location taking account of the consequences (number of individuals at the location) and frequency (distance away from the pipeline).

A re-assessment will be required if the development at an infringement that was previously covered by a worst-case assessment has caused that development to now become a higher risk, due to increased building occupancy or traffic flow (by >5%) than the previous worst case.

A normally occupied building is a building where at least one person is resident there, or at least one person spends their normal working day there (or a large part of it), such as at least 16 hours per week, i.e. 4 hours per day for an average of 4 days per week.

8.10.2 Guidance on where it might be inappropriate to carry out risk assessment.

Where there are a large number of infringements on a single pipeline it might be appropriate to carry out a more fundamental review of the operation of the pipeline rather than justifying the continued operation at its current operating parameters through risk assessment.

The risk assessment service provider should be provided with criteria by the company to identify where a more fundamental review may be necessary. The risk assessment service provider will therefore advise the relevant Pressure System User with the identified infringements to determine the appropriate means of assessment.

8.10.3 Ditch Crossings

Generic risk assessments (e.g. Report References: Advantica R6174), have been carried out for ditch crossings in both R and S type areas. These generic risk assessments have demonstrated that the risks associated with ditch crossings that are not slabbed in accordance with the requirements of IGEM/TD/1 Edition 4 and subsequent editions are ALARP and therefore do not need to be slabbed retrospectively to bring an earlier constructed pipeline up to the requirements of Edition 4 or later.

However, it should be ensured that the location of the pipeline is appropriately marked with an approved marker post in line with the recommendations in CAD/PM/TR/28 and CAD/SP/TR/29. This does not preclude the recommendation that a risk-based approach is adopted with the agreement of the Network Engineer and Senior Pipeline Engineer.

9.0 ABOVE GROUND PIPELINE SECTIONS

A survey of all above ground crossings and exposed pipeline sections shall be undertaken to assess the condition of the pipeline section and associated civil structures and security devices.

For IP pipelines CAD/PM/MS/5, management procedure for the inspection and maintenance of exposed pipeline sections and their support on the <7 bar network, shall be consulted for advice on maintenance inspections and records management.

For HP pipelines CAD/PR/MAINT/5009 shall be consulted for details of how the inspection is undertaken.

CAD/PM/SA/1 management procedure for the inspection of structural assets shall be consulted for pipelines with bespoke support structures

A summary of frequency of above ground inspections is presented in APPENDIX B.

The records requirements of CAD/PL/RE/1 (Policy for the capture, update and retention of Engineering asset records) shall be maintained.

10.0 CONDITION MONITORING

IGEM/TD/1 and IGEM/TD/3 state that the condition of a pipeline should be established periodically and that the condition of a pipeline should be established by:

- For LTS HP pipelines: the use of internal inspection devices on those pipelines which can be monitored using those devices. These pipelines shall be inspected in accordance with CAD/PM/OLI/1 at a frequency not exceeding 15 years. Approved external inspection techniques (CIPS) shall also be used to provide additional intermediate inspections.
- For LTS HP pipelines: the use of approved external inspection techniques on those pipelines or sections of pipelines, which cannot be monitored using internal inspection devices. These pipelines shall be inspected in accordance with GDN/PM/OLI/4.
- Hydrostatic testing: the use of hydrostatic testing on those pipelines or section of pipelines which are not suitable for either of the above. Hydrostatic retests should be carried out in accordance with IGEM/TD/1 and CAD/PM/PT/1 at a frequency not exceeding 20 years.

- For IP Pipelines: the use of approved external inspection techniques on those pipelines or sections of pipelines at a frequency not exceeding 10 years
- For LTS RTP line pipe: the use of hydrostatic testing is recommended for RTP pipe due to integrity methodologies such as ILI and CIPS bein ineffective. Hydrostatic retests should be carried out in accordance with IGEM/TD/1 and CAD/PM/ML/1007 at the frequency given in Appendix B. A summary of the hydrotest procedure is given in Appendix G.

For buried spurs less than 10m in length condition monitoring in accordance with CAD/PM/OLI/1 or GDN/PM/OLI/4 is not possible and so a routine major inspection of the cathodic protection system should be undertaken at the frequency given in Appendix B.

11.0 CORROSION CONTROL

11.1 Cathodic Protection Routine Monitoring

Monitoring and maintenance of the CP system shall be undertaken in accordance with the requirements of CAD/PL/ECP/2.

11.2 Close Interval Potential Survey

Close Interval Potential Surveys (CIPS) shall be undertaken in accordance with CAD/PM/ECP/2 and CAD/SP/ECP/8.

11.2.1 Notification of Close Interval Potential Surveys

All stakeholders (owners and occupiers) who are affected by a close interval potential survey shall be notified in advance, being given a minimum period of notice of 2 weeks.

11.1.2 Records

The following details of stakeholder contacts shall be maintained on GDPR 2018 compliant databases:

- Name, address and telephone number of the stakeholder.
- The date of any contacts made.
- Historical details of any problems and the actions taken (owners and occupiers only)
    - Crop loss - amount claimed and payments made.
    - Drainage - type of work carried out, costs and the contractor
    - Complaints - date and nature

The records shall be maintained in accordance with the requirements of CAD/PL/RE/1 and, where details of owner / tenants are concerned, compliant with the General Data Protection Regs 2018

Note: During both routine monitoring and CIPS a record shall be made on the condition of all marker posts. Replacement and remedial work shall be carried out in accordance with Section 14.

11.3 Stress Corrosion Cracking

Whenever damage is investigated on a pipeline normally operating above 30% SMYS, then if it is exposed and the coating is removed or found to be dis-bonded, magnetic particle inspection shall be carried out to determine whether external stress corrosion cracking or other surface breaking defects are present and reported in accordance with CAD/PM/P/11. If, due to the large area of exposure it is impractical to carry out magnetic particle inspection over the whole area then specialist advice should be sought.

If internal stress corrosion cracking is either suspected or known to exist, then specialist advice shall be sought. In such cases its potential presence shall be prominently displayed in all relevant pipeline record files and its potential presence is communicated to all appropriate personnel, before any work is performed on the pipeline.

11.4 Examination of Coatings

Whenever a pipeline is exposed the coating should be examined, particularly for dis-bondment. If disbondment is found the mechanism shall be investigated to ensure it is not as a result of CP overprotection (see CAD/PM/ECP/2). Any areas of damage or dis-bondment shall be repaired in accordance with GIS/CW/5.

11.5 Microbial Influenced Corrosion (MIC)

Whenever metal loss due to corrosion is found on a pipeline protected with a coating system of bitumen/asphalt, or tapes / PE coatings employing bitumen-based adhesives / mastics, the possible presence of MIC should be considered.

While bitumen/asphalt coatings are not common within the companies LTS gas system, bitumen-based adhesives are widely used in conjunction with cold-applied laminate tapes, polyethylene coatings and heat shrink sleeves.

If an investigation is required, further advice and guidance is provided in Advantica Report R8577. This investigation for MIC requires specialist skills. If MIC is identified, its presence should be reported to the User and a separate Integrity Management Plan prepared in accordance with CAD/PM/PS/3 and the relevant CAD/PM/OLI/1 or GDN/PM/OLI/4. Damage should be reported in accordance with CAD/PM/P/11.

The presence of MIC is suspected if:

- Sulphides are detected in deposits/corrosion,
- Corrosion features and deposits are typical of MIC, and
- Bacteria are associated with deposits/corrosion

11.6 Calcareous formations and CIPS / coating defect assessment

Calcareous formations are non-conductive calcium-based deposits that can form on bare steel surfaces in areas where soil composition favours scale formation, e.g. high bicarbonate (the deposits are in the form of calcium carbonate) or low bicarbonate with high levels of dissolved magnesium & calcium (the deposits are in the form of calcium hydroxide).

The formation of calcareous scale requires the CP to be effective to produce the conditions that favour scale formation. The alkaline nature of the scales will bestow passivity to the steel and reduce the CP current density required for effective CP. The scales would be conductive, so a CP shielded environment is unlikely to be created. These factors mitigate any corrosion risk where such scales have formed.

In circumstances where a calcareous deposit has formed, the CP current density required to achieve protection will decrease. Therefore, the ability of the CIPS technique to indicate possible coating defects will be significantly reduced where calcareous deposits are present.

Due to the reduction in CP current density required for protection at the deposit, mechanical damage can be ‘hidden’ from some overline coating defect assessment techniques. The potential for calcareous formations shall be considered when selecting an overline coating defect assessment technique. Guidance can be found in CAD/PM/ECP/2 and CAD/SP/ECP/8.

11.7 Records

Records shall be maintained on an appropriate database.

Details of all magnetic particle inspections shall be reported using the FR1 form, contained in CAD/PM/FAULT/3, including examinations that have not detected the presence of any features.

The records shall be maintained in accordance with the requirements of CAD/PL/RE/1.

12.0 UNDERWATER CROSSING SURVEYS

A survey shall be undertaken of all river crossing points, navigable water courses, estuaries, large expanses of water and other locations affected by adverse water and associated ground conditions to establish the following;

- The depth and profile of the pipeline within the limits of the crossing
- The profile of the bed and banks
- Where exposed, the condition of the pipelines within the crossings
- The construction and condition of the bed and banks
- That the pipeline has adequate cathodic protection in accordance with CAD/PM/ECP/2

Note: The river crossing shall receive a CIP Survey at the closest suitable river crossing survey interval to the planned CIPS for the pipeline e.g. for a pipeline on a 15 year CIP survey interval and a 5 year river crossing interval the river crossing shall receive a CIP survey every 3rd cycle.

CAD/PR/MAINT/5010 describes how the survey is undertaken.

In addition to the maintenance frequencies in Appendix B, a survey should also be considered following a period of adverse weather, such as flooding.

Underwater crossing surveys would not normally include drains, dykes, ditches and canals although where ‘as laid’ details are not available, or such crossings are subject to regular cleaning by mechanical means, then consideration should be given to completing a survey to determine the depth and detail of construction.

A copy of the report shall be maintained in the pipeline file.

The records shall be maintained in accordance with the requirements of CAD/PL/RE/1.

13.0 NITROGEN SLEEVES

The condition of nitrogen sleeves shall be monitored.

The frequency for monitoring of nitrogen sleeves is presented in Appendix B.

The typical arrangements for checking the content of nitrogen sleeves, the standard maintenance procedure of nitrogen sleeves and the procedure for checking and venting of nitrogen sleeves containing hydrogen are presented in CAD/PR/MAINT/5008.

All faults on nitrogen sleeves shall be reported to the User and rectified. Where there is a delay in a permanent repair, then additional maintenance visits shall be carried at an appropriate frequency to maintain a positive nitrogen pressure in the sleeve. Further guidance on monitoring, maintenance and remediation is available in the UKOPA/12/0001-Sleeve Management Strategy Document.

Where nitrogen sleeve pressure is monitored by remote means e.g. Abriox remote pressure monitor or Cello remote pressure monitor, the alarm set points shall be set to appropriate levels, depending on leakage rates, to allow for re-pressurisation before zero pressure is recorded in the sleeve. This is to eliminate the possibility of water ingress into the sleeve.

Where a sleeve has been grouted, CP performance shall be monitored, and pipeline and sleeve potentials managed as per the requirements of CAD/PM/ECP/2.

14.0 MARKER POSTS

14.1 Monitoring/Maintenance

All marker posts shall be installed, inspected and maintained in accordance with CAD/PM/TR/28 and conform to the specifications laid out in CAD/SP/TR/29.

The condition of marker posts shall be recorded as part of line walking and during other routine maintenance with damaged and missing posts replaced within a suitable time frame, as determined in CAD/PM/TR/28 so as to ensure 3rd party interaction with the asset is minimised.

14.2 Records

Records shall be maintained in accordance with the requirements of CAD/PL/RE/1.

15.0 VALVES AND ACTUATORS

15.1 LTS Valve maintenance and inspections

This covers the scheduled routine maintenance of remotely, locally powered and manually operated valves. The purpose of this maintenance is to exercise all moving parts, confirm satisfactory operation of the valve and, where appropriate, the addition of lubricant/sealant. For the purpose of allocating frequency of valve maintenance, refer to the definitions in Section 3 and the frequencies in Appendix B.

Note 1 *– Remote Operated Valves shall be checked for operation both locally and remotely.*

Note 2 *– The testing of Remotely Operated Valves (ROVs) shall be carried out in accordance with an authorised site-specific procedure which details all other valve movements in the correct sequence which may be necessary.*

Note 3 *- A leakage survey should be undertaken annually on all unfilled block valve chambers, which are directly accessible to the public. This survey should include measurement of gas concentration at the edges of the valve chamber and at any gaps or cracks in the valve chamber cover. It would not normally be necessary to remove the valve chamber cover to carry out this survey. Remedial action should be taken if there is any evidence of leakage inside the valve chamber. It is advisable that this maintenance is aligned with critical and non-critical valve maintenance to minimise site visits and maximise efficiency.*

Note 4 *– All redundant valves should be checked for any leakage to atmosphere at the frequency stated in Appendix B and any leakage reported to the line manager.*

Functional checks are required to ensure that all valves remain operational. Any further work will depend on the outcome of the functional check. The functional check will comprise full or partial operation plus leakage check depending on the category of the valve. These shall be carried out in accordance with:

- CAD/PR/MAINT/5030 for critical valves with remote operation
- CAD/PR/MAINT/5031 for critical valves with local operation, or
- CAD/PR/MAINT/5032 for non-critical valves with local operation.

Special attention should be paid to valves identified as **'critical'** as defined in Section 3 and a record of the valve maintenance carried out included in the pipeline maximum operating pressure (MOP) affirmation [IGEM/TD/1] reports.

Note 5 *– Valve Compounds (Security Check of Compound only) CAD/PM/MAINT/2 part 2. A Routine Check is only required on sites where the site operational history has shown it to be necessary, e.g. vandalism, operational requirements. In such cases the Maintenance Manager or nominated Operational representative will recommend a Routine Check, at an appropriate interval and, where necessary, agree the deviation with the central Engineering Team. This shall be recorded in the appropriate company work management system.*

15.2 IP Valve maintenance and inspections

IP valves are classified as M1 Strategic Valves. The maintenance regime varies between 1 and 5 years depending on valve type and manufacturer. Reference shall be made to CAD/PM/V/17 - Management Procedure for the Classification and Maintenance of valves in pipelines operating at pressures up to 7 Bar for further information on identification and maintenance activities required.

CAD/PM/V/17 is supplemented by the following work procedure covering the maintenance of Class M1 strategic valves: CAD/PR/V/1701 - Work Procedure for the maintenance of class M1 Strategic Valves

Note*: the above work procedure is for GATE VALVES only. For ball and plug valves follow the guidance within CAD/PM/MAINT/5031*

16.0 AERIAL SURVEY (LTS HP System)

16.1 General

An aerial survey shall be undertaken to report on ground activities which, if allowed to develop, might affect the pipeline. This is to minimise the likelihood of damage by external factors and third parties and also determine where the environment in which the pipeline is situated has altered.

16.2 Frequency

The frequency of aerial surveillance is presented in Appendix B.

16.3 Surveillance process

CAD/PR/MAINT/5001 describes how the aerial surveillance is undertaken and dealing with sightings (e.g. encroachments, infringements etc) that are identified from aerial surveillance.

A vantage point survey shall be carried out in accordance with Section 17 of these procedures on all pipeline sections which cannot be inspected due to flying restrictions or if the company nominates the line to be vantage point surveyed. These flying restrictions may be imposed by, for example, built up areas, proximity to airport approaches, areas of special interest such as bird sanctuaries etc. or any other unusual feature which may have a possible effect on the pipeline integrity.

In addition, a vantage point survey should be conducted on selected flown lines once a year to audit the service provided by the aerial surveillance team and ensure that there are no encroachments that may have been missed. It is recommended that this audit is combined with existing pipeline activities such as CIP Surveys, Line-walks or CP maintenance activities to minimise additional resource requirements. Any missed encroachments shall be addressed, and an Incident Investigation conducted with the aerial surveillance provider to determine the reasons for the missed encroachment. The incident, investigation and outcomes shall be recorded within the companies IMS system in line with CAD/SHES/MS/17.

If an aerial survey is cancelled, due to for example adverse weather conditions or aircraft mechanical problems, then the sections missed shall be reported within 5 working days to the User and Maintenance Manager for the appropriate Network(s). An assessment shall be made by the User or

nominated deputy as to the vulnerability of the pipeline sections missed. Areas of significant threat to third party damage, e.g. areas of known activity, areas subject to ground movement, IGE/TD/1 infringements etc, shall be surveyed by vantage point survey in accordance with Section 8.

In the case of helicopter surveillance, the aircraft observer shall report on any potential threat (i.e. a sighting that has been confirmed as being unknown to The Company and which could affect the future integrity or safe operation of the pipeline) or an activity as detailed in Work Procedure CAD/PR/MAINT/5001. For example: mechanical excavation equipment working within the vicinity of the pipeline, work on drainage, ditching, fencing or any other farm activity, ground movement, changes in watercourses, bank erosion etc.

In the case of Beyond Visual Line of Sight (BVLOS) drones, the operative monitoring the video feed (either live or a video playback) shall report on any potential threat (i.e. a sighting that has been confirmed as being unknown to The Company and which could affect the future integrity or safe operation of the pipeline) or an activity as detailed in Work Procedure CAD/PR/MAINT/5001.

A full vantage survey shall be carried out if two successive aerial surveys (i.e. over a 4-week period) are cancelled. The full vantage point survey shall be undertaken within 5 working days of the second missed survey or as soon as reasonably practical.

16.4 Response to Reports

For aerial surveys a surveillance reporting for pipelines (SRP) program should be used as a navigational aid and for recording details of any encroachments found.

The nominated person shall obtain details of all encroachments from the SRP immediately following the survey and take the appropriate action within the time scale recommended by the observer i.e. immediate (within 2 hours*), or next calendar day as per work procedure CAD/PR/MAINT/5001.

Note: *for helicopter surveys, if the helicopter lands the observer shall stop the work in the vicinity of the pipeline, and then observer shall contact the Nominated Person within the relevant Network, to request immediate attendance to site by a Pipeline Operative. In the event the Helicopter cannot land contact the Nominated Person to request immediate attendance to site by a Pipeline Operative.*

The Company shall inform the Observer of the Nominated Person for each of the Networks prior to the start of the surveys.

16.5 Records

Each encroachment recorded on the SRP shall be evaluated and updated on the Work Management System to provide details of all action taken and to report on the actual encroachment details found. This includes details of whether the encroachment is within the Area of Interest (AOI) or the Right of Way (ROW). For the purposes of the SRP the AOI is 35m and the ROW is 10m.

The records shall be maintained in accordance with the requirements of CAD/PL/RE/1.

Any person responding to aerial survey reports and visiting site should meet directly with the people carrying out the work, (not a representative), and confirm and record if they have received a copy of CAD/SP/SSW/22 or CAD/SP/SSW/222, issue if confirmation cannot be found.

17.0 VANTAGE SURVEY

17.1 General

A vantage point survey shall be undertaken over all sections of LTS HP pipelines that cannot be aerial surveyed due to either:

a) flying restrictions or

b) following missed or incomplete aerial surveys or

c) on lines nominated as only being subject to vantage point surveys

in accordance with Section 16 of this document.

For 2 to 7 bar IP systems a vantage point survey may be conducted if deemed required based on risk from either previous 3rd party interference issues, potential risk from the pipelines environment or specification i.e. material, wall thickness, diameter and operating pressure. A decision support tool is presented in appendix F.

The survey should be undertaken by the surveyor from pre-determined fixed points along the route, the points being selected to ensure that all relevant parts of the route are visible. The use of drones for imaging difficult to view areas may be considered. These shall be used in line with the guidance presented in CAD/PM/MAINT/5002

A vantage point survey shall be undertaken to report on ground activities which, if allowed to develop might affect the pipeline. This is to minimise the likelihood of damage by external factors and third parties and also to determine where the environment in which the pipeline is situated has altered.

The frequency of vantage point surveillance is presented in Appendix B.

CAD/PR/MAINT/5002 describes how the vantage point survey is undertaken and dealing with sightings (e.g. encroachments, infringements etc) that are identified from the survey.

Special attention should be paid to pipeline sections where there is a significant threat of third-party damage, e.g. areas of known activity, and areas subject to ground movement, IGEM/TD/1 proximity infringements etc.

The surveyor shall report on occurrences as outlined in the work procedures CAD/PR/MAINT/5001 and CAD/PR/MAINT/5002.

The surveyor shall make any individuals working on activities identified as encroachments aware of the presence of the pipeline, legal obligations when working within the pipeline easement, and of safe working requirements by issuing the people undertaking the work (not a representative) with a copy of CAD/SP/SSW/22 or CAD/SPM/SSW/222, for which they should sign for and a record kept of any of the recipients.

A register shall be maintained on the company's Work Management System to record the sections of pipeline that are vantage point surveyed. This register shall have provision to include sections of pipeline that need to be vantage point surveyed following missed aerial surveys. A copy of the layout of the register is shown in available in CAD/PM/DP/1 Appendix E which shall be maintained in the pipeline file.

The vantage points should be periodically reviewed by the Network Pipeline Engineer or nominated representative to ensure that they still provide the best locations for viewing the pipeline. Particular attention shall be made to reviewing vantage points following pipeline diversions or major infrastructure developments in the vicinity of the pipeline.

17.2 Records

A register will be held on the Work Management System which will show all locations of pipeline that are subject to aerial survey and/or vantage surveys, complete with associated work orders. This register shall have provision to include sections of pipeline that need to be vantage point surveyed following missed aerial surveys.

Encroachments shall be recorded and reported in accordance with Section 20 below.

The records shall be maintained in accordance with the requirements of CAD/PL/RE/1.

18.0 LINE WALKING / GROUND PATROL SURVEYS

A full line walk (ground patrol survey) shall be undertaken on all pipelines to determine the condition of the areas immediately around the pipeline route as detailed in CAD/PR/MAINT/5041.

Areas identified with reduced depth of cover, as per IGEM/TD/1 shall be dealt with in accordance with CAD/PM/MAINT/14.

The interval between subsequent line walks should either be on a:

- 4 yearly cycle for above 7 bar LTS pipelines or
- 10 yearly cycle for 2 to 7 bar pipelines or
- determined by a risk-based approach

The owners/ occupiers shall receive a standard letter prior to any planned visits.

A register will be held on the Work Management System which will show all areas of the pipelines that are walked with provision to include sections of pipeline that it was not possible to physically walk and the reasons for any missed sections e.g. overgrowth, water courses etc.

19.0 STAKEHOLDER LIASION INCLUDING OWNER / OCCUPIERS

Full details on the companies approach to stakeholder liaison can be found in CAD/PM/DP/1 Management Procedure for the Prevention of Damage to Cadent's Network. This document shall be used in conjunction with CAD/PM/DP/1 for stakeholder liaison

20.0 MANAGING ENCHROACHMENTS

Management

Management of encroachments shall be carried out in accordance with CAD/PM/DP/1 and CAD/PM/SSW/22

Records

Records of encroachment details shall be maintained in the work management system or pipeline file.

The records shall be maintained in accordance with the requirements of CAD/PL/RE/1.

21.0 DEALING WITH POTENTIAL THREATS TO PIPELINE INTEGRITY

This section deals with issues identified through routine reporting tools i.e. general public report, aerial, vantage/pinch point, line walking survey or from any employee of the company or sub-contractor.

A threat has been defined as: a 'sighting' that has been confirmed as being unknown to the company and therefore could affect the integrity of a pipeline or any associated installation.

A sighting has been defined as an activity near a pipeline that has either been identified during a routine survey or from a public/employee report.

Any threat to the pipeline (or any associated installation) should be resolved as soon as possible to prevent an incident which could cause a loss of supply or a more serious danger to the general public, site workers, the company's staff and contractors and may also affect the local environment.

Reports of a possible threat are likely to be from one of the following:

- A telephone call or personal visit to a company site/office from a member of the general public (e.g. walkers, landowners / tenants).
- From the observer / pilot during or following a routine (or non-routine) aerial survey.
- Directly from a member of the company's staff when in the vicinity.
- From a routine operation by the company's staff (or sub-contractor) such as a Vantage Survey or Line Walking.

All reports should be accurately recorded and passed to the relevant Line Manager for the defined Network who will investigate and action accordingly in line with Work Procedure CAD/PR/DP/5 who will report any findings back to the initial contact to add to the records database as found appropriate.

APPENDIX A - REFERENCES

This Management Procedure makes reference to the following documents.

Institution of Gas Engineers (IGEM) publications

IGEM/TD/1	Steel Pipelines for High Pressure Gas Transmission
IGEM/TD/3	Steel and PE Pipelines for Gas Distribution
IGEM/TD/19	Reinforced Thermoplastic Pipelines for High Pressure Gas Transportation

Legislation

PSR – 96	The Pipeline Safety Regulations 1996
PSSR – 2000	The Pressure Systems Safety Regulations 2000

Company Standards

CAD/SP/CW/5	Specification for Field Applied External Coating for Buried Pipe Work and Systems
CAD/SP/GM/1	Specification for the Protection of Pipelines from Ground Movement and External Loading
CAD/SP/GM/4	Specification for the Protection of Steel Pipelines Operating at Pressures Above 7 Bar Subjected to Vibrations Caused by Blasting, Piling or Demolition
CAD/PM/GM/10	Management Procedure for Quarries, Other Large Excavations or Similar Activities in Close Proximity to Gas Pipelines and Associated Installations
CAD/PR/PW/12	Work Procedure for Pipeline Protection from Mineral Extraction at Surface
CAD/PM/MAINT/2 Part 3	Management Procedure for Maintenance of Pressure Regulating Installations.
CAD/PM/DP/1	Management Procedure for the Prevention of Damage to Cadent's Network.
CAD/PM/MAINT/14	Management Procedure for Managing Gas Distribution Pipelines Above 2 bar with Reduce Depth of Cover
CAD/PL/MAINT/99	Policy for Maintenance of Gas Transmission and Distribution Assets
CAD/PM/P/11	Management Procedure for Inspection, Assessment and Repair of Damaged (Non-Leaking) Steel Pipelines Above 150mm Nominal Diameter and Designed to Operate at Pressures Greater than 2 Barg
CAD/PM/P/20	Management Procedure for Inspection, Assessment and Repair of Damaged (Non-Leaking) Steel Pipelines and Pipe-work up to 150mm Nominal Size Designed to Operate at Pressures Greater Than 2 Barg.
CAD/SP/PA/10	Technical Specification for New and Maintenance Painting at Works and Site for Above Ground Pipeline and Plant Installations.
GDN/PM/P/18	Procedures for Working on Pipelines Containing Defective Girth Welds or Girth Welds of Unknown Quality
CAD/PR/DP/5	Work Procedure for Safe Working in the Vicinity of Cadent Assets

CAD/PM/SSW/2 Procedure for Safe Working and Development in the Vicinity of Pipelines and Associated Installations Operating Above 7 Barg.

CAD/SP/SSW/22 Specification for Safe Working and Development in the Vicinity of Pipelines and Associated Installations Operating Above 7 Barg.

CAD/SP/SSW/222 Pipeline Safety Advise for Farmers, Landowners, Occupiers and Contractors

CAD/PM/DAM/1 Defect Assessment Management Procedure

CAD/PL/ECP/1 Policy for Corrosion Control of Buried Steel Systems.

CAD/PM/ECP/2 Management Procedure for Cathodic Protection of Buried Steel Systems.

CAD/PL/FAULT/2 Policy for the Reporting and Analysis of Faults on Gas Transmission, Distribution and Gas Supply Metering Assets.

CAD/PM/PS/3 Management Procedure for Ensuring Compliance with the Pressure Systems Safety Regulations 2000 for Gas Pressure Systems, General Compliance Duties.

CAD/PM/PT/1 Management Procedure for Pressure Testing Pipe-work, Pipelines, Small Bore Pipe-work and Above Ground Austenitic Stainless Steel Pipe-work.

CAD/PL/RE/1 Policy for the Capture, Update and Retention of Engineering Asset Records.

CAD/PM/NDT/1 Management Procedure for Carrying Out Non Destructive Testing of Plant and Equipment.

CAD/SP/TR/18 National Grid Gas Specification for Engineering of Pipelines & Installations Operating Above 7 Barg.

CAD/SP/TR/19 Specification for Assessing the Fatigue Life of Transmission Pipelines Designed in Accordance with IGEM/TD/1.

CAD/PM/TR/28 Management Procedure for the Siting and Installation of Marker Posts for Pipelines Operating Above 7 Barg.

CAD/SP/TR/29 Specification for Marker Posts to be used for Above 7 Barg Pipelines.

CAD/PM/OLI/1 Management Procedure for Carrying Out On-Line Inspection of Steel Pipeline Systems (In-Line Inspection).

CAD/PM/OLI/4 Management Procedure for Monitoring the Condition of High Pressure Steel Pipelines Externally.

CAD/PM/GM/10 Management Procedure for Quarries, Other Large Excavations or Similar Activities in Close Proximity to Gas Pipelines and Associated Installations.

CAD/PR/MAINT/5008 Work Procedure for Nitrogen Sleeve Monitoring/Filling.

CAD/PR/MAINT/5009 Work Procedure for Surveys of Above Ground Crossing and Exposed Pipeline Crossings.

CAD/PR/MAINT/5010 Work Procedure for Underwater Crossing Surveys

CAD/PR/MAINT/5029 Work Procedure for Opening and Closing of Pig Trap Door Closures and Pressure Vessel Closures.

CAD/PR/MAINT/5030 Work Procedure for the Functional Check of Critical Valves with Inlet Pressures Above 7 Barg (Remote Operation).

CAD/PR/MAINT/5031 Work Procedure For The Functional Check Of Critical Valves With Inlet Pressures Above 7 Barg (Local Operation)

CAD/PR/MAINT/5032 Work Procedure for the Functional Check of Non-Critical Valves with Inlet Pressures Above 7 Barg

CAD/PR/MAINT/5041 Work Procedure for Pipeline Walking Survey

CAD/SHES/MS/17 Incident Reporting and Investigation.

CAD/PR/MAINT/5028 Work procedure for carrying out Mechanically Assisted Excavations near to High Pressure Pipelines

CAD/SP/CE/12 Protective slabbing requirements shall be in attendance with PART 12 Pipeline Protection slabs

CAD/PM/V/17 Management procedure for the classification and maintenance of valves in pipelines operating at pressures up to and including 7 bar

CAD/PR/V/1701 Work Procedure for the maintenance of class M1 valves

CAD/PM/MS/5 Management procedure for the inspection and maintenance of exposed pipeline sections and their supports on the <7bar network

CAD/PM/ML/1007 Management Procedure Reinforced Thermoplastic Pipelines for High Pressure Gas Transportation

Other References

Advantica R6174

APPENDIX B – Maintenance Frequencies

ACTIVITY	FREQUENCY	COMMENTS
Pig Traps	1 month	Prior to Use
Maximum Operating Pressure	LTS HP only - Annually*	*Any changes to the pipeline which could affect the MOP shall be considered immediately, otherwise annually. The relevant Control Room shall provide the annual MOP information from the SCADA information to the Pressure System User by the second month of the year following the year for which the data is being provided.
Pipeline maximum operating pressure (MOP) affirmation reports	LTS HP only – 4 yearly	The relevant Control Room shall provide the annual pressure cycling information from the SCADA information, in the form of the number of equivalent hoop stress cycles of 125 N/mm^2, to the Pressure System User by the second month of the year following the year for which the data is being provided.
Above ground pipeline sections	LTS HP - 2 yearly IP – Risk based frequency (min 3 years max 10 years)	Where it is known that exposed crossings are prone to vandalism or subject to adverse weather conditions e.g. torrential rain, flooding etc. a more frequent inspection may be necessary. For IP pipelines refer to CAD/PM/MS/5 for details on inspection frequencies

Cathodic Protection (LTS HP & IP)
The frequency of routine monitoring for each type of system is as follows:

	Functional	**Interim**	**Major**
Sacrificial Anode Systems	6 Monthly	-	2 Yearly
Impressed Current Systems			
Single Source	1 Monthly	12 Monthly	5 yearly
Multi Source	3 Monthly*	12 Monthly	5 yearly

* Note: On systems which have good levels of protection and which have more than one source of CP current i.e. two or more T/R's or T/R and bond.
Remote monitoring can replace the requirement for the site manual checks.

Close Interval Potential Surveys:
Pipelines subject to In-Line Inspection (LTS HP)

- In-Line Inspection shall be undertaken in accordance with CAD/PM/OLI/1 at a frequency described in CAD/PM/PS/3 and calculated using CAD/PM/OLI/6 and the Intervals II package

- Close Interval Potential Surveys shall be undertaken at the midpoint between In-Line Inspections.

Pipelines not subject to In-Line Inspection LTS HP

- Above ground surveys shall be undertaken in accordance with GDN/PM/OLI/4 at a frequency described in CAD/PM/PS/3.

IP pipelines

- 10 yearly – usually 5 years after the pipeline linewalk

Hydrostatic test:

- For RTP pipelines – an initial test at 5 years then at 10 yearly intervals subsequent to the initial 5 yearly test

UNDERWATER CROSSING SURVEYS

All crossings shall be surveyed at least once to determine “as laid” profiles and the position of the pipeline within the watercourse bed/bank. This should then be used to determine future requirements.

The frequency of surveys should be set by a risk-based approach. If this is not practicable, the frequency should be in accordance with the table below. A risk-based approach should take into account:

a) Regulatory requirements

b) The nature of the water course, seasonal variations and severe weather patterns

c) The stability of the riverbed

d) The activities of other parties, for example, dredging

e) Previous inspection history

f) The results of studies to evaluate the risks to the pipeline integrity

g) Periods of high-level flooding, for example, to consider visual inspection of river banks, change in pipeline support etc

LTS HP Pipelines	**Depth of cover (m)**			
	<=0.5	>0.5 <=1.2	>1.2 <=4	>4
	Survey interval (years)			
Major water course (tidal)	1	1	1	1
Major water course (navigable)	2	3	5	15
Minor water course	5	5	5	Not required
Other water course (generally wadeable)	During external condition monitoring or close interval protection survey of the pipeline. Additional inspections where the local situation requires.			
IP Pipelines	**Depth of cover (m)**			
	<=0.5	>0.5 <=1.1	>1.1	
	Survey interval (years)			
All major and minor water courses	1	3	5	

If a pipeline laid below a watercourse is found to be exposed, it shall be reported immediately and protection or remedial works carried out urgently.

NITROGEN SLEEVES

All pressure tiers - annually or as determined by remote monitoring

VALVES AND ACTUATORS

All valves as defined in Section 3 are to be maintained in accordance with Section 14 and in line with the frequencies shown in the table below:

Valve Category	**Function Check**	**Major Overhaul**	**Maintenance Examinations**
Critical	12 months (full or part operate - depending on network resilience)	as determined by functional check	6 years maximum
Non-critical	2 years (full operation)	as determined by functional check	6 years maximum
Redundant	2 years (atmosphere check only)	n/a	6 years maximum
IP M1 Valve - ball valve & plug valve	12 months (full or part operate) as determined by network analysis and valve criticality	as determined by functional check	N/A
IP M1 Operational Valve - other valve types	5 yearly (full or part operate – depending on network resilience) see CAD/PR/V/1701	as determined by functional check	N/A

3rd PARTY INTERFERENCE MONITORING

Activity	**Frequency**	**Comments**
Aerial Survey	2 Weekly – unless RA requires more frequent inspections	Helicopter / Fixed Wing / BVLOS Drone / Satellite **See CAD/PM/DP/1**
Vantage Survey*	HP LTS Assets: 2 Weekly – unless RA requires more frequent inspections IP LTS Assets: via risk assessment if deemed necessary	Can be: • scheduled or • ad-hoc as required for pipeline sections missed from aerial survey(s). **See CAD/PM/DP/1**
Line Walk/Ground Patrol Surveys	HP - 4 Yearly IP – 10 Yearly	Owners/occupiers of land shall be sent a letter prior to proposed survey **See CAD/PM/MAINT/14**
Stakeholder Liaison including with Owner/Occupier Liaison*	Annually	Owners/occupiers of land shall be sent an annual calendar with a letter plus an annual liaison letter,

		which shall not be sent with the calendar**.
Local Authority Planning Departments Liaison	5 Yearly	Contact shall be made, by telephone or face to face meeting, with each Planning Authority annually and a detailed review of the deposited plans held by each Planning Authority.
'Other' Key External Stakeholders i.e. 3rd Party Liaison* (iDNs, Other Utilities/Pipeline Operators, Contractors, National Parks etc.).	Annually	Personal Visit, Letter, Asset Awareness Calendar Deposit of plans/maps/drawings and copies of CAD/SP/SSW/222 & CAD/SP/SSW/2. **CAD/PM/DP/1**
Quarry / Mine Operator Liaison*	Routine Inspection – 2 weekly General Inspection (active sites) – 5 yearly for full audit as per CAD/PM/GM/10	Personal Visit. QRA may be required to assess risk from activities that may require additional measures

***Note**: - these do not override the requirement for non-routine visits resulting from reports generated from the Aerial Survey

APPENDIX C – Pig Trap Pressure Cycle Record Sheet

Pig Trap Reference:	
Permanent / Portable	
Nominal Size:	
Location (storage site for portable traps):	

Date	AGI Location	Start Pressure	Min Pressure	Finish Pressure

Signature:	

Title:	

Date:	

For Portable Pig Traps this record should be retained in the Pipeline File, to enable fatigue life calculations to be completed, for inclusion in the Affirmation Survey.

For Temporary Pig Traps an individual file should be created. This record should be retained in the file, to enable fatigue life calculations to be completed.

APPENDIX D – Annual Declaration of Maximum Operating Pressure (MOP)

ANNUAL DECLARATION OF MAXIMUM OPERATING PRESSURE (MOP)
for year 20

Pipeline Name:	
Pipeline Reference No*:	
Current MOP:	
Current SOL:	
Location of Pressure Measurement	
Maximum Pressure during year:	

If the maximum pressure recorded has exceeded the current MOP + 2.5% and for more than 5 hours at any one time or for more than 20 hours per year then the following table should be completed to record the excursions.

Date	Maximum Pressure	Duration of Excursion

Having considered the requirements of IGEM/TD1 and the above information, I confirm that the Maximum Operating Pressure of the above pipeline should be .....bar.

Signature (Pressure System User):	

Name:		**Date:**	

This record should be retained in the Pipeline File, to provide information for inclusion in the TD/1 report.
* Note: It may be more acceptable to group pipelines under a Pressure System as opposed to individual pipeline references.

It is acceptable to retain this data in alternative formats, e.g. a spreadsheet or companies electronic data capture system provided all of the data identified in the form is retained in an auditable form, there are adequate controls in place to ensure the security of the data and the Pressure System User is able to electronically record his confirmation of the Maximum Operating Pressure.

APPENDIX E – Nitrogen Sleeve Maintenance Record Form

NITROGEN SLEEVE MAINTENANCE RECORD FORM

Network:	
Pipeline Name:	
Pipeline Reference No.:	

Sleeve No.	Location	Hydrogen present?	Grid Ref	Box or Pit B/P	Sleeve Pressure Bar		LEL %	
		Y/N			Before	After	Atmos	Sleeve

Maintained/Refilled By:	

Date:	

It is acceptable to retain this data in alternative formats, e.g. a spreadsheet or companies electronic data capture system provided all of the data identified in the form is retained in an auditable form, there are adequate controls in place to ensure the security of the data.

APPENDIX F – IP pipeline vantage point survey decision Support Tool

The attached risk assessment matrix is intended to assist and support decisions on IP pipelines where it is determined that vantage point surveys may or may not be required.

HOW TO USE:

Total up Likelihood of Failure (LoF) and Consequence of Failure CoF scores. Multiply LoF and CoF totals to get score i.e. (Material + DoC + Location + Markers) X (Location + LoS + Evacuation Liklihood)

Up to 35 = LOW - vantage point survey not required

36 to 60 = MEDIUM - see note below

Over 60 = HIGH - vantage point survey recommended

***Note**: for medium risk pipelines an additional assessment may be made looking at historic 3rd party interference events and their frequency to determine the need for a regular vantage point survey*

Likihood		
	Material	
	PE	3
	Steel<11.91	2
	Steel>11.91	1
	DoC	
	>0.9m	1
	0.6m to 0.9m	2
	<0.6m	3
	Location	
	Rural - Meadow / unworked land	1
	Rural - worked land	2
	Suburban / Town	3
	Pipeline marking	
	Compliant with TR/28	1
	>80% of line compliant with TR/28	2
	<80% of line compliant with TR/28	3

Consequence		
	Location	
	Rural	1
	Suburban	2
	Town	3
	Loss of supply	
	<50	1
	51 to 10,000	2
	>10,000	3
	Evacuation likely?	
	No	1
	Yes	3

		Liklihood of Damage / failure								
Consequence of damage / failure		**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	3	12	15	18	21	24	27	30	33	36
	4	16	20	24	28	32	36	40	44	48
	5	20	25	30	35	40	45	50	55	60
	6	24	30	36	42	48	54	60	66	72
	7	28	35	42	49	56	63	70	77	84
	8	32	40	48	56	64	72	80	88	96
	9	36	45	54	63	72	81	90	99	108

APPENDIX G – RTP hydrotest procedure

i) Fill the pipeline section in accordance with IGEM/TD/1 Appendix 6 Section A6.2

ii) Establish an exclusion zone of 30 m in accordance with IGEM/TD/1 Section 8.7.4

iii) Apply a preliminary test stabilisation period of a minimum of 60 minutes in accordance with BS EN 805.

iv) The test pressure is 1.5 x MOP = 28.5 bar

v) When the pipeline section is completely filled with water, the pressure shall be increased slowly to the test pressure.

vi) Calculate the volume of air trapped in the pipeline section to ensure is less than 0.2%. If this volume is exceeded, the pipe section should be emptied and refilled.

vii) Commence the hydrostatic test, which must be a minimum of 2 hours duration.

viii) Monitor the pressure, and if necessary, regularly repressurise to overcome the effects of creep, to maintain the pressure within 80% of the test pressure (IGEM/TD/3 Section 7.8.2)

ix) The test is satisfactory when the pressure decay and the time elapsed between each pressurisation is declining and not exceeding 5% of the test pressure per hour (IGEM/TD/3 Section 7.8.2).

Drying

Dry the pipeline in accordance with IGEM/TD/1 Section 9.4, applying a minimum soak time of 12 hours.

Cadent
Ashbrook Court
Prologis Park
Central Boulevard
Coventry
CV7 8PE