UKOPA

United Kingdom Onshore Pipeline Operators' Association

UKOPA Good Practice Guide

Requirements for the Siting and Installation of Wind Turbines Installations in the Vicinity of Buried Pipelines

UKOPA/GP/013 Edition 1

June 2017

GUIDANCE ISSUED BY UKOPA:

The guidance in this document represents what is considered by UKOPA to represent current UK pipeline industry good practice within the defined scope of the document. All requirements should be considered guidance and should not be considered obligatory against the judgement of the Pipeline Owner/Operator. Where new and better techniques are developed and proved, they should be adopted without waiting for modifications to the guidance in this document.

Comments, questions and enquiries about this publication should be directed to:

UK Onshore Pipeline Operators' Association
Pipeline Maintenance Centre
Ripley Road
Ambergate
Derbyshire
DE56 2FZ

E-mail: enquiries@ukopa.co.uk

Website: www.UKOPA.co.uk

Revision and change control history

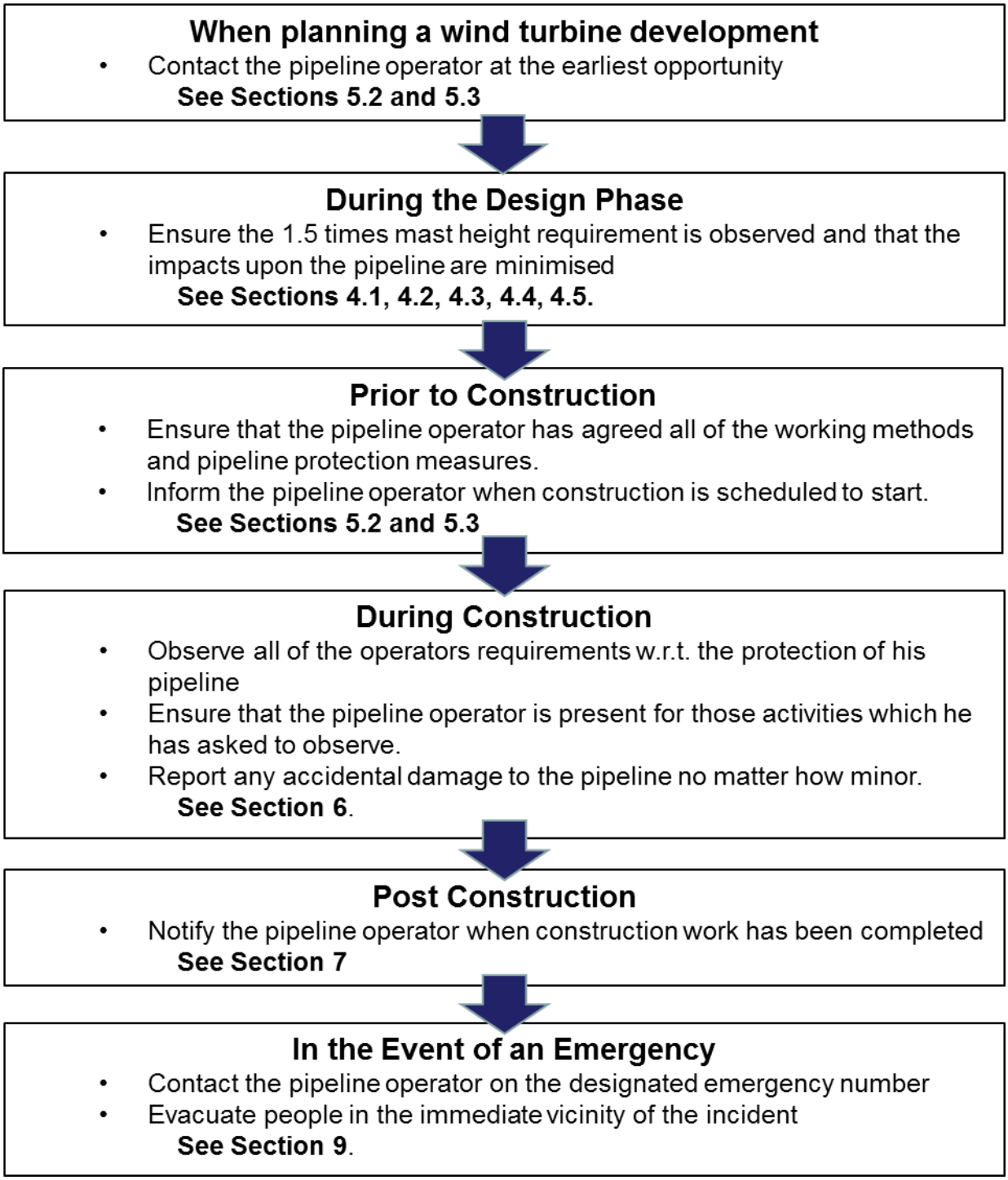
Planned revision: January 2022

Edition	Date	No. of pages	Summary of changes
A	June 2017	17	Replaces UKOPA/13/006 – UKOPA Guidance for the Siting of Wind Turbines Close to High Pressure Pipelines, February 2013. Updated to take account of impact on CP systems.
B			
C			
1			

CONTENTS

1. EXECUTIVE SUMMARY

An overview of the overall process described within this document is provided in the diagram below, however the individual sections of this document should be consulted for the detailed requirements at each stage of the planning, design, construction and operation of a wind turbine installation:



2. INTRODUCTION

This document has been produced by the pipeline operating companies that are members of UKOPA in consultation with, and the support of, the Health and Safety Executive. Its purpose is to ensure wind turbines are designed, sited, commissioned, operated and decommissioned in the safest possible way. The intention of the document is to ensure that the most appropriate decisions are made throughout every stage of life cycle of the wind turbine project.

Appropriate communication between the wind turbine developer and designer is critical throughout the project in order to ensure that the safety impacts on the pipeline are minimised. The document has been produced to support both the wind turbine developer and the pipeline operator in this communication process throughout the pipeline lifecycle. In order to ensure that the requirements of the document are appropriately applied, it is important that the pipeline operator is contacted by the wind turbine developer at the earliest possible stage in the project.

In Great Britain, the control of risks arising from third party damage to pipelines is addressed by Regulations 15 and 16 of the Pipelines Safety Regulations 1996 (PSR). PSR Regulation 15 states: 'No person shall cause such damage to a pipeline as may give rise to a danger to persons'.

Actions that may be necessary to comply with PSR Regulation 15 include:

- checks done during the planning of a job to establish whether any pipelines are located in the vicinity,
- if a pipeline is present, making contact with the pipeline operator and obtaining plans,
- carrying out site surveys,
- utilising appropriate safe digging techniques,
- reassessing the risks if the scope of the work changes,
- stopping work if there are any unexpected findings on site.

PSR Regulation 16 places complementary duties on pipeline operators and states the following: 'For the purpose of ensuring that no damage is caused to a pipeline, the operator shall take such steps to inform persons of its existence and whereabouts as are reasonable'.

A range of measures can be utilised to secure compliance with PSR Regulation 16.

This Good Practice Document sets out to help wind turbine developers by describing the practical steps that they need to take in order to both meet their legal duties and effectively minimise the risks to buried pipelines.

2.1 Background

The pipeline network operated by UKOPA members is buried typically at depths of 1 m (however this depth may vary and contact with the pipeline operator shall confirm the actual depth), and the majority of this Network is located in rural areas away from centres of population. There have been an increasing number of instances over recent years of wind turbines being constructed in the immediate vicinity of these buried pipelines. This document provides guidance to ensure that the safety impacts of wind turbines on buried pipelines are minimised throughout their lifecycle by ensuring that they are suitably designed, sited, constructed, commissioned, operated and decommissioned.

The intention of the document is not to restrict wind turbine development but to make wind turbine designers and developers aware of the pipeline operator's requirements. This should minimise any potential project delays by ensuring that all of the pipeline operator's requirements are known and understood by the wind turbine developers and operators at the earliest possible stage in the project.

2.2 Scope

The guidance in this document is applicable to siting and installation of wind turbines in the vicinity of buried pipelines operated by the UKOPA member companies. These pipelines can be categorised as:

- Natural gas high pressure (HP) pipelines
- Petrochemical liquids and gas pipelines
- Oil and refined liquid pipelines

For natural gas pipelines, the guidance is generally applicable to pipelines with maximum operating pressures above 7 bar, however the principles of the document can be equally applied to natural gas pipelines operating at lower pressures.

This guidance is generally applicable to all wind turbines but smaller scale wind turbines, i.e. typically with mast heights less than 15 m, are less likely to cause significant damage to buried pipelines. It is however still important that, even for smaller scale wind turbines, the appropriate contact requirements detailed in this document are complied with. Wind turbine developers of these smaller installations should not however find the requirements of this document overly onerous to meet.

2.3 Application

This guidance has been developed for the developers and operators of onshore wind turbines (and replaces the guidance document UKOPA/13/006 [1] developed in 2013). The guidance has been developed in order to minimise the impact of the construction and operation of onshore wind turbines on buried pipelines transporting hazardous materials as defined in Section 3.1. The requirements within the document cover the siting, design, construction, operation, subsequent decommissioning and demolition of onshore wind turbines.

The guidance is considered to represent industry good practice and the requirements within the document have been endorsed by the HSE and Renewable UK. It is based on technical work sponsored by UKOPA (References 1, 2 and 3) and is in line with regulatory requirements and pipeline industry standards (Reference 4, 5 and 6). This document has been produced in order to ensure consistency across the pipeline industry for the mutual benefit of all parties.

Within this document:

Shall: indicates a mandatory requirement.

Should: indicates good practice and is the preferred option.

3. OVERVIEW OF UK PIPELINES

The network of pipelines operated by the UKOPA member companies is over 27,000 km in length. The safety record for these pipelines in the UK has been extremely good. This is as a result of them being designed and operated to well-developed industry standards and the application of a robust legal framework.

The continued safe operation of this pipeline network could be adversely impacted by wind turbines unless sufficient safeguards are taken during their siting, construction and operation. A pipeline failure could result in a loss of containment of the hazardous fluid being transported by the pipeline, resulting in a thermal or environmental hazard.

A wind turbine could potentially affect a buried pipeline operated by a UKOPA member company in the following ways:

- Damage to the pipeline caused during the construction of the wind turbine during site preparation work including the excavation of soils associated with the site levelling, the building of construction compounds, the construction of access roads, cable trenching, fencing, etc.
- Damage caused by drainage of the site including the excavation of drainage ditches.
- Damage as a result of piling or construction of foundations for the wind turbine or security fences.
- Damage caused by heavy construction traffic crossing over or close to the pipeline.
- Damage to the pipeline caused during repair or maintenance of the wind turbine.
- Damage to the pipeline caused by a failure associated with the operation of the wind turbine, e.g. a turbine blade failure.
- Electrical interference with the pipeline's cathodic protection (CP) system, see Section 4.2.
- Restricting access to the pipeline both during normal operation of the pipeline or in the event of a pipeline emergency.

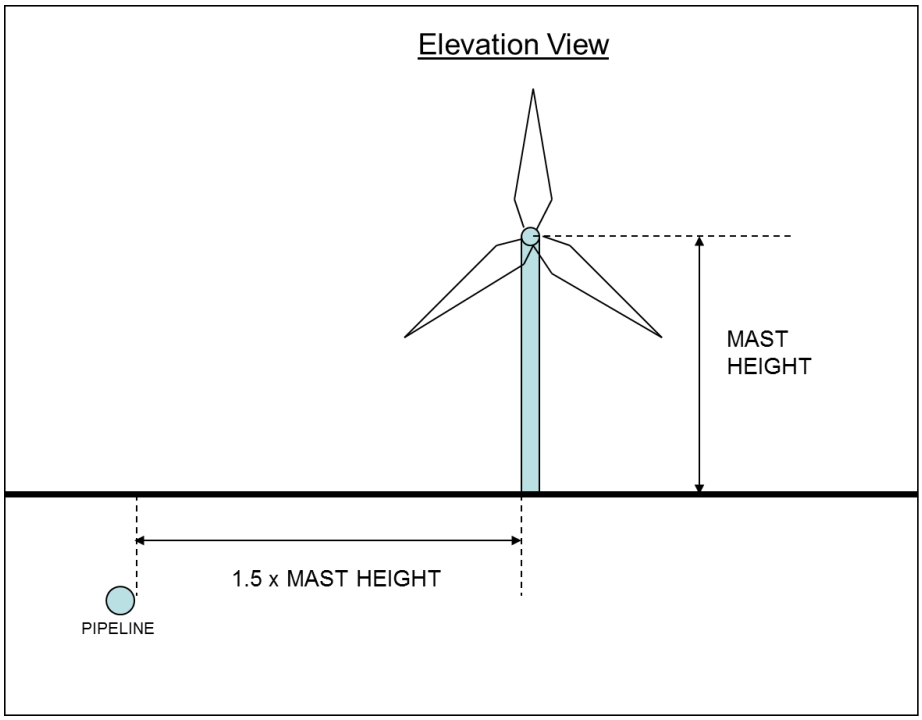
Communication between the pipeline operator and the wind turbine developer, and taking suitable precautions as outlined in this document, can ensure the above issues are avoided.

Damage to a buried pipeline containing hazardous material is a safety and environmental concern: a major economic impact could also result due to loss of gas supplies to homes and industry or disruption of critical fuel supplies

Minor damage to a pipeline results in a requirement for the operating pressure to be reduced causing supply constraints.

One of the principle ways of preventing damage to the pipeline is by ensuring that there is adequate physical separation between the wind turbine and the buried pipeline. UKOPA has sponsored research and developed risk models in order to ensure that there is a suitable separation distance without unnecessarily sterilising land that could be used by wind turbine developers. The basis of this work is documented in a technical paper published at the Institution of Chemical Engineers Conference in 2012 (Reference 2).

This work concluded that an appropriate exclusion zone for wind turbines around transmission pipelines is considered to be 1.5 times the turbine mast height (see also Appendix A).



This 1.5 times the mast height separation requirement is also reflected in the latest versions of the relevant pipeline industry standards (References 5 and 6).

4. DESIGN CONSIDERATIONS

4.1 Siting of Wind Turbines

At the earliest possible stage and prior to applying for planning permission (see Section 5.2 for more details), if there is believed to be a buried pipeline in the vicinity of the proposed wind turbine development area (i.e. within 0.5 km), the pipeline operator should be contacted in order to confirm the exact location of the pipeline route. It is important that the pipeline operator is contacted by the wind turbine developer at the earliest possible stage in the project in order to ensure that all the requirements of this document are understood.

The separation distance requirements for the siting of wind turbines are detailed in Appendix A. These should be observed when planning the location of any wind turbine installations within the proposed development area.

Note: that formal planning permission from the Local Authority does not take account of the hazards that the wind turbine might pose to the buried pipeline. Obtaining planning permission shall not therefore be seen as confirmation that legal duties under the Pipelines Safety Regulations and Construction Design Management Regulations (CDM) (see Section 5.1) have been met.

4.2 Siting/routing of associated electrical infrastructure

4.2.1 Electrical design and risk assessment

A risk assessment showing the impacts of the effects of a rise of earth potential (touch and step potentials and possibility of voltage exceeding the dielectric strength of pipeline coatings, hence consequential damage to coatings and pipelines), under fault conditions, should be submitted to the pipeline operator for consideration at the completion of the design phase and prior to the commencement of any construction works.

Cable diagrams should be provided to the pipeline operator for consideration at the completion of the design phase and prior to the commencement of any construction works. These should show the proposed location of all electrical cables, both buried and above ground, in the vicinity of the pipeline. All electrical cables should be kept out of the pipeline easement (apart from pre-agreed pipeline crossing points). Both buried and above ground alternating current (AC) electrical cables should be routed to avoid the cables running parallel to the pipeline; sub-stations should not be placed adjacent to pipelines.

Where a buried electrical cable or other services are required to cross the pipeline route, then the pipeline operator should specify the minimum clearance distance above or below the pipeline.

4.2.2 Impact upon pipeline cathodic protection

In order to assess any impacts of the Wind Turbine Installation on the pipeline cathodic protection (CP) system, the operator may wish to undertake pre-construction and post-construction monitoring.

Potential impacts could be as a result of:

- The Wind Turbine Installation grounding rings or grounding networks shielding the pipeline from the cathodic protection system.
- AC interference from buried or above ground AC cables.
- Stay current direct current (DC) interference.

The potential for AC or DC interference could increase under fault conditions or after a period of time if some degradation of the cabling insulation occurs.

Depending upon the perceived risks of the above and / or the result of initial monitoring surveys, the pipeline operator may wish to install long term monitoring systems in order to detect any impact which may compromise the CP system.

The costs of any monitoring systems and any remediation works that are deemed necessary would be recharged to the Wind Turbine Installation developer.

4.3 Other Considerations

As well as observing the separation distance detailed in Appendix A, the construction of the proposed wind turbine installation should be planned such that:

- There is sufficient access for all construction equipment and vehicles avoiding the need to cross over the pipeline.
- There is sufficient separation between the proposed construction activities and the pipeline including any planned crane lifts. Any work within the pipeline easement should be subject to agreement and a permit to work issued by the pipeline operator.

Lifting of equipment over the pipeline route (i.e. the pipeline easement width) should be avoided. The pipeline operator should be asked to review and comment on the lifting plans for all planned lifts in the vicinity of the buried pipeline. The pipeline operator may also request to be present whilst these lifts are taking place, see Section 6.

If the crossing of vehicles and heavy machinery over the pipeline cannot be avoided during construction of the wind turbine installation, then the pipeline operator should agree the specific measures required to protect the pipeline. The pipeline operator should confirm that these measures are in place prior to the commencement of the proposed construction work.

4.4 Easement and Wayleave Requirements

The majority of buried pipelines have easements (also known as a Deed of Grant) or wayleaves. These are legal entitlements to rights of access agreed by the pipeline operator with the landowner which allow the pipeline operator to have access to install and maintain the pipeline within a specified strip of land.

Easement and wayleave strips vary in width depending on the diameter and pressure of the pipeline but are typically a strip between 6 m and 25 m in width centred on the pipeline. The majority of easement and wayleave agreements also allow the pipeline operator the right to restrict any permanent construction within the agreed easement strip.

The relevant pipeline operator should be contacted for details of the extent of the easement strip in the vicinity of the proposed Wind Turbine Installation development.

A Deed of Indemnity may be required for any cables or concrete slabs that cross the pipeline.

4.5 Other Assets Associated with the Pipeline

The planned construction works should also recognise any potential impacts on other infrastructure associated with the pipeline. This may include:

- buried cables associated with the pipeline's CP systems,
- anode ground beds associated with the pipeline's CP systems,
- above ground pipeline marker posts and above ground CP system test posts,
- pipeline anchor points, if for example the pipeline is constructed in land that is susceptible to flooding,
- buried pipeline valves, pipeline fittings and pipeline sleeves.

The pipeline operator should provide appropriate advice on the precautions that need to be taken to prevent these systems being damaged.

There may also be buried land drainage in the vicinity of the pipeline, installed by the pipeline operator to protect the pipeline and its associated installations from flooding, or by the landowner to protect their land from the effects of flooding. It is important that both the landowner and the pipeline operator are contacted so that they can advise of the potential impacts of the proposed wind turbine installation construction works on any buried drainage assets.

5. REQUIREMENTS PRE-CONSTRUCTION

5.1 Legal Requirements

Under the CDM Regulations, the principal designer is required to plan, manage and coordinate the planning and design work to ensure that the installation can be built safely. The principal designer is also required to produce and maintain a health and safety file which must include information related to the management of health and safety risks during any future maintenance, repair, construction work or demolition work. For work in the vicinity of a pipeline, the health and safety file must also recognise the potential hazards associated with the pipeline.

In addition to the CDM Regulations, there are also a number of Regulations that are relevant to construction work in the vicinity of buried pipelines. These include Regulation 15 of the Pipelines Safety Regulations. As detailed in Section 1, Regulation 15 specifies that '*no person shall cause such damage to a pipeline as may give rise to danger to persons*'. In order to meet this legal requirement it is important that the requirements in the following sections of this document are followed.

5.2 Notifications and Consents

It is important that the pipeline operator receives a minimum of 4 week's notice of any planned work within the vicinity of the pipeline. This will allow the pipeline operator to provide the wind turbine installation developer with early advice which will help with the planning of the proposed work and understand any constraints on the design, including details of any location specific pipeline issues that need to be taken into account. Typically the operator should be contacted at the following stages of the project:

5.2.1 Feasibility

At the earliest possible stage in the project, the pipeline operator should be contacted in writing with details of the proposed wind turbine development. This should include details if known of the proposed location of the wind turbine(s) and location options. Details of wind turbine sizes including mast heights and planned project timescales should also be provided at this stage. The operator should be advised when formal planning permission is applied for to facilitate appropriate input into the planning process.

5.2.2 Following Planning Consent

Once planning consent has been given, the operator should be provided with any further details regarding the proposed location of the wind turbine(s) and any other major items of equipment. This should include site plans providing the details of supporting foundations and other infrastructure such as the location of buried and/or overhead cables and any other ancillary equipment such as transformers and earthing. Any changes to the proposed project timescales should also be provided at this time.

5.2.3 Prior to Wind Turbine Construction

Once the construction programme is known, the pipeline operator should again be contacted so that he can advise on any pipeline protection measures that might be required. The pipeline operator should review the construction arrangements and method statements at this stage including lifting plans and site access arrangements. Formal confirmation should be provided to the pipeline operator that any required pipeline protection measures have been put in place before the commencement of any construction work.

Depending on how close the proposed work is to the pipeline route, the pipeline operator may wish to supervise any work that was close to, or over, the pipeline. It is important that these arrangements are agreed with the pipeline operator at this stage.

5.3 Prior to the Commencement of Physical Work

Prior to the commencement of the proposed construction work, the pipeline operator should review and comment on the method statements for the planned construction activities that might affect the pipeline. These method statements should include details of any pipeline protection requirements and any other constraints on working arrangements specified by the pipeline operator.

Prior to the works commencing, the pipeline operator should review:

- Details of any locations where the pipeline will be crossed with vehicles, plant and equipment, the operator may require additional pipeline protection measures at these locations.
- Details of any utilities that will be crossing the pipeline, including the location of electrical cables and the associated voltages.
- Details of any drainage and fencing.
- The locations of all wind turbines and their footings.

The pipeline operator should be given a minimum of 14 days notice prior to the commencement of work on site. The route of the pipeline should be marked out by the pipeline operator or the pipeline operator's representative prior to the commencement of any work on site.

Note: Pipelines are not always laid in straight lines so the location of the marker posts should never be used to infer the location of the buried pipeline.

The pipeline operator may require a finger print survey of the CP system so that the impact of the wind turbine installation can be monitored.

6. CONSTRUCTION

The pipeline operator should provide the wind turbine developer or their nominated agent with details of all of the restrictions that should be observed during the construction of the wind turbine. This will include requirements regarding the use of excavating machinery and power tools in the vicinity of the pipeline and any restrictions with respect to the storage of materials and equipment, including storage compounds, and the parking of vehicles.

The pipeline operator will also provide details of the specific activities that require supervision. **Under no circumstances should any of these activities be undertaken without the pipeline operator or his/her nominated representative being present.**

The pipeline operator shall confirm that any specified pipeline protection measures, including protection under vehicle access routes and fencing off of vehicle access routes and/or roadways, are in place.

No work should commence until the wind turbine developer has received a formal written confirmation from the pipeline operator that all the necessary controls are in place and that the work can proceed.

Any damage to the pipeline, including even minor damage to the pipeline's coating, can have a long term effect on the pipeline's integrity. It is therefore very important that **any damage to the pipeline that occurs during construction work, no matter how slight, shall be reported immediately to the pipeline operator.**

All personnel working on site should be made aware of the potential hazards associated with the pipeline and the actions they should follow in case of an emergency, see Section 9.

If at any time during the course of the new construction the pipeline operator is required to carry out emergency works on the pipeline, the work on the new wind turbine installation construction should cease until the work has been completed. This work will be carried out in the shortest possible time. The pipeline operator will not be responsible for any delay or associated costs to the wind turbine installation.

7. POST CONSTRUCTION

The wind turbine developer should inform the pipeline operator when construction work has been completed. The pipeline operator may then want to undertake a review post-construction, this may include:

- A CP survey to confirm that pipeline CP protection is not being adversely affected by the new installation.
- Checks to confirm that the ground cover in and around the pipeline has been reinstated to the correct depth.
- Confirmation that any of the above ground infrastructure such as CP test posts and pipeline marker posts have not been damaged by the construction and installation work.

The pipeline operator will require evidence to confirm that any drainage affected by the construction work has been successfully reinstated.

The pipeline operator will seek to recover from the wind turbine developer costs associated with any remediation/rectification work that may be required to be undertaken by the pipeline operator subsequent to the completion of the installation of wind turbine.

8. ONGOING OPERATIONS

As stated in section 4.2.2, the pipeline operator may wish to undertake ongoing monitoring or put long term monitoring systems in place in order to detect any impact which may compromise the CP system.

It is important that the pipeline operator is notified of any ongoing or future operational activities that might impact upon the pipeline. The pipeline operator shall provide the wind turbine operator with the necessary contact details and shall provide guidance on the activities to be notified of and the required pre notification period. This would normally include any underground works within 50 metres of the pipeline. Typically the pipeline operator will require at least 14 days notice prior to any work being undertaken that may impact upon the pipeline.

The pipeline operator should be provided with a contact address and contact telephone number for the wind turbine operating company. The pipeline operator should be notified if these details change.

It is important that any restrictions or requirements specified by the pipeline operator continue to be observed during the lifetime of the wind turbine installation. If in any doubt, contact the pipeline operator.

There may be some non-routine operations associated with the pipeline that could have an impact on the operation of the wind turbine. These may possibly include operations that will require the wind turbine to be temporarily shutdown. If this is anticipated then the pipeline operator will discuss any restrictions on the operation of the wind turbine with the wind turbine operator well in advance of the proposed works.

9. ACTIONS TO TAKE IN THE EVENT OF AN EMERGENCY

Prior to wind turbine operation, the wind turbine operator should liaise with the pipeline operator in order to ensure all of the relevant contact details for use in the event of an emergency have been provided and the key actions that should be taken have been specified.

Typical emergency arrangements will include the following:

In the event of a pipeline leak:

- Evacuate or remove all personnel from immediate vicinity.
- Dial 999 and call the Fire and Rescue Service (FRS) and Police.
- Contact the relevant Pipeline Operators Control Room (or other emergency contact center) using the emergency number that has been provided.
- Remove all sources of ignition, e.g. stop engines, stop smoking, extinguish all naked flames, and do not use any electrical apparatus.
- Prevent the approach of traffic and the general public.
- Assist in safeguarding persons and property as necessary or as requested by the Police, FRS or pipeline operator.
- Do not attempt to stop or seal any leak at source.

Action to be taken if damage has occurred to the pipeline:

- Contact the pipeline operator or his/her agent.
- Do not backfill and await the representative of the pipeline operator to inspect the damage and decide on the action required.
- Evacuate the immediate vicinity of the pipeline – if the pipeline has not failed you should assume that it could fail.

Note that should a pipeline fail, the hazards that result are product specific; it is important that the pipeline operator's advice for a specific pipeline is followed.

10. REFERENCES

1. UKOPA/13/006, UKOPA Guidance for the Siting of Wind Turbines Close to High Pressure, February 2013.

2. Ensuring an Adequate Separation Distance Between Wind Turbines and Buried Energy Infrastructure, N Jackson, P Baldwin, R Andrews, Hazards XXIII, November 2012.

3. A Preliminary Review of Wind and Solar Power Generation to Ascertain Possible Threats to Pipeline Integrity – Rev A (ref UKOPA/BD/15/022) prepared by John Dyson of Corrosion Consultancy Services Ltd, 28 January 2016.

4. A Guide to the Pipelines Safety Regulations 1996, HSE Document L82.

5. IGEM/TD/1 Edition 5, Communication 1735, Steel Pipelines and Associated Installations for High Pressure Gas Transmission.

6. PD 8010-1:2014 Code of Practice for Steel Pipelines on Land.

APPENDIX A

Required separation distance between buried pipeline and a wind turbine.

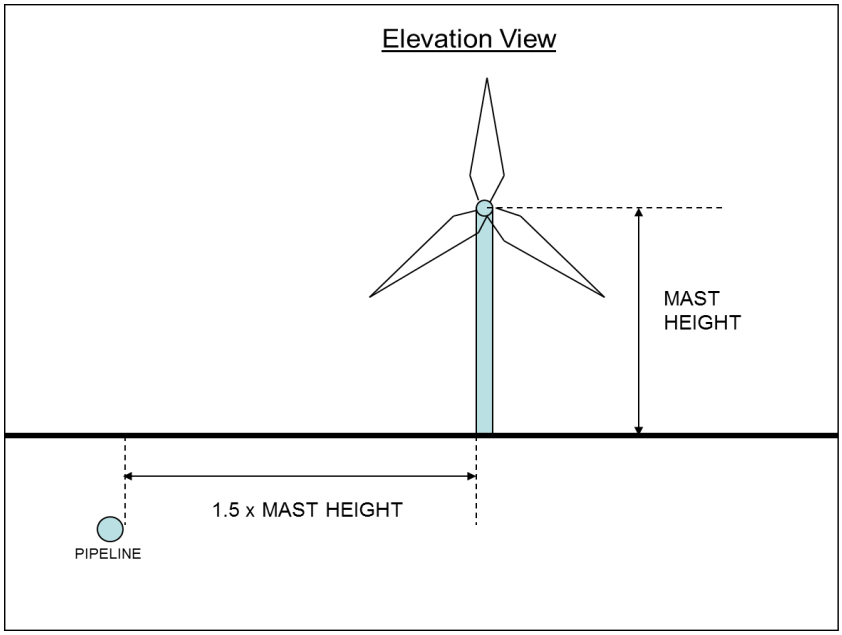


Figure A.1 Required Separation Distance - Elevation View

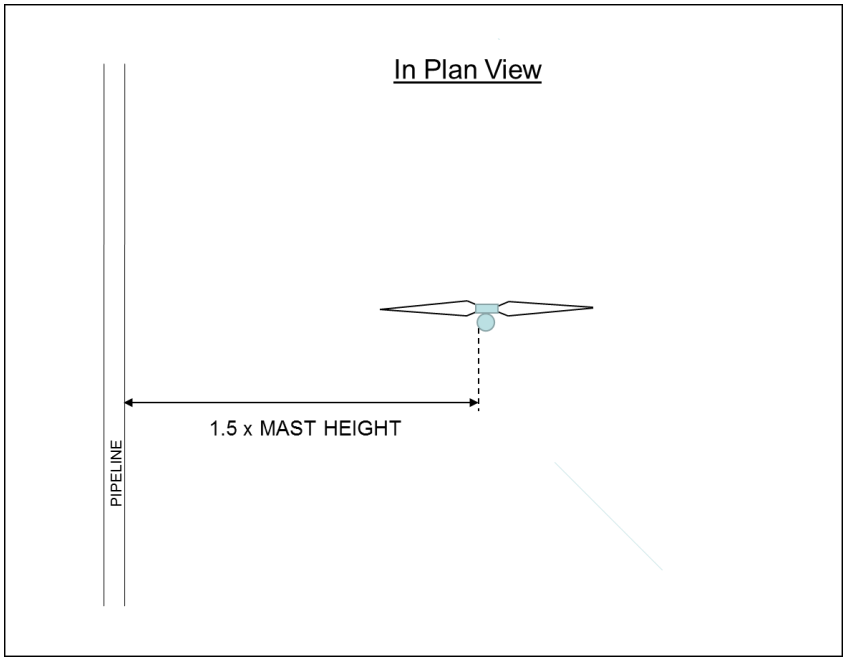


Figure A.2 Required Separation Distance – Plan View

A detailed technical study has been sponsored by UKOPA to identify the potential risks to its buried pipelines from onshore wind turbines. The study was based on data collected for wind farms in the UK and used a methodology that has been developed in the Netherlands.

The study assessed all the potential failure modes that could be a potential threat to the integrity of a pipeline, including blade failure; fall of the nacelle or rotor and toppling of the mast. UKOPA have published the details of the technical study in Reference 2. A copy of this document is available on the UKOPA website.

Based on the study, **the recommended distance from the nearest part of the mast of the wind turbine at ground level mast to the nearest part of the pipeline has been identified as a minimum of 1.5 times the turbine mast height.**

The mast height is defined as the height from the ground level up to the centre line of the wind turbine axle as shown in Figure A.1 above.