E2 Scoping the environmental impacts of pipelines (oil and gas)

Explanatory note

For projects which require Environmental Impact Assessment (EIA), a scoping exercise should be undertaken early in the planning stages of the project. This enables the project to be designed to avoid or minimise negative environmental impacts and provides an opportunity to incorporate positive environmental enhancements into the project. Early consultation with all interested parties, including the Environment Agency, is an essential part of scoping. Even if a project does not require EIA under EIA legislation, it may be advisable (and in some cases necessary) to undertake a scoping exercise in any case (e.g. to support applications for other relevant consents and authorisations needed to carry out the project).

This guidance note aims to promote a good practice approach to scoping as part of the EIA process which in some respects goes beyond the statutory EIA requirements. When scoping a project, developers, or their consultants, should satisfy themselves that they have addressed all the potential impacts and the concerns of all organisations and individuals with an interest in the project.

This guidance note provides information on the most likely potential environmental impacts of oil and gas pipelines. However, each project must be considered on a case-by-case basis as the detailed characteristics of the proposal and the site will determine the potential impacts.

This guidance is based on the main legal requirements on EIA stemming from the EC Directive and the UK Regulations. However, developers should seek independent legal advice to ensure that the proposed development is carried out in compliance with the requirements of this and any other relevant legislation relating to planning as well as to pollution control.

This guidance note must be read in conjunction with the *Scoping Handbook*, which provides general guidance on the EIA process and the scoping of projects.

ENVIRONMENT AGENCY

This guidance note must be read in conjunction with the *Scoping Handbook*, which provides general guidance on the EIA process and the scoping of projects.

In addition, the following scoping guidance notes are also relevant to *all* oils and gas pipeline projects:

- A1 Construction work
- A2 Demolition and decommissioning works
- A4 Vegetation management and conservation enhancements
- D3 Petro-chemical industry – offshore developments, including exploration
- D4 Petro-chemical industry – onshore developments, including exploration

The following scoping guidance notes *may* be relevant in certain circumstances:

- A3 Redevelopment and clean-up of contaminated land
- J9 Surface water abstractions
- J10 Groundwater abstractions

Contents

1 Introduction

1.1 This guidance note, in conjunction with the *Scoping Handbook* and the notes listed on the previous page, seeks to help developers and other interested parties identify the potential impacts of oil and gas pipelines on the environment as a whole. It should be emphasised that the list of impacts is by no means exhaustive and that a full investigation into positive and negative impacts should be undertaken. Early consultation with the Environment Agency and other relevant organisations will enable the identification of environmental issues and constraints and the avoidance of sensitive areas, thus reducing the need for redesigning and mitigating avoidable impacts at a later stage.

1.2 Following this brief introduction, an overview of the legal requirements for EIA in relation to pipeline developments is provided. The potential environmental impacts of such projects are identified in Section 3. The text and summary table in this section will enable the reader to begin to identify the likely impacts arising from the particular proposal under consideration. The subsequent sections present the mitigation measures that may be relevant to oil and gas pipeline projects, followed by key references and further reading.

Background to development type

1.3 Oil and gas pipelines are a low-risk, cost-effective and an energy-efficient means of moving large quantities of residual and distillate petroleum products from one location to another, usually between oil refineries. This is likely to involve the feeding of different products into the line, without any barrier between them. The mixing of petroleum products is minimised by keeping the rate of flow above 6 km h-1. Examples of the types of product carried are, gas, fuel oils, long residue, waxy distillate, gas oils, and gas oil components. Pipelines can be located either above or below the ground. In some cases pipelines can be laid on the seabed. The pipeline operations are controlled from a central unit, which closely monitors the movement of petroleum products in transit. Pipelines provide a valuable method of transporting petroleum products and allow bi-directional flow, reducing the need for vehicular transport. However, there are environmental risks associated with the development of oil and gas pipelines which are primarily to do with the contamination of the local environment from leakages and faults along the pipeline. In addition to these risks there is also the potential for contamination of the local environment resulting from explosions and fires from the gas bearing pipelines. A thorough scoping exercise and careful consideration of alternatives are therefore of prime importance.

2 Development control and EIA

Development control

2.1 Oil and gas pipeline activities are likely to require planning permission under the town and country planning regime, and as a result developers should contact their local planning authority to confirm whether or not their proposals require planning permission (or are subject to any other form of development control). They should also seek advice on the impact on their proposals of other planning-related legislation, for example the Conservation (Natural Habitats & c.) Regulations 1994 (as amended). SI No.94/2716.

Environmental Impact Assessment

2.2 Pipelines for the transport of oil and gas are included in the Schedules to the EIA Regulations; Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 1999 No. 293). The Regulations list applicable thresholds and criteria which apply to Schedule 1 and Schedule 2 developments. If the thresholds are not exceeded, then EIA is not required and so these thresholds and criteria are termed "exclusive criteria". In cases where the thresholds are exceeded, Schedule 1 developments require an EIA (mandatory) but Schedule 2 developments only require an EIA if the development is likely to have significant effects on the environment by virtue of factors such as its nature, size or location. The exclusive criteria for Schedule 1 developments are taken from the EIA Directive, but those for Schedule 2 developments have been laid down in the UK Regulations, as provided for by the Directive. In addition to the specific criteria and thresholds set out in Schedule 2, all developments listed in Schedule 2 may require an EIA if any part of the development is to be carried out in a sensitive area.

2.3 The former DETR published guidance (referred to in the *Scoping Handbook*) which helps in the decision on whether, in respect of Schedule 2 projects, impacts are significant and whether EIA should be required. The guidance thus contains "indicative criteria", although area sensitivity and project-specific issues must be taken into account and the decision remains discretionary. The following threshold criteria apply:

- Schedule 1 thresholds

  Schedule 1 (mandatory EIA) includes, under paragraph 16, pipelines for the transport of gas, oil or chemicals with a diameter of more than 800 millimetres and a length of more than 40 kilometres.

- Exclusive criteria

  Under Schedule 2, paragraph 10(k), EIA would be required where the area of work for oil and gas pipeline installations exceeds 1 hectare, or in the case of a gas pipeline, the installation has a design operating pressure exceeding 7 bar gauge.

- Indicative criteria

  Annex A, Paragraph A28, of the Department of the Environment, Transport and the Regions Circular 02/99, *Environmental Impact Assessment,* states that for the installation of oil and gas pipelines. "The major impact to be considered will generally be the disruption to the surrounding ecosystems during construction, whilst for surface pipelines visual impact will be a key consideration. EIA is more likely to be required for any pipeline over 5 km long. EIA is unlikely to be required for pipelines laid underneath a road, or for those installed entirely by means of tunnelling."

Furthermore, EIA may be required for any change or extension of an existing pipeline, where the change or extension may have significant adverse effects on the environment. Responsibility for determining whether an EIA is required lies initially with the local planning authority.

2.4 Whether or not a formal EIA of proposed pipeline activities is required, the Environment Agency and other statutory consultees and regulators may request environmental information concerning the proposal. An EIA may provide the most appropriate method for a developer to collate the necessary information.

2.5 The Food and Environment Protection Act 1985 Part II (FEPA) requires that a licence be obtained from DEFRA (the licensing authority) to deposit any article or substances in the sea or under the seabed. FEPA licence applications require external consultation which can be implemented through the EIA process.

Other licences, consents and authorisations

2.6 Certain aspects of an oil or gas pipeline project may require prior permissions from the Environment Agency. These may include, for example, land drainage consents, abstraction licences, impounding licences and discharge consents. It is recommended that the developer seek independent legal advice and liaise with the Environment Agency during project design and subsequent stages to identify the consents, licences and authorisations that will be required

3 Potentially significant environmental effects

3.1 The EIA Directive requires the EIA to 'identify, describe and assess…the direct and indirect effects of a project on the following factors: human beings, fauna and flora; soil, water, air, climate and the landscape; material assets and the cultural heritage; [and] the interaction between the [above] factors.' Socio-economic issues, health and safety in the workplace, material assets and cultural heritage are all considered in EU Guidance on Scoping (ERM, 2001a) but are not impact categories for which the Environment Agency is the principal competent authority. Advice on these issues is presented in this guidance note without prejudice to the advice of the relevant competent authority, but the relevant competent authority should be consulted for each of these categories in all cases (further advice on the appropriate competent authority to contact is given in the *Scoping Handbook*).

3.2 An EIA of any proposed pipeline should determine the potential impacts on the environment of each aspect of the project, including location and management. Careful scoping facilitates this process. This section provides a non-exhaustive description of the environmental issues that might arise during the scoping of such a project. The *Scoping Handbook* provides guidance on how to conduct a scoping exercise.

3.3 Oil and gas pipeline activities have the potential to affect the environment in many ways. They can differ widely in terms of their mode of operation and location, and key issues are likely to vary from site to site. Therefore, it is recommended that expert advice on detailed technical issues be obtained. The issues arising for all environmental receptors will change over time throughout the construction, operational

and decommissioning phases. Developers and site operators should therefore consider the impacts arising from all aspects of the development activities.

3.4 Potential impacts are discussed here in broad terms only as their nature and intensity will depend on the physical characteristics of the project and the composition of any polluting materials. An EIA of proposed oil and gas pipeline activities should take these factors into account in assessing potential impacts on the environment.

3.5 The following paragraphs should be read in conjunction with Table E2. This details the activities involved in the preparation and ongoing management of pipeline activities, and the impacts arising from them.

Water environment

3.6 Surface water hydrology can be affected during all phases of oil and gas pipeline operations. The construction phase may result in the compaction of soils and an increase the area of impermeable (or slowly permeable) surfaces. The subsequent increase in surface runoff may, in turn, increase the risk of flooding and soil erosion. Surface drains, installed to distribute water evenly around the pipeline and to prevent waterlogging of the soil, may also increase flood risk.

3.7 Surface water quality could be affected by a number of factors during pipeline operations. Construction and trenching activities may encourage soil erosion and increase the sediment loads of nearby streams, while accidental leaks or spills of oil or fuel from construction activities and vehicles may also pollute surface waters. The trenches constructed for the laying of subsurface pipelines will also result in stockpiling of soil to the one side of the trench. The exposure of soil to the rain may result in the formation of silt laden runoff. The introduction of large quantities of silt into local watercourses, can seriously reduce water quality. Once operational it is possible that the pipeline may be subject to accidental failure with the possible release of petroleum products and hydrocarbons into local watercourses thus potentially seriously affecting local water quality. In the event of possible insidious leakages above or below the ground, pollution may decrease over time as the hydrocarbon products biodegrade. However, the more viscous petro-chemical products will not degrade easily in the environment. The spread of such substances into the surrounding surface waters will require the employment of techniques to minimise the environmental impact. These techniques will be discussed in the mitigation section. Other potential sources of contamination to surface waters include the release of waters used to clean and flush out the pipeline system prior to its decommissioning.

3.8 Pipeline activities may have significant impacts on groundwater hydrology and quality. The site may need to be drained and trenches excavated in order to accommodate subsurface pipelines, resulting in the possible lowering of the water table. Buried pipelines may also potentially interrupt lateral subsurface drainage. Abstractions of water may be required for pipeline hydro testing to identify any pipeline defects and leakages. Water may also be abstracted for flushing out the pipeline prior to decommissioning.

3.9 In order to protect vulnerable groundwater resources, it is the policy of the Environment Agency to encourage new developments to locate in areas of low vulnerability to groundwater pollution. However, this policy does not imply an automatic prohibition on pipeline projects within source protection zones.

Land

3.10 Oil and gas pipeline projects will have implications for the physical characteristics and land use of the site. By their nature, such projects have the potential to change the site significantly, especially in areas where no prior industrial development has taken place. Issues to consider include: the effect on landscape character of the pipeline structure; the loss land associated with the development; the impacts of the construction and decommissioning processes; and the potential for soils to become contaminated with hydrocarbon products from the accidental failure or insidious leakages associated with the pipeline. In the event of such a failure, soil contamination may continue long after pipeline operations have ceased. These environmental impacts are addressed in the mitigation section.

Air and climatic factors

3.11 Pipeline practices have the potential to affect local air quality and climate, and to contribute to global climate change. During the construction phase, local air quality may decline as a result of gaseous and particulate emissions from vehicle movements on and off site. However, once operational, the pipeline should not generate any emissions other than from possible gas leaks along the pipeline and at the pipeline compressor stations. The compressor stations are required to push the gasses through pipe bores over considerable distances and may have the potential to affect air quality, as emissions from the combustion-powered compressors may include oxides of nitrogen and benzene, ethyl benzene, toluene, and xylene (BETX).

Ecology

3.12 The removal of native vegetation and its replacement with a pipeline may cause direct damage to, or loss of, terrestrial and aquatic habitats. Aspects of pipeline operations may affect terrestrial and aquatic species; for example, the silt laden runoff from the construction phase may coat aquatic plants and fish eggs with sediments, thus reducing the overall productivity of the freshwater habitat. In addition to this, silt-laden waters may also result in the reduction of oxygen and light required by fish and aquatic bottom dwellers. Also, there is a risk to the local ecology from the possibility of pipeline rupture and the spillage of hydrocarbon products. Some hydrocarbons will degrade naturally in the environment more readily than others; this will be dependent upon contact with air, viscosity, and the type of soil or rock that the petroleum product comes into contact with. Therefore any ecological impacts will vary according to the oil type and local environmental conditions.

Human environment

3.13 The potential impacts of a pipeline development upon the human environment may take a variety of forms. They are divided here into sections covering socio-economic and health issues; amenity, visual impact and nuisance issues; and culture, heritage and archaeology.

3.14 Potential health impacts include the risks associated with fires and explosions to residents living within close proximity to the pipeline and also to the surrounding local populations. Oil and gas pipelines usually require comparatively small staffing levels and, as a result, employment is not likely to have a significant effect on the local economy. However, social issues should be considered when scoping an EIA. In addition to the amenity, visual impact and nuisance issues noted below, these may include noise impacts, e.g. 24-hour construction work, etc.

3.15 The identification of which of these issues are significant or are perceived to be significant is an important function of public involvement during the scoping exercise. Understanding likely public concerns is a key issue

and reference to experiences from other pipeline developments and any public representations to the local planning authority should be made.

3.16 Amenity issues that commonly need to be addressed are the visual impact of the pipeline, and noise and vibration nuisance from traffic during both the construction and decommissioning phase of the site. Restrictions to access that may arise as a result of the development should also be considered. A below-ground pipeline will require the provision of a working width of up to 20 metres to allow for access, pipe storage, soil bunding and isolation of the area from agricultural or other activities. Nuisance issues during the construction may include 24-hour works; work at night with the aid of floodlights and generators; vibration; slow-moving vehicles for the delivery of the pipes and mud on roads. However, these impacts will be short term.

3.17 Impacts on architectural and archaeological heritage and possible damage to archaeological features during the pipeline construction and decommissioning phases should be considered. The likelihood of there being any unrecorded sites and their potential for discovery should also be examined.

Table E2

3.18 The impact identification table highlights:

- sources of impact (development activities);
- potential impacts;
- receptors for these impacts.

3.19 It is recommended that the table is annotated and used during consultations with other interested parties. Reference should also be made to the prompt lists detailing impacts and sources of impacts in the *Scoping Handbook*.

Table E2 Summary of key potential impacts of pipelines (oil and gas)

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operation phase/ongoing site maintenance	Decommissioning/post-operation
WATER	Surface water hydrology and channel morphology	**Use of vehicles and machinery** • Increase in surface runoff from soil compaction **Works next to or near watercourses** • Change in flow velocities • Increased erosion and subsequent changes in bed and bank stability • Increased flood risk **Earthworks** • Increased sedimentation in watercourses **Water abstraction for hydro testing** • Temporary changes to channel hydrology	**Use of vehicles and machinery** • Increase in surface runoff from soil compaction **Site drainage** • Rapid transfer of rainwater to watercourses via drains • Changes to flow regimes in watercourses downstream of the pipeline • Change in deposition regime, from changes in flow and possible increase in sediment input from soil erosion • Increased flood risk	**Site drainage** • Increase in surface runoff following sealing of trenches • Increased flood risk **Pipeline flushing/cleaning prior to disassembly** • Possible contamination of surface water with hydrocarbon residuals
	Surface water quality	**Earthworks** • Pollution from suspended material • Disturbance of contaminated soil and subsequent pollution of watercourses **Materials management** • Pollution from spills or leaks of fuel, oil and construction materials **Discharge of waters used for hydro testing** • Possible alterations to water quality	**Pipeline failure** • Decrease in water quality from sudden releases (e.g. from liner failure) or gradual seepage of oil products into nearby watercourses **Materials management** • Pollution from spills or leaks of fuel and oil **Use of machinery** • Sediment loading of watercourses	**Pipeline management** • Continued pollution of surface water by insidious oil leakages escaping from faulty pipeline valves, etc. **Pipeline flushing/cleaning prior to disassembly** • Possible contamination of surface water with hydrocarbon residuals within the flushed fluids

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operation phase/ongoing site maintenance	Decommissioning/post-operation
WATER *continued*	Groundwater hydrology	**Earthworks and site drainage** • Reduction in water table • Changes to groundwater distribution and flow **Possible abstraction of water for hydro testing** • Temporary changes to groundwater flow	**Buried pipelines** • Interruption of lateral drainage • Possible alteration of groundwater flow	**Physical presence of buried pipeline** • Possible ongoing alterations to groundwater flows
	Groundwater quality	**Earthworks** • Disturbance of contaminated soil and subsequent groundwater pollution **Materials management** • Pollution from spills or leaks of fuel, oil and building materials	**Pipeline management** • Contamination from sudden releases (e.g. from pipeline failure) or slow seepage of leachate to groundwaters **Materials management** • Contamination from spills or leaks of fuel and oil	**Decommissioning activities** • Possible pollution of groundwater by spills and leakages from the decommissioning vehicles and activities **Pipeline flushing/cleaning prior to disassembly** • Possible contamination of groundwater with hydrocarbon residuals within the fluids
LAND	Landscape	**Excavations and earthworks** • Creation of new landform • Visual impact of works	**Physical presence of pipeline above ground** • Change in character of landscape • Visual impact of structure	**Physical presence of former pipeline** • Possible raised land and existence of surface structures
	Soils	**Use of vehicles and machinery** • Compaction • Erosion **Earthworks** • Further erosion of exposed soil • Removal or alteration of soils on site for pipeline trench construction and stockpiling of soil	**Pipeline operation** • Possible contamination of soil from toxic oil-based materials through leakages and spills • Generation of fugitive gasses from pipelines whether buried below or above ground, and possible migration to soils beyond site boundary	**Legacy of the pipeline** • Implications of contaminated land for future use of site • Damage to soil in restored pipeline area from fugitive gas emissions and possible oil leakages

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operation phase/ongoing site maintenance	Decommissioning/post-operation
LAND *continued*	Geology	**Excavations** • Removal of rock by excavation works	**Excavations** • Further removal of geological resource following site expansion of the subsurface pipeline	
AIR	Local air quality	**Use of vehicles and machinery** • Emissions from construction site traffic • Dust generation	**Fugitive gas emissions** • Releases of pipeline gas to the atmosphere **Use of vehicles and machinery** • Exhaust emissions	**Pipeline decommissioning** • Continued release of landfill gas to atmosphere
	Regional/ global air quality		**Fugitive gas generation** • Contribution to the greenhouse effect from releases of gasses	**Fugitive gas generation** • Continued contribution to greenhouse effect
FLORA AND FAUNA	Aquatic ecology	**Drainage works and use of vehicles** • Negative impact on flora and fauna from increased sediment loading of streams **Materials management** • Harm to aquatic flora and fauna from oil, fuel, cement or other substances entering watercourses	**Pipeline leakages** • Possible pollution of watercourses by oil products **Site drainage** • Indirect effect on aquatic flora and fauna from ongoing changes to stream hydrology and morphology **Materials management** • Direct and indirect effects from oil, fuel or other substances entering the aquatic environment	**Post closure land-use** • Continued effects of soil contamination • Possible migration of nitrogen oxide gasses **Restoration design** • Opportunity for enhancement of nature conservation value

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operation phase/ongoing site maintenance	Decommissioning/post-operation
FLORA AND FAUNA *continued*	Terrestrial ecology	**Earthworks and excavations** • Habitat removal, fragmentation or severance • Disturbance to, or loss of, species (including rare and sensitive species)	**Physical presence of pipeline** • Alteration or loss of terrestrial habitats **Fugitive gas generation** • Harm to species from releases of nitrogen oxides gas **Insidious oil leakages** • Harm to species from releases of oil products, cleaning fluids, etc.	**Physical presence of former pipeline** • Continued habitat fragmentation or severance **Restoration design** • Positive or negative effect on existing ecology from introduction of new (possibly non-native) species
HUMAN ENVIRONMENT	Socio-economic[1]	**Earthworks and excavations** • Disruption of services such as electricity, gas, water, or telecommunications due to excavation work • Construction-related employment **Negative publicity** • Migration of people away from proposed pipeline	**Pipeline operations** • Possible migration of people away from the site of the pipeline	**Restoration design and after-use** • Public perception of the area may improve following sensitive restoration plans
	Health and safety[1]	**Earthworks and excavations** • Risk of injury on construction site **Negative publicity** • Adverse reaction to perceived health issues	**Pipeline operations** • Risk of harm to humans from fire or explosions from pipeline failures • Release of oxides of nitrogen, metals formaldehyde and benzene, ethyl benzene, toluene, and xylene (BETX) from the combustion powered compressors	**Decommissioning and construction activities** • Possibility of accidents occurring during pipeline disassembly

[1] The Agency considers that key impacts to be identified and assessed are likely to include the following, but further advice and guidance should be sought from the relevant competent authority, as included in the *Scoping Handbook*.

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operation phase/ongoing site maintenance	Decommissioning/post-operation
HUMAN ENVIRONMENT *continued*	Amenity	**Earthworks and excavations** • Possible loss of amenity value of the surrounding land	**Erection of security fencing to prevent trespass and vandalism and injury** • Possible alteration of rights of way or reduction in access	**Restoration design** • Provision of amenity/recreational area
	Nuisance	**Use of vehicles and machinery** • Noise from construction traffic and operations • Mud on roads	**Use of vehicles and machinery at the compressor stations** • Noise • Mud on roads **Pipeline maintenance checks** • Possible disturbance caused by regular helicopter maintenance checks for pipeline faults and leakages	**Decommissioning activities** • Possible disturbance caused by the noise and vehicular activity associated with deconstruction – temporary impacts
	Architectural and archaeological heritage[1]	**Earthworks and excavations** • Damage to known or unknown features of archaeological or cultural importance	**Pipeline operations** • Further damage to archaeological features resulting from expansion of the site	

[1] The Agency considers that key impacts to be identified and assessed are likely to include the following, but further advice and guidance should be sought from the relevant competent authority, as included in the *Scoping Handbook*.

Additional site-specific issues:

4 Mitigation measures

4.1 Following the scoping exercise and the identification of potential environmental effects, mitigation measures should be proposed to avoid or reduce potential negative impacts to air, water, land, ecology and humans, or to introduce positive aspects to the development. For example, such measures could aim to minimise the potential for pipeline failure and insidious leakages. Guidance has been provided by the Environment Agency to assist developers on a range of relevant subjects in the form of Pollution Prevention Guidelines (see the *Scoping Handbook and Section 5*).

4.2 A primary consideration in impact mitigation must be the siting of an oil or gas pipeline. The development site should be selected to avoid damage to important ecological sites and high quality landscapes. Also, it is Environment Agency policy to seek the preferential location of developments in areas which are not vulnerable to groundwater pollution (Environment Agency, 1998). It is strongly recommended, therefore, that developers undertake an assessment of alternative sites.

Mitigating the impacts of construction activities

4.3 Pipeline construction activities have the potential to affect all environmental receptors. However, the following list summarises the mitigation measures most relevant to pipeline developments:

- phasing of construction work to minimise disturbance to wildlife at sensitive times of year, such as during the breeding season or when young are being raised;
- use of techniques to minimise compaction of soil, such as restricting access during wet conditions, and using protective boarding and low ground pressure machinery. If necessary, soil should be carefully removed and stored for subsequent reinstatement;
- use of dust control strategies;
- storage of fuel, equipment and construction materials so as to minimise the risk of soil contamination or water pollution (see Environment Agency, 2000a);
- setting the route and timing of construction traffic so as to avoid residential areas or other sensitive human receptors (e.g. schools, hospitals, nursing homes);
- use of silenced welders for pipeline welding (especially at night) and the careful selection of machinery and also the use of baffles and screens to minimise noise impacts;
- top and subsoil should be carefully removed and stored separately so that the reinstatement of the soils can be carried out; also, soil stockpiles should be protected to reduce runoff;
- access roads should avoid riparian zones and should be built using appropriate construction materials.

Mitigating the impacts of the operational phase

4.4 Although sensitive siting and design of a pipeline are the primary means for avoiding or reducing its environmental impacts, further measures can be introduced to minimise impacts occurring from the ongoing management of the site. An overall consideration for the proposed pipeline is that its design and operation are in accordance with planning conditions and other relevant legislation. Developers should seek

independent legal advice to ensure that all legal requirements relating to the proposed development are identified and complied with.

4.5 The measures have been arranged according to their primary receptor, however it should be noted that many of the following mitigation measures are interrelated. For example, correct handling and storage of chemicals, plus bunding to contain spills, would serve to reduce the impacts of such an incident on soils, surface and groundwaters, and ecology.

Protecting the water environment

4.6 In order to minimise potential impacts on the water environment in the design and running of a pipeline one must ensure that:

- an appropriate water management system is used, including, for example, efficient land drainage and the use of constructed ponds for receiving site runoff to reduce its impact on nearby watercourses;
- sustainable drainage systems should be used to alleviate flooding, improve water quality and ensure recharge of groundwater base flows;
- hazardous or potentially polluting materials such as fuel, oil or wastes must be sited on an impervious base away from water, properly bunded, and kept locked when unattended;
- a sensitive monitoring system is in place to aid early leak detection;
- intelligent pigging is carried out periodically to detect any corrosion;
- an automatic pump shutdown and manual block valve system are installed to prevent the further spread of detected leakages;
- cathodic protection techniques are in place;
- high specification pipe walls are used in environmentally vulnerable and sensitive areas;
- trenches are constructed across the potential oil migration paths, and if leaks do occur that the oil is pumped out;
- in the event of an oil spillage into open moving water that floating booms are used to contain the spills;
- in the event of an oil spillage into still waters, oil can be detained or deflected using water or air jets;
- in the event of an oil spillage the following can be used to mitigate the pollution of both surface and groundwaters: skimmers; absorbent materials; mechanical removal; washing of surfaces and chemical dispersants (however, these mitigation measures may have their own environmental impacts);
- where pipelines run underwater, extra layers of pipeline protection should be incorporated into the design whereby in the event of a leakage, the oils will be contained (some underwater pipelines are coated with neoprene rubber);
- oil interceptors or drip trays are used in vehicle parking areas, and are inspected and cleaned regularly;
- a risk assessment and consequence analysis is carried out for the pipeline;
- an emergency plan is formulated and tested through exercises to ensure that procedures to prevent or mitigate impacts due to accidents or spillages are in place and operate effectively (some developments may require such plans to be formulated and the Environment Agency should be consulted to identify where this is the case).

Protecting the land environment

4.7 Certain measures noted above for protecting the water environment, such as the installation of an automatic pump shut-down and manual block valve systems, will also reduce the likelihood of soil contamination. Impacts on soils and landscape may also be mitigated by the following:

- appropriate designs for buildings/structures on site;
- appropriate screening for visual impacts, for example, the above-surface pipeline may be screened by shrubs;
- effective stabilisation of altered landforms and soil stockpiles so as to minimise soil erosion and the potential for pollution from suspended solids.

Protecting the air environment

4.8 Developers should consider the aspects of the development that are likely to lead to emissions to air. Such aspects can include vehicle emissions during the construction and decommissioning phases, and the release of nitrogen oxide, formaldehyde and benzene, ethyl benzene, toluene, and xylene (BETX) from the combustion-powered compressors required to push the gasses through the pipe bores. Suitable mitigation measures may include the use of pollution abatement equipment including adequate filtration systems, and the monitoring and calibration of
equipment to minimise fugitive emissions and to ensure the maximum operating efficiency.

Protecting ecology

4.9 Measures designed to prevent or reduce impacts to water or land will also help to prevent adverse impacts on ecology. The following list identifies further measures to reduce or avoid impacts to terrestrial and aquatic species and their habitats:

- existing habitat features should be incorporated into site design and protected from change;
- further habitats should be created to compensate for habitat losses and to improve the landscape and ecological potential for the site;
- restoration plans should incorporate measures to improve the ecological status of the former pipeline site.

Protecting the human environment

4.10 Some of the measures noted above can also reduce possible impacts on humans, notably the risk assessment and emergency planning measures. Further mitigation measures more specific to the human environment are listed below:

- management operations should aim to minimise disturbance to adjacent residential and recreational uses during the construction period; once operational, nuisance noise will originate only from the pumps at the sending stations. This should be indistinguishable from existing background levels;
- where access restrictions result from the pipeline development, arrangements for alternative access should be made with the provision of gates, bridges or stiles as appropriate;
- safety concerns should be addressed by such measures as implementing strict health and safety procedures for workers, and the installation of adequate fencing and other site security to prevent trespass and vandalism;

- a risk assessment and consequence analysis should carried out for the pipeline so that an assessment of the safety of the pipeline to the nearest residential population can be made;
- sites of archaeological or cultural interest should be preserved in situ where possible. As relocation is rarely possible, thorough archaeological investigations should be carried out where damage is unavoidable.

5 References and further reading

1 **American Gas Association (1985)** *Gas Engineering and Operating Practices. Volume II, Book T-2:* Compressor Station Operations. AGA, Washington DC.

2 **American Petroleum Institute (1991)** *Waste Minimisation in the Petroleum Industry: A Compendium of Practices.* API, Washington DC.

3 **Construction Industry Research and Information Association (2001)** *Sustainable Urban Drainage Systems – Best Practice Guide.* C523, CIRIA, London.

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5 **Construction Industry Research and Information Association (1994)** *Environmental Assessment. Special Publication 96.* CIRIA, London.

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7 **Department of the Environment, Transport and the Regions (2000)** *Environmental Impact Assessment: A Guide to the Procedures.* Thomas Telford Publishing, London.

8 **Department of the Environment, Transport and the Regions (1997)** *Mitigation Measures in Environmental Statements.* Rotherham.

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