

G3: Scoping the Environmental Impacts of Chemical Manufacturing, Processing and Storage

Explanatory Note

For projects which require Environmental Impact Assessment (EIA), a scoping exercise must be undertaken early in the planning stages of the project. This enables the project to be designed to avoid or minimize 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 chemical manufacturing, processing and storage. 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 pollution control.

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

In addition, the following scoping guidance notes are also relevant to *all* chemical production and storage developments:

- ◆ A1 Construction works
- ◆ A4 Vegetation management and conservation enhancements

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

- ◆ A2 Demolition and decommissioning works
- ◆ A3 Redevelopment and clean-up of contaminated land
- ◆ L4 Solid waste management facilities

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1. Introduction

- 1.1 This guidance note, in conjunction with the Scoping Handbook and the other notes listed on the previous page, seeks to help developers and other interested parties identify the potential impacts of developments for the manufacture and storage of chemicals 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 chemical production or storage development is provided. The potential environmental impacts arising from such a development are identified in Section Three. The text and summary table in this section will enable the reader to begin to identify the likely impacts arising from the particular development proposal under consideration. The subsequent sections present the mitigation measures that may be relevant to chemical production and storage developments, and key references and further reading.
- 1.3 *Background to development type*
The development of facilities for the manufacture or storage of chemicals involves the conversion of an area of land to a new industrial use. This can involve the creation of buildings, access roads, parking areas, pipelines, water intakes and outlets, storage tanks and other ancillary structures. Such developments may be perceived of as “bad neighbour” developments and may attract negative publicity. Therefore, a thorough scoping exercise and careful consideration of alternatives are of prime importance.

2. Development control and EIA

- 2.1 *Development Control*
Development of chemicals production or storage facilities falls under the Town and Country Planning system and will, therefore, be likely to require planning permission. Developers should contact their Local Planning Authority to confirm whether or not their proposals require planning permission. Reference should also be made to other planning legislation. For example, the Planning (Hazardous Substances) Regulations (SI 1992 No 656), apply to developments that involve the storage of chemicals.

Environmental Impact Assessment

- 2.2 Chemicals manufacture and storage developments are listed under both Schedule 1 and Schedule 2 in the 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 DETR has 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 is still discretionary. The following criteria apply:

◆ Exclusive criteria

Schedule 1 (mandatory EIA) includes, under paragraph 6, “integrated chemical installations.” This covers the production on an industrial scale of: basic organic chemicals; basic inorganic chemicals; phosphorous-, nitrogen- or potassium-based fertilisers; basic plant health products and biocides; basic pharmaceutical products; and explosives. Installations for the storage of petroleum, petrochemical or chemical products with a capacity of 200,000 tonnes or more are included under paragraph 20.

Under Schedule 2, paragraph 6, EIA may be required for installations for (a) the treatment of intermediate products and production of chemicals and; (b) the production of pesticides and pharmaceutical products, paint and varnishes, elastomers and peroxides if the area of new floor space exceeds 1000 square metres. Storage facilities for petroleum, petrochemical and chemical products may require EIA if: (i) the area of any new building or structure exceeds 0.05 hectare; or (ii) more than 200 tonnes of product is to be stored at any one time.

◆ Indicative criteria

Annex A of the Department of the Environment, Transport and the Regions Circular 02/99, *Environmental Impact Assessment* states that, “New manufacturing or industrial plants of the types listed in the Regulations may well require EIA if the operational development covers a site of more than 10 hectares. Smaller developments are more likely to require EIA if they are expected to give rise to significant discharges of waste, emission of pollutants or operational noise. Among the factors to be taken into account in assessing the significance of such effects are:

- whether the development involves a process designated as a “scheduled process” for the purpose of air pollution control;
- whether the process involves discharges to water which require the consent of the Environment Agency;
- whether the installation would give rise to the presence of environmentally significant quantities of potentially hazardous or polluting substances;

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- whether the installation would give rise to radioactive or other hazardous waste;
 - whether the development would fall under Council Directive 96/82/EC on the control of major accident hazards involving dangerous substances (COMAH).”

Furthermore, EIA may be required for any change to or extension of a chemicals production or storage facility already authorised, developed or in the process of being developed, 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 a proposed chemicals production or storage installation 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.

Other licences, consents and authorisations

- 2.5 Certain aspects of a chemicals production or storage development, such as the discharge of effluent to a water course, may require prior permission from the Environment Agency. These may include for example land drainage consents, abstraction licences, impounding licences and discharge consents. Also, certain chemical production processes require authorisation under the Pollution Prevention and Control regime (IPPC). 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. Where a PPC permit is required efforts should be made to ensure that the two processes are consistent with each other, although the timings of the EIA and PPC submissions may be different.

3. Potentially significant environmental issues

- 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 the cultural heritage are all considered in EU Guidance on scoping (ERM, 2001b) but are not impacts 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 Developments for chemicals production or storage have the potential to affect the environment in many ways. They can differ widely in terms of their design and location, and key issues are likely to vary from site to site. Therefore, it is recommended that expert advice on detailed technical issues should be obtained. The issues arising for all environmental receptors will change overtime as the site is prepared, as the installation is built and operated, and following the end of operations. Developers and site operators should consider the impacts arising from both construction activities and operational practices, and following the closure or decommissioning of the development.
- 3.3 Environmental impacts can affect both humans and ecological resources. Potential impacts are discussed here in broad terms only as their nature and intensity will depend on the physical characteristics of a chemicals production or storage facility and the composition of

any polluting materials. An EIA should take these factors into account in assessing potential impacts on the environment.

- 3.4 The following paragraphs should be read in conjunction with Table G3. This details the activities involved in the construction, on-going management and decommissioning of a chemicals production or storage facility, and the impacts arising from them.

Water environment

- 3.5 Surface water hydrology can be affected during construction of a chemicals production or storage facility. The creation of buildings, loading/unloading areas and any ancillary structures can result in compaction of soils and an increase in impermeable (or slowly permeable) surfaces. The subsequent increase in surface runoff may, in turn, increase soil erosion and the risk of flooding. During the operational life of the development, the presence of impermeable surfaces and site drainage will continue to promote the rapid transfer of rainwater to local watercourses, and so increase flood risk. Also, the abstraction of water from nearby streams may alter their flow regimes and patterns of erosion and deposition.
- 3.6 Surface water quality could be affected by a number of factors during both the construction and operation of the chemicals production or storage installation, and following its closure. Earthworks during construction may promote soil erosion and, in turn, increase the sediment loads of nearby streams, while accidental leaks or spills of oil, fuel or construction materials can also pollute surface waters. During operation of the facility, surface water quality may be adversely affected by both routine discharges and unplanned or accidental releases of substances used or produced on-site. Such discharges and releases may affect the temperature, pH and other physical and chemical properties of the receiving water body. Also, abstractions of surface water may affect downstream quality due to a reduction in dilution capacity.
- 3.7 Chemicals production or storage facilities may have significant impacts on groundwater hydrology and quality. The site may need to be drained to enable construction, resulting in the lowering of the water table, while the foundations of buildings will present an ongoing barrier to the flow of groundwater. During operations, abstractions of groundwater may further affect the flow and distribution of groundwater. The main threat to groundwater quality, as for surface waters, is that of pollution from routine or accidental releases of hazardous or potentially harmful substances.
- 3.8 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 chemical production or storage facilities within Source Protection Zones.

Land

- 3.9 Development of a chemicals production or storage installation will have implications for land take and soil loss as well as the physical characteristics and land use of the site. By their nature, such installations have the potential to change the site significantly. Issues to consider include: the removal of bedrock and topsoil during excavations; the effect on landscape character of the buildings and structures needed; and the potential for soils to become contaminated from leaks or spills of hazardous materials used in or produced by the process, or stored on-site. Consideration should also be given to possible problems associated with contaminated land as these may continue long after operations have ceased.

Air and Climatic Factors

- 3.10 A chemicals production or storage facility has the potential to affect local air quality and climate, and to contribute to global climate change. During both construction and operation, local air quality may decline as a result of gaseous and particulate emissions from vehicle

movements on- and off-site. However, the principal impacts on air quality are likely to occur during the operational phase due to routine and accidental releases of substances to air.

- 3.11 Substances released to air include volatile organic compounds (VOCs), particulates, and other gases generated during the production process. The nature of the substances that could be released will vary according to the different processes and materials used. These may have a negative effect on local air quality such as photochemical smog, while certain emissions, such as carbon dioxide (CO₂), nitrous oxide (N₂O), ozone and water vapour, may act as “greenhouse gases,” contributing to the effect of global warming. Also, other gases, such as sulphur dioxide and oxides of nitrogen, may contribute to the formation of acid precipitation (“acid rain”).

Ecology

- 3.12 During construction, the removal of vegetation, soils and bedrock can cause direct damage to terrestrial and aquatic habitats and the displacement or loss of species. During the operational life of the facility, terrestrial and aquatic species may be affected if, for example, land or water become polluted by substances used, transported or stored on-site.

Human environment

- 3.13 The potential impacts of a chemicals production or storage development on 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 The potential for socio-economic and perceived health impacts arising from a chemicals production or storage installation is likely to be considered as significant by the people that may be directly affected. Such developments may need comparatively high staffing levels and, as a result, employees may affect local socio-economic issues. Also, issues such as the perceived “bad neighbour” status of the development should be considered when scoping an EIA, as should opportunities for planning gain. In addition to the amenity, visual impact and nuisance issues noted below, these may include the movement of people away from properties that are close to a proposed site. The likely reaction of people to perceived health issues, such as the contamination of drinking water, should also be taken into account.
- 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 chemicals production or storage developments and any public representations to the local planning authority should be made.
- 3.16 Amenity and visual impact issues that commonly need to be addressed include restrictions to access that may arise as a result of the development and the visual impact of the development. Nuisance issues include noise and vibration from machinery and traffic during both construction and operation of the installation, unpleasant odours generated by the process, and light intrusion during night-time operations. Also, impacts to recreational users of nearby land and downstream water courses from air and water pollution should be considered.
- 3.17 Impacts on architectural and archaeological heritage are likely to be primarily issues of concern in the construction phase. The effects that the physical presence of the facility and its access roads may have on such archaeological and historical features should be taken into account. The likelihood of there being any unrecorded sites and the site’s influence on the potential for discovery should also be examined.

Table G3

- 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 G3. Summary of Key Potential Impacts of Chemical Manufacturing and Storage Developments

Potential Receptors of Impact		Activities and Potential Impacts		
		Construction phase	Operation phase/on-going site maintenance	Decommissioning / Post-operation
WATER	surface water hydrology & channel morphology	<p>Use of vehicles and machinery</p> <ul style="list-style-type: none"> increase in surface runoff from soil compaction and vegetation removal <p>Works next to or near water courses</p> <ul style="list-style-type: none"> change in flow velocities, with subsequent changes to erosion and deposition affecting bed and bank morphology increased flood risk <p>Earthworks</p> <ul style="list-style-type: none"> increased sedimentation of water courses 	<p>Site drainage</p> <ul style="list-style-type: none"> rapid transfer of rainwater to water courses via drains changes to flow regimes of water courses downstream of the facility and possible increase in flood risk <p>Abstractions and discharges</p> <ul style="list-style-type: none"> changes to flow regime and patterns of erosion and deposition in water courses downstream of abstraction/discharge point 	<p>Redundant structures</p> <ul style="list-style-type: none"> on-going hydrological effects from structures such as water intakes, outfall pipes and site drains <p>Cessation of abstractions and discharges</p> <ul style="list-style-type: none"> compensatory changes in flow, erosion and deposition regimes of water courses
	surface water quality	<p>Earthworks</p> <ul style="list-style-type: none"> pollution from suspended material disturbance of contaminated soil and subsequent pollution of water courses <p>Materials management</p> <ul style="list-style-type: none"> pollution from spills or leaks of fuel, oil and construction materials 	<p>Site management</p> <ul style="list-style-type: none"> decrease in water quality from routine or accidental releases of substances <p>Transportation and storage</p> <ul style="list-style-type: none"> pollution from spills or leaks of fuel, oil and chemicals <p>Car parking</p> <ul style="list-style-type: none"> addition of polluted runoff to water courses 	<p>After-use</p> <ul style="list-style-type: none"> possible disturbance of contaminated soil and subsequent transfer to water courses
	groundwater hydrology	<p>Earthworks and site drainage</p> <ul style="list-style-type: none"> reduction in water table changes to groundwater distribution and flow 	<p>Physical presence of facility</p> <ul style="list-style-type: none"> continued alteration of groundwater flow 	<p>Cessation of abstractions and discharges</p> <ul style="list-style-type: none"> potential for natural recharge of groundwater reserves
	groundwater quality	<p>Earthworks</p> <ul style="list-style-type: none"> disturbance of contaminated soil and subsequent groundwater pollution <p>Materials management</p> <ul style="list-style-type: none"> pollution from spills or leaks of fuel, oil and construction materials 	<p>Site management</p> <ul style="list-style-type: none"> pollution from routine or accidental releases of substances <p>Transportation and storage</p> <ul style="list-style-type: none"> pollution from spills or leaks of fuel, oil and chemicals 	<p>After-use</p> <ul style="list-style-type: none"> possible disturbance of contaminated soil and subsequent transfer to ground water

Potential Receptors of Impact		Activities and Potential Impacts		
		Construction phase	Operation phase/on-going site maintenance	Decommissioning / Post-operation
LAND	landscape	Excavations & earthworks <ul style="list-style-type: none"> removal or creation of landforms 	Buildings and plant <ul style="list-style-type: none"> change in character of landscape 	Buildings and plant <ul style="list-style-type: none"> existence of unused or derelict structures
	soils	Use of vehicles and machinery <ul style="list-style-type: none"> compaction erosion Earthworks <ul style="list-style-type: none"> further erosion of exposed soil physical removal of soils on site 	Transport, use and storage of substances <ul style="list-style-type: none"> contamination of soil from contact with toxic or hazardous chemicals pollution from spills or leaks of fuel and oil 	After-use <ul style="list-style-type: none"> implications of contaminated land for future use of site
	geology	Excavations <ul style="list-style-type: none"> removal of bedrock by excavation works 		
AIR	local air quality	Use of vehicles and machinery <ul style="list-style-type: none"> emissions from construction site traffic dust generation 	Production, transport and storage of chemicals <ul style="list-style-type: none"> routine or accidental release of gases and particulates to the atmosphere “fugitive emissions” from the volatilisation of chemicals in transit or storage Use of vehicles and machinery <ul style="list-style-type: none"> exhaust emissions 	
	regional / global air quality		Production, transport and storage of chemicals <ul style="list-style-type: none"> contribution to the greenhouse effect from releases of gases such as CO₂, O₃, N₂O, VOC release leading to tropospheric ozone production 	

Potential Receptors of Impact		Activities and Potential Impacts		
		Construction phase	Operation phase/on-going site maintenance	Decommissioning / Post-operation
FLORA & FAUNA	aquatic ecology	<p>Drainage works and use of vehicles</p> <ul style="list-style-type: none"> negative impact on flora and fauna from increased sediment loading of streams <p>Materials management</p> <ul style="list-style-type: none"> harm to aquatic flora and fauna from oil, fuel, cement or other substances entering watercourses 	<p>Production, transport and storage of chemicals</p> <ul style="list-style-type: none"> potential for pollution of watercourses <p>Abstractions and discharges</p> <ul style="list-style-type: none"> harm from polluted discharges or run-off entering water courses indirect effect on aquatic flora and fauna from ongoing changes to stream hydrology and morphology discharge of water at higher than ambient temperature can damage aquatic organisms <p>Use of vehicles and machinery</p> <ul style="list-style-type: none"> direct and indirect effects from fuel or oil entering the aquatic environment 	<p>Post closure land-use</p> <ul style="list-style-type: none"> continued effects of soil contamination opportunity for enhancement of nature conservation value of former industrial site
	terrestrial ecology	<p>Earthworks and excavations</p> <ul style="list-style-type: none"> habitat removal, fragmentation or severance disturbance to, or loss of, species (including rare and sensitive species) 	<p>Buildings and plant</p> <ul style="list-style-type: none"> continued habitat fragmentation or severance <p>Production, transport and storage of chemicals</p> <ul style="list-style-type: none"> risk of harm to terrestrial ecology from routine releases or accidental spills or leaks of hazardous or toxic substances 	<p>Unused buildings and plant</p> <ul style="list-style-type: none"> continued habitat fragmentation or severance <p>Post closure land-use</p> <ul style="list-style-type: none"> continued effects of soil contamination opportunity for enhancement of nature conservation value of former industrial site

Potential Receptors of Impact		Activities and Potential Impacts		
		Construction phase	Operation phase/on-going site maintenance	Decommissioning / Post-operation
HUMAN ENVIRONMENT	socio-economic ¹	Earthworks and excavations <ul style="list-style-type: none"> disruption of services such as electricity, gas, water, or telecommunications due to the presence of underground cables and pipes construction-related employment Negative publicity <ul style="list-style-type: none"> migration of people away from proposed development 	Manufacture of chemicals <ul style="list-style-type: none"> continued migration of people away from the operational installation employment 	After-use <ul style="list-style-type: none"> public perception of the area may improve following sensitive restoration plans
	health and safety ¹	Earthworks and excavations <ul style="list-style-type: none"> risk of injury on construction site Negative publicity <ul style="list-style-type: none"> adverse reaction to perceived health issues 	Use, transport and storage of chemicals <ul style="list-style-type: none"> risk of harm to people on-site risk of harm to general public (e.g. consumption of contaminated drinking water) risk of explosions or fires 	After-use <ul style="list-style-type: none"> possible health issues arising from the existence or disturbance of contaminated soil
	amenity	Site location <ul style="list-style-type: none"> possible alteration to rights of way or reduction in access 	Site location <ul style="list-style-type: none"> continued alteration to rights of way or reduction in access 	After-use <ul style="list-style-type: none"> provision of amenity/recreational area
	nuisance	Use of vehicles and machinery <ul style="list-style-type: none"> noise from construction traffic and operations mud on roads dust 	Use of vehicles and machinery <ul style="list-style-type: none"> noise Production and storage of chemicals <ul style="list-style-type: none"> odours noise 	After-use <ul style="list-style-type: none"> unused site may become a target for vandals Derelict buildings and plant <ul style="list-style-type: none"> possible negative visual impact
	architectural and archaeological heritage ¹	Earthworks and excavations <ul style="list-style-type: none"> damage to known or unknown features of archaeological or cultural importance 		Buildings <ul style="list-style-type: none"> Old manufacturing facilities may be of historical interest and require conservation.

Additional site specific issues:

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.

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 prevent the release of pollutants and to ensure that any inadvertent release is contained. 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 “References and Further Reading” in the Scoping Handbook).

4.2 A primary consideration in impact mitigation must be the siting of a chemicals production or storage installation. The development should 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, 1998b). It is strongly recommended therefore that developers undertake an assessment of alternative sites.

Mitigating the impacts of construction activities

4.3 Construction activities have the potential to affect all environmental receptors. Readers are referred to guidance note A1 of this series, which deals with construction works in more detail. However, the following list summarises the mitigation measures most relevant to chemicals production or storage developments:

- ◆ phasing of construction work to minimize disturbance to wildlife at sensitive times of year, such as during the breeding season or when young are being raised;
- ◆ use of techniques to minimize 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 minimize the risk of soil contamination or water pollution (see Environment Agency, 2000c);
- ◆ 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);
- ◆ 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 chemicals production or storage facility 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 development is that its design and operation are in accordance with all 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 inter-related. 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 ground waters, and ecology.

Protecting the water environment

4.6 In order to minimise potential impacts on the water environment, the design and operation of chemicals production or storage installations must ensure that:

- ◆ an appropriate water management system is used, including, for example, Sustainable Drainage Systems, efficient land drainage and the use of constructed ponds for receiving site runoff to reduce the impact of runoff on nearby water courses; there may be opportunities for site water to be cleaned via low energy technologies such as reed beds before final discharge into controlled waters;
- ◆ hazardous or potentially polluting materials (such as fuel, oil or chemicals used or produced by the process) are sited on an impervious base away from water, properly bunded and kept locked when unattended;
- ◆ separate containment and drainage provided for site runoff, loading/unloading and processing areas (the latter in particular may need specialised treatment before release);
- ◆ oil interceptors or drip trays are used in vehicle parking areas, and are inspected and cleaned regularly;
- ◆ a risk assessment is carried out for each substance to be used, produced or stored on site, and the appropriate containment measures installed;
- ◆ 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 correct bunding of storage areas, 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;
- ◆ effective stabilisation of altered landforms so as to minimise soil erosion and the potential for water pollution from suspended solids;
- ◆ adequate bunding or containment measures are installed throughout the site, particularly in chemical storage and transfer areas, to minimise risk of soil contamination;
- ◆ use of drip trays under stationary machinery to prevent oil and grease contaminating soil and groundwater.

Protecting the air environment

4.8 Developers should consider the aspects of the development that are likely to lead to air emissions, incorporating process alterations to minimise pollutant formation and flue gas recovery or treatment systems. Issues may include the release of particulates, VOCs and other gaseous emissions during production or storage of chemicals; and vehicle emissions. Agency guidance is available for many chemical processes. Suitable mitigation measures may include

process alterations to minimise the formation of pollutants, the use of efficient flue gas recovery or treatment systems.

Protecting ecology

4.9 Measures designed to prevent or reduce impacts to water or land will also benefit ecological populations. The following list identifies further strategies for reducing or avoiding 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.

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;
- ◆ where access restrictions result from the development, arrangements for alternative access should be made with the provision of gates, bridges or stiles;
- ◆ safety concerns should be addressed by such measures as implementing strict health and safety procedures on-site, and the installation of adequate fencing and other site security to prevent trespass and vandalism;
- ◆ odour control strategies should take account of varying wind directions;
- ◆ sites of archaeological or cultural interest should be preserved in situ where possible. As relocation is rarely feasible, thorough archaeological investigation should be undertaken where damage is unavoidable.

5. References and further reading

1. Construction Industry Research and Information Association (2001) Sustainable urban drainage systems – Best Practice Guide. C523, CIRIA, London.
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