

H1 Scoping the environmental impacts of cemeteries and crematoria

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 cemeteries and crematoria. 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.



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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 relevant to *all* cemetery and crematorium developments:

- A1** Construction work
- A2** Demolition and decommissioning works
- A4** Vegetation management and conservation enhancements

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

- A3** Redevelopment and clean-up of contaminated land
- B3** Control of pest species, including disease vectors
- L1** Incineration, including animal carcasses and incineration with energy recovery
- L2** Landfill sites

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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 cemeteries and crematoria 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, a brief overview of the legal requirements for EIA in relation to cemeteries and crematoria 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 cemeteries and crematoria, followed by key references and further reading.
- Background to development type**
- 1.3 Cemetery development involves a change in land use, including the construction of buildings as chapels, offices and toilets, the clearing of vegetation prior to grave digging and the extension or widening of roads. The main features of crematorium development include construction of the cremation facility, offices and parking. While impacts will vary depending on the site that is selected and the size of the facilities constructed, such developments have the potential to affect both the natural environment and human receptors. Also, ethical and religious concerns may need to be considered prior to such a development. Therefore, a thorough scoping exercise and careful consideration of alternatives are of prime importance.
- 1.4 New cemetery developments or extensions to existing cemeteries can be an emotive subject with local residents so sensitivity will be needed in scoping the full range of issues to be considered in an EIA.
- 1.5 The Environment Agency has carried out research on potential impacts of cemeteries and readers of this scoping guidance note should refer to that research, reported in Environment Agency (1999c).

2 Development control and EIA

Development control

- 2.1 Development of crematoria and cemeteries 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 Cemetery and crematorium developments are not named as development types in the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 1999 No. 293). However, activities associated with these developments are listed in these Regulations and so EIA may be required. 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 (now DTLR) 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

Under Schedule 2, Paragraph 11(b), installations for the disposal of waste (unless included in Schedule 1) may require EIA if:

- (i) the disposal is by incineration; or
- (ii) the area of the development exceeds 0.5 hectare; or
- (iii) the installation is to be sited within 100 metres of any controlled waters.

- Indicative criteria

Referring to installations for the disposal of non-hazardous waste, Paragraph A36 of DETR Circular 02/99, *Environmental Impact Assessment*, states that, "The likelihood of significant effects will generally depend on the scale of the development and the nature of the potential impact in terms of discharges, emissions or odour."

Furthermore, EIA may be required for any change to or extension of cemeteries or crematoria already authorised, 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 cemetery or crematorium 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 cemetery or crematorium development 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 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 cemetery or crematorium 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 projects. The *Scoping Handbook* provides guidance on how to conduct a scoping exercise.

- 3.3 Cemeteries and crematoria have the potential to affect the environment in many ways. 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 as the site is prepared, as the installation is built and operated, and following the end of operations. Developers and site operators should, therefore, consider the impacts arising from both construction activities and operational practices and following the closure or decommissioning of the development.

- 3.4 In this guidance note, potential impacts are discussed 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 a proposed cemetery or crematorium 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 H1. This details the activities involved in the construction, ongoing management and decommissioning of cemeteries and crematoria, and the impacts arising from them.

Water environment

- 3.6 Surface water hydrology can be affected during the construction of cemeteries and crematoria. Construction of buildings and use of vehicles and machinery could result in compaction of soils and an increase in the surface area of impermeable (or slowly permeable) surfaces. The creation of open areas and the removal of trees and shrubs for graveyard preparation would cause a subsequent increase in surface runoff which may, in turn, increase the risk of flooding and soil erosion.
- 3.7 Surface water quality could be affected by a number of factors during both the construction and operation of cemeteries and crematoria and following their closure. Construction activities and grave digging during the operational phase may cause increased soil erosion and sediment loading of nearby streams, while accidental leaks or spills of oil, fuel or other substances can also pollute surface waters and impact on groundwaters. During the operation of cemeteries and crematoria, the major threat to surface water quality is likely to be pollution from pesticides and herbicides used in graveyard maintenance. Fly-ash and other water soluble substances in air-borne pollutants from crematoria must also be taken into consideration. Gradual seepage of decomposition products from corpses may also continue to contaminate surface waters for a long time, even after closure of the premises. Surface water contamination will be a particular issue where groundwater provides baseflow to rivers.
- 3.8 Cemeteries and crematoria may have significant impacts on groundwater hydrology ecology and quality. Potential chemical contaminants which need to be considered include dissolved organic carbon; ammonia; chlorides; sulphates and alkali earth metals such as sodium. Current embalming chemicals, such as, formalin, degrade quickly and pose little environmental threat. There is also a potential risk from pathogenic micro-organisms; the scale of the risk is dependent on their ability to survive in the subsurface and on the size of pores or fissures to which they may migrate, and the depth of the water table. In general, shallow groundwater protected by only a thin unsaturated zone is more vulnerable to contamination, and the scale of contamination will be proportional to the size of the cemetery. The risk of other contaminants being present should be assessed, for example where pets are buried and have undergone veterinary treatment.
- 3.9 The site may need to be drained to provide suitable conditions for construction, resulting in a lowering of the water table, while land readjustment, grave digging and construction of crematoria may result in changes to local groundwater flow patterns. Installation of drains may also introduce additional pathways to surface waters. Individual graves should be located away from land drains. The major concern, however, is likely to be groundwater quality with the gradual seepage into groundwater of decomposition products from corpses. Application of herbicides and pesticides for graveyard maintenance may also impact on groundwater quality.

- 3.10 In order to protect vulnerable groundwater the Environment Agency encourages new developments to be located in areas of lowest vulnerability in order to minimise the risks to groundwater from pollution. Normally the Agency would object to graveyards within Zone 1 Groundwater Source Protection Zones.

Land

- 3.11 Cemetery and crematorium developments 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. Issues to consider include: the effect of the graveyard or crematorium on landscape character; the removal of bedrock and topsoil during land readjustment (graveyard preparation); and, most importantly, the potential for soils to become contaminated by the decomposition products from corpses, pesticides, herbicides, fly-ash and wash water from crematoria. Problems associated with soil contamination may continue long after operations have ceased.

Air and climatic factors

- 3.12 Cemeteries and crematoria have the potential to affect local air quality and climate. During construction, operation and decommissioning, local air quality may decline as a result of dust generation from on- and off-site vehicle movements and earth moving. However, the principal impacts from crematoria on air quality occur during the operation phase as emissions of smoke, dust, greenhouse gases, odour and other air-borne pollutants. In regional/global terms, the National Atmospheric Emissions Inventory attributes 10% of national mercury emissions to crematoria.

Ecology

- 3.13 During the construction of cemeteries and crematoria, removal of vegetation, soils and bedrock can cause direct damage to, or loss of, terrestrial and aquatic habitats. Cemeteries may affect terrestrial and aquatic species as, for example, land or water may become contaminated by use of herbicides and pesticides, or decomposition products from corpses. Grave digging and earth moving, which would cause noise and vibration may also disturb ecological communities. The operation of a crematorium could threaten aquatic and terrestrial habitats by emitting air-borne pollutants, heat and fly-ash. In addition, there is a risk of impact associated with depositing crematoria ash on the ground for disposal for example on gardens of remembrance. Discharge of cooling and wash water from crematoria may cause an adverse effect in the event of leaks or spills.

Human environment

- 3.14 The impacts of a cemetery or crematorium 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.
- 3.15 The potential for socio-economic and health impacts (real and perceived) arising from cemeteries and crematoria are likely to be considered significant by the people that may be directly affected. Cemeteries and crematoria have relatively small staffing levels and, as a result, employees are not likely to have a significant effect on local socio-economic issues. However, negative publicity associated with such facilities may reduce the value of properties or land in the vicinity.

- 3.16 The identification of which of these issues are significant or perceived to be significant is an important function of public involvement during the scoping exercise. Understanding likely public concerns is a key issue and experiences of similar developments and any public representations to the local planning authority should be considered.
- 3.17 Other issues that commonly need to be addressed are the noise and vibration from traffic, grave digging and mowing during both the construction and the operational phase of the development. Issues related to smoke and odour from crematoria should also be addressed.
- 3.18 Impacts on architectural and archaeological heritage are likely to be issues of concern primarily 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 their potential for discovery should also be examined.

Table H1

- 3.19 The impact identification table highlights:
- sources of impact (development activities);
 - potential impacts;
 - receptors for these impacts.
- 3.20 It is recommended that the table is annotated and used during consultations with other interested parties. Readers should also refer to the prompt lists detailing impacts and sources of impacts in the *Scoping Handbook*.

Table H1 Summary of key potential impacts of cemeteries and crematoria

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	<p>Use of vehicles and machinery</p> <ul style="list-style-type: none"> • Increase in surface runoff from soil compaction <p>Works next to or near watercourses</p> <ul style="list-style-type: none"> • Change in flow velocities • Increased erosion and subsequent changes in bed and bank stability • Increased flood risk • Removal of drains may lead to waterlogging <p>Earthworks</p> <ul style="list-style-type: none"> • Increased sedimentation of watercourses <p>Removal of trees, shrubs, bushes and creation of open surface</p> <ul style="list-style-type: none"> • Increased flood risk 	<p>Use of vehicles and machinery</p> <ul style="list-style-type: none"> • Increase in surface runoff from soil compaction <p>Site drainage</p> <ul style="list-style-type: none"> • Rapid transfer of rainwater to watercourses via drains • Changes to flow regimes of watercourses downstream of the development • Change in deposition regime, caused by changes in flow and possible increase in sediment input from soil erosion • Increased flood risk • Removal of drains may lead to waterlogging <p>Water abstraction</p> <ul style="list-style-type: none"> • Lowering of water table <p>Grave digging</p> <ul style="list-style-type: none"> • Further risk of sedimentation of watercourse 	

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operation phase/ongoing site maintenance	Decommissioning/post-operation
WATER <i>continued</i>	Surface water quality	<p>Earthworks</p> <ul style="list-style-type: none"> • Pollution from suspended material • Disturbance of contaminated soil and subsequent pollution of watercourses <p>Materials management</p> <ul style="list-style-type: none"> • Pollution from spills or leaks of fuel, oil and construction materials 	<p>Materials management</p> <ul style="list-style-type: none"> • Pollution from spills or leaks of fuel and oil <p>Use of machinery</p> <ul style="list-style-type: none"> • Sediment-loading of watercourses <p>Leachate management</p> <ul style="list-style-type: none"> • Water quality degradation by gradual seepage of decomposition products from corpses • Potential for chemical contamination with dissolved organic carbon; ammonia; chlorides; sulphates; alkali earth metals (e.g. sodium) • Potential for microbiological contamination from pathogenic micro-organisms <p>Grave digging</p> <ul style="list-style-type: none"> • Increased turbidity <p>Use of pesticide, herbicide and fertiliser</p> <ul style="list-style-type: none"> • Contamination from spills or seepage <p>Cremation and discharge of cooling water</p> <ul style="list-style-type: none"> • Pollution from fly-ash and air borne pollutants • Rise in water temperature 	<p>Leachate management</p> <ul style="list-style-type: none"> • Continued pollution of surface water by decomposition products from corpses • Continued risk of seepage into surface water • Continued potential for chemical contamination with dissolved organic carbon; ammonia; chlorides; sulphates; alkali earth metals (e.g. sodium) • Continued potential for microbiological contamination with viruses, bacteria and pathogens

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operation phase/ongoing site maintenance	Decommissioning/post-operation
WATER <i>continued</i>	Groundwater hydrology	Earthworks and site drainage <ul style="list-style-type: none"> Reduction in water table Changes to local groundwater flow patterns 	Grave digging <ul style="list-style-type: none"> Possible change in groundwater flow 	
	Groundwater quality	Earthworks <ul style="list-style-type: none"> Disturbance of contaminated soil and subsequent groundwater pollution Materials management <ul style="list-style-type: none"> Pollution from spills or leaks of fuel, oil and building materials 	Materials management <ul style="list-style-type: none"> Contamination from spills or leaks of fuel and oil Leachate management <ul style="list-style-type: none"> Contamination from gradual seepage of decomposition products from corpses Potential for chemical contamination with dissolved organic carbon; ammonia; chlorides; sulphates; alkali earth metals (e.g. sodium) Potential for microbiological contamination with viruses, bacteria and pathogens Use of pesticide, herbicide and fertiliser <ul style="list-style-type: none"> Contamination from spills or seepage 	Leachate management <ul style="list-style-type: none"> Continued pollution of surface water by decomposition products from corpses Continued risk of seepage into groundwater Continued potential for chemical contamination with dissolved organic carbon; ammonia; chlorides; sulphates; alkali earth metals (e.g. sodium) Continued potential for microbiological contamination with viruses, bacteria and pathogens
LAND	Landscape	Excavations and earthworks <ul style="list-style-type: none"> Removal or creation of landforms 	Physical presence of cemeteries and crematoria <ul style="list-style-type: none"> Change in character of landscape 	

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operation phase/ongoing site maintenance	Decommissioning/post-operation
LAND <i>continued</i>	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 • Removal or alteration of soils on site for land readjustment 	Use of vehicles and machinery <ul style="list-style-type: none"> • Soil compaction • Soil erosion Leachate management <ul style="list-style-type: none"> • Contamination of soil by decomposition products from corpses • Contamination from spills or leaks of wash water of cremation facility Cremation <ul style="list-style-type: none"> • Deposition of fly-ash and air borne pollutants Use of pesticide, herbicide and fertiliser <ul style="list-style-type: none"> • Contamination of soil from spills or seepage 	<ul style="list-style-type: none"> • Continued seepage of decomposition products from corpses
	Geology	Excavations <ul style="list-style-type: none"> • Removal of rock by excavation works 	Grave digging <ul style="list-style-type: none"> • Further removal of geological resource 	
AIR	Local air quality	Use of vehicles and machinery <ul style="list-style-type: none"> • Emissions from construction site traffic • Dust generation Removal of trees, shrubs and bushes <ul style="list-style-type: none"> • Change in carbon dioxide absorption capacity 	Use of vehicles and machinery <ul style="list-style-type: none"> • Exhaust emissions Increased traffic <ul style="list-style-type: none"> • Exhaust emissions • Dust Cremation <ul style="list-style-type: none"> • Fly-ash • Odour • Air temperature rise and possible change in local air currents 	

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operation phase/ongoing site maintenance	Decommissioning/post-operation
AIR <i>continued</i>	Regional/ global air quality		Cremation <ul style="list-style-type: none"> • Contribution to global warming by releasing greenhouse gases • Contribution to atmospheric mercury level 	
		FLORA AND FAUNA	Aquatic ecology	Drainage works and use of vehicles <ul style="list-style-type: none"> • Negative impact on flora and fauna from increased sediment loading of streams Materials management <ul style="list-style-type: none"> • Harm to aquatic flora and fauna from oil, fuel, cement or other substances entering watercourses

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operation phase/ongoing site maintenance	Decommissioning/post-operation
FLORA AND FAUNA <i>continued</i>	Terrestrial ecology	Earthworks and excavations <ul style="list-style-type: none"> Habitat removal, fragmentation or severance Disturbance to, or loss of, species (including rare and sensitive species) 	Physical presence of cemeteries and crematoria <ul style="list-style-type: none"> Alteration or loss of terrestrial habitats Disturbance to, or loss of, species (including rare and sensitive species) Leachate management <ul style="list-style-type: none"> Direct and indirect effect from gradual seepage of corporal decomposition products Grave digging <ul style="list-style-type: none"> Disturbance to, or loss of species (from removal of top soil and vibration) Materials management <ul style="list-style-type: none"> Direct and indirect effects from oil, fuel and other substances Use of pesticides, herbicides and fertilisers <ul style="list-style-type: none"> Direct and indirect effects from spills and seepage Cremation <ul style="list-style-type: none"> Direct and indirect effects from heat release and emission Graveyard mowing and trimming <ul style="list-style-type: none"> Direct and indirect effects of vibration, noise, oil fuel leaks direct and indirect effects of vibration, noise, oil fuel leaks 	Restoration design <ul style="list-style-type: none"> Positive or negative effect on existing ecology from introduction of new (possibly non-native) species Post-closure land-use <ul style="list-style-type: none"> Continued effects of soil contamination

		Activities and potential impacts		
		Potential receptors of impact	Construction phase	Operation phase/ongoing site maintenance
HUMAN ENVIRONMENT	Socio-economic ¹	<p>Earthworks and excavations</p> <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 <p>Negative publicity</p> <ul style="list-style-type: none"> • Effects on popularity, property and land value 	<p>Negative publicity</p> <ul style="list-style-type: none"> • Effects on populace, property and land values • Adverse reaction to perceived health issues 	
	Health and safety ¹	<p>Earthworks and excavations</p> <ul style="list-style-type: none"> • Risk of injury on construction site 	<p>Leachate management</p> <ul style="list-style-type: none"> • Risk of consumption of water contaminated by decomposition products from corpses <p>Use of pesticides, herbicides and fertilisers</p> <ul style="list-style-type: none"> • Risk of contact or inhalation 	
	Amenity		<ul style="list-style-type: none"> • Possible alteration of rights of way or reduction in access 	
	Nuisance	<p>Use of vehicles and machinery</p> <ul style="list-style-type: none"> • Noise from construction traffic and operations • Mud on roads 	<p>Grave digging</p> <ul style="list-style-type: none"> • Noise • Vibration • Dust <p>Cremation</p> <ul style="list-style-type: none"> • Fly-ash • Smoke • Odour <p>Increased traffic</p> <ul style="list-style-type: none"> • Light intrusion • Dust • Noise 	

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 <i>continued</i>	Architectural and archaeological heritage ¹	Use of vehicles and machinery <ul style="list-style-type: none"> • Damage to known or unknown features of archaeological or cultural importance 		

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. 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*). Other relevant publications are listed in Section 5.
- 4.2 A primary consideration in impact mitigation must be the siting of a cemetery or crematorium. 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 Construction activities have the potential to affect all environmental receptors. However, the following list summarises the mitigation measures most relevant to cemetery and crematorium 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);
- 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 cemetery or a crematorium are the primary means for avoiding or reducing its environmental impacts, further measures can be introduced to minimise impacts arising 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 relevant legislation. Developers should seek independent legal advice to ensure that all legal requirements 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 To minimise potential impacts on the water environment in the design and running of cemeteries and crematoria it is important to 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 the impact of runoff on nearby watercourses;
- 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;
- where large cemetery sites are proposed (a site receiving more than 200 burials per year), a formal risk assessment should be carried out taking into hydrogeological and geological conditions, proximity of receptors (e.g. springs and wells) and other environmental factors;
- an appropriate water management system is used, including, for example, sustainable drainage systems to minimise the impacts of the site on receiving watercourses (where this does not conflict with the need to reduce potential impacts from contaminants percolating into groundwater);
- individual graves should not be located close to land drains, wells, boreholes or surface watercourses;
- depth of burial, density of plots and conditions for burial (e.g. whether in sealed coffins or biodegradable bags, etc.) should be considered where possible;

- a risk assessment is carried out for each substance to be used 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);
- undertake an assessment of risk to controlled waters from cemetery development;
- careful and minimum application of herbicide and pesticide.

Protecting the land environment

4.7 Certain measures noted above for protecting the water environment, such as water management and materials management, will also reduce the likelihood of soil contamination. Impacts on soils and landscape may also be mitigated by the following:

- appropriate designs for buildings and 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.

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 of greenhouse gases, air-borne pollutants, fly-ash, heat, dust and odours. Suitable mitigation measures may include efficient combustion and the use of effective scrubbers and cooling systems for crematoria and vegetation screens to act as a barrier to gaseous and particulate emissions.

Protecting ecology

- 4.9 Measures designed to prevent or reduce impacts to water or land will also help 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 of the site;
 - restoration plans should incorporate measures to improve the ecological status of 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:
- 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 for workers on site, and the installation of adequate fencing and other site security to prevent trespass and vandalism;
 - 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

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