

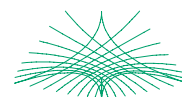


SAFEGROUNDS

Good practice guidance for the management of contaminated land on nuclear and defence sites

Participation (by organisations or individuals) in the SAFEGROUNDS project must not be taken as an indication of either support for or disagreement with the content of this guidance in its entirety. This is the first version of the guidance and it is not yet tried and tested. It is intended that the guidance will be revised at intervals, taking into account experience in using it and regulatory and other changes

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SAFEGROUNDS Good practice guidance for the management of contaminated land on nuclear and defence sites

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Stakeholder dialogue

This guidance was drafted following a stakeholder dialogue process, designed and managed by the project management team (see below), which included stakeholder workshops, questionnaires and one-to-one discussions. The specific outcomes from this process were: a deeper understanding of the issues important to stakeholders from different backgrounds; suggestions for the key principles that should underpin the guidance and the phrasing of those key principles; suggestions for other principles to be encapsulated in additional explanation and amplification; and detailed comments on the draft guidance prior to publication.

The issues for management of contaminated land on nuclear-licensed sites and defence sites were explored at a SAFEGROUNDS stakeholder workshop in July 2000, facilitated by The Environment Council. The suggestions for key principles were identified through a series of postal and web-based questionnaires. The process for this was designed under the guidance of a Consultation Steering Group representing civilian and defence nuclear liability owners, regulators, local authorities and community-based organisations. The wording of the key principles was discussed at two stakeholder workshops held in May 2001 and July 2001. All the stakeholder workshops and the meetings of the Consultation Steering Group were organised by The Environment Council. Allen Hickling of Allen Hickling & Associates led the facilitation team.

Detailed comments on the draft guidance were also sought from all those previously contacted by the project, and about 120 copies of the draft were distributed in March 2002 for this purpose.

CIRIA, on behalf of all those involved in preparing this guidance, would like to thank everyone who participated in the SAFEGROUNDS project.

Project steering group

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Mr P Booth	BNFL
Mr S Clark	DERA Radiation Protection Services, later MoD
Mr J Cochrane	Scottish Environment Protection Agency
Mr F Dawson	Ministry of Defence
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**SAFEGROUNDS
project management**

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1

Introduction

1.1

Scope

The guidance describes good practice for the management of contaminated land on two types of site:

- *nuclear-licensed sites* (including those being decommissioned, whether or not they are to be delicensed)
- non-nuclear *defence sites* for which a change of use and/or ownership is planned.

These types of site are distinguished by the potential for radioactive contamination, but non-radioactive and mixtures of radioactive and non-radioactive contamination may also be present. The guidance is for land on these sites where any of these three types of contamination has been found or is suspected to be present.¹

The guidance contains key principles (Chapter 2), amplification of these principles (Chapter 3) and a structured approach to the management of contaminated land that will assist in putting the key principles into practice (Chapter 4). Guidance on carrying out the major steps in the structured approach is given in Chapters 5 to 8. Further guidance for nuclear-licensed sites and defence sites is given in Appendices A1 and A2, respectively.

1.2

Purpose

The guidance has been developed primarily to assist those responsible for the management of contaminated land. It will also inform other stakeholders who are involved in the processes of determining how contaminated land is managed.

Although it is aimed at a technical readership, most of the guidance is not detailed nor highly technical. It deals mainly with general approaches and focuses on issues outside of the technical sphere that practitioners need to be aware of when planning and carrying out their work.

The guidance is intended to be relevant both in planning the future management of contaminated land (including making liability estimates) and in managing the land in practice. It is particularly relevant to strategic planning for the overall management of contaminated land on a site, but can also be applied to specific situations or cases. It takes account of the variety of situations on nuclear-licensed sites and defence sites and is not intended to be prescriptive.

¹ The guidance may also be useful for other types of site where contaminated land is present. One example is defence sites that would be classed as nuclear-licensed sites if the Ministry of Defence (MoD) were subject to the Nuclear Installations Act. Another example is radioactively contaminated sites other than nuclear-licensed sites and defence sites where a change of use and/or ownership is planned. (Such sites in their current use will be covered by the regulatory regime being developed for radioactively contaminated land to mirror that which already exists for non-radioactively contaminated land under Part IIA of the Environmental Protection Act.)

1.3

Status

This guidance is a living document. It is intended to be revised at intervals in the light of experience in using it and in response to policy, regulatory and other changes. It is not binding; it supplements regulations and associated guidance but has no legal standing.

Participation (by organisations or individuals) in the SAFEGROUNDS project must not be taken as an indication of either support for or disagreement with the content of this guidance in its entirety. Experience gained in using this first version of the guidance will be collected through the SAFEGROUNDS Learning Network and used in producing subsequent versions. This experience will enable the degree of commitment to the guidance to be determined and may or may not result in a change to the status of the guidance.

1.4

Definitions

1.4.1

Contaminated land

The term “contaminated land” is used in a general way in the guidance and means any land in, on or under which there are radioactive or non-radioactive contaminants at levels above the natural and artificial background levels that are typical of the area of the UK in which the site is located. This definition is broader than the statutory definition in Part IIA of the Environmental Protection Act 1990, which applies only to land in its current use (including any use for which planning permission has been granted), and which reflects the intention of the Part IIA regime to focus on sites with the potential to give rise to the highest risks to people and the environment. The broader definition is employed so as to cover all cases where the presence of contaminants is or could be a cause for concern to the owners or operators of the site, the regulators and other stakeholders.²

1.4.2

Management of contaminated land

The term “management of contaminated land” is used in this guidance to mean the taking of any actions to control, monitor or remove (wholly or partially) contamination once it has been discovered, and all the processes that lead up to the decisions to take such actions. This definition excludes actions to prevent contamination occurring in the first place, because these are outside the scope of the SAFEGROUNDS project. It also excludes the characterisation of sites to determine whether and to what extent the land is contaminated, because this is covered by separate SAFEGROUNDS guidance (Baker *et al*, 2000).

1.5

Related SAFEGROUNDS documents

Other documents produced by the SAFEGROUNDS project and which are referenced in this guidance are as follows:

Status of SAFEGROUNDS advocacy issues
CIRIA, London

Baker *et al*, 2000
SAFEGROUNDS site characterisation guidance
CIRIA, London

² The definition is similar to that of “land affected by contamination” in the 2002 government consultation paper on draft technical advice for local planning authorities (DTLR, 2002). For further discussion of definitions for contaminated land see Hill (2002).

Smith (2002)

Assessments of health and environmental risks from contaminated land

CIRIA, London

Collier (2002)

Community stakeholder involvement in the management of contaminated land

CIRIA, London

Hill M (2002)

The regulatory framework for contaminated land on nuclear licensed sites and defence sites

CIRIA, London

Mallett (2002)

Technical options for managing contaminated land

CIRIA, London

Key principles for the management of contaminated land

The SAFEGROUNDS project has identified five key principles for the management of all contaminated land on nuclear and defence sites. The principles have been established through a consultative process in which representatives of a variety of stakeholder groups were involved. The principles are non-overlapping and complementary and should be applied together. The key principles are as follows:

Principle 1: Protection of people and the environment

The fundamental objective of managing contaminated land on nuclear-licensed sites and defence sites should be to achieve a high level of protection of people and the environment, now and in the future.

Principle 2: Stakeholder involvement

Site owners/operators should develop and use stakeholder involvement strategies in the management of contaminated land. In general, a broad range of stakeholders should be invited to participate in decision-making.

Principle 3: Identifying the preferred land management option

Site owners/operators should identify their preferred management option (or options) for contaminated land by carrying out a comprehensive, systematic and consultative assessment of all possible options. The assessment should be based on a range of factors that are of concern to stakeholders, including health, safety and environmental impacts and various technical, social and financial factors.

Principle 4: Immediate action

Site owners/operators should take measures immediately to monitor and control all known (or suspected) contamination and continue such measures until an acceptable management option has been identified and implemented.

Principle 5: Record keeping

Site owners/operators should make comprehensive records of the nature and extent of contamination, the process of deciding on the management option for the contaminated land and the findings during the implementation and validation of the option. All records should be kept and updated as necessary.

Most of the key principles apply primarily to options for the long-term management of contaminated land. Some apply throughout the process of identifying, implementing and validating a management option; others are mainly relevant at particular stages. Chapter 3 expands on the principles and subsequent s give guidance on their application. Further guidance for nuclear-licensed sites and defence sites is in Appendices A1 and A2, respectively.

3

Amplification of the key principles

3.1

Principle 1: Protection of people and the environment

The fundamental objective of managing contaminated land on nuclear-licensed sites and defence sites should be to achieve a high level of protection of people and the environment, now and in the future.

3.1.1

General

In applying the principle, the “protection of people” refers to the health and well being of workers and the public. The “environment” includes, but is not limited to, people’s property (eg houses and land), existing and potential resources (eg groundwater, water quality, air quality) and natural ecosystems.³

It should not be assumed that protecting people will always protect the environment, or vice versa. The balance between protecting people and protecting the environment has to be resolved in the process of identifying the preferred land management option, which takes account of these and other factors (see Principle 3). This process should include the identification of appropriate indicators for environmental protection.

It is necessary to protect people and the environment both from expected situations and those with only a chance of occurring. This means taking measures, if needed, to reduce the likelihood of adverse effects occurring as well as reducing the effects themselves.

In deciding what constitutes a “high level of protection”, account should be taken of important scientific uncertainties. These are associated with the effects of radionuclides and other contaminants on people’s health and the health of other organisms. There are also uncertainties in the environmental processes leading to the exposure of people or the contamination of the environment. Some stakeholders have differences of opinion on these issues that should be recognised and acknowledged. The guidance recommends a case-by-case approach to the practical specification of a high level of protection (see Section 3.1.2).

It is necessary to protect people and the environment in the future at least to standards accepted today. This is essential to uphold the concept of “sustainability”. Putting this into practice is discussed further in Section 3.1.3.

3.1.2

Specifying a level of protection

Radioactively contaminated land

The topic of appropriate levels of protection from radioactively contaminated land (“clean-up criteria”) was covered at length in the questionnaires distributed and workshops held during the SAFEGROUNDS consultation on key principles. The major views expressed are summarised in Box 3.1. The outcome of the consultation was that no agreement was reached on the form of primary levels (risk, dose or radionuclide

³ In environmental protection in general, people are regarded as part of “the environment”. The distinction is made here because it is conventional to do so in radiological protection and in health and safety contexts.

concentrations) or on any numerical levels. It is therefore recommended that, for the present, a case-by-case approach, with stakeholder involvement (see Principle 2), should be used. In this approach the appropriate level of protection is not selected in advance of comparing various land management options (see Principle 3). The levels of protection associated with each option are factors (“attributes”) in option comparisons (see Chapter 5). The appropriate level for any particular situation is defined when the preferred option has been identified and is the level of protection that that option would achieve if implemented.

The SAFEGROUNDS project is advocating further consultation on policy and standards for radioactively contaminated land, and review and clarification of the existing legislation (CIRIA, 2002). In doing so, participants in the project recognise that many of the points listed in Box 1 will be made again and it is likely to be difficult to resolve these conflicting views.

Non-radioactively contaminated land

The topic of appropriate levels of protection for non-radioactively contaminated land was not addressed in any detail during the SAFEGROUNDS consultation on key principles. This was partly because the subject area is too large, and partly because it was known that DEFRA and the Environment Agency were due to issue guidance on the topic in the context of Part IIA. This guidance has now been published and more is planned (Environment Agency, 2002a). It is recommended that this guidance is used in conjunction with the case-by-case approach.

Both types of contaminated land

When comparing management options, it is important to include at least one option that would result in a reduction of contaminant concentrations to levels that are essentially indistinguishable from natural and artificial background, either immediately, or after a period of time (see Chapter 5). Background is taken to be the concentration of natural and artificial contaminants at the location, not including any contributions from the site’s activities. EA (2002b) contains information on establishing and defining background levels of radioactivity. Options that achieve background levels will give the highest level of protection and could have other advantages, such as maximising the resale value of the land.

Particularly in situations where a variety of locations are contaminated, an integrated strategy for the whole site is needed to provide protection from all the contamination. Such a strategy is required if there are several radioactively or non-radioactively contaminated areas on a site. Similarly, the combined impact of both non-radioactive and radioactive contaminants should be considered where both are present together. For example, it is not appropriate to consider a small patch of radioactivity in isolation if there is a large patch of hydrocarbon contamination nearby (DOE, 1995).

Levels for the protection of people and the environment are not appropriate if they cannot be applied in practice. Due consideration should be given to the limits of monitoring equipment, as well as to uncertainties in identifying and measuring contaminants.

Box 3.1

Major views expressed during the consultation on levels of protection for radioactively contaminated land

- the NRPB guidance (NRPB, 1998) and the “tolerability of risk” approach should be used. An individual risk (of death) of 10^{-6} is an appropriate target and a risk of 10^{-5} should be used as an upper limit
- it is premature to specify levels of radiation risk, radiation dose or radionuclide concentrations while there is so much scientific debate on radiation risks to human health. Radiation risk estimates currently used by the nuclear industry and its regulators are generally too low and for intakes of some radionuclides substantially too low
- numerical levels in the form of radiation risk or dose to people, and radionuclide concentrations derived from risk or dose, would not necessarily provide an appropriate level of protection for the environment. Protecting the environment means protecting the health of non-human organisms and avoiding levels of contamination that could prejudice legitimate uses of water, air and land. Prejudice of legitimate use could arise at very low levels of contamination and even when estimated risks to humans and other organisms are judged by the site owner/operator to be insignificant
- radioactive waste “clearance levels” (eg the 0.4 Bq/g level in the substances of low activity exemption order) do not correspond to an appropriate level of protection for contaminated land because they were not derived for this purpose. Reducing land contamination to below clearance levels has the advantage that any wastes generated when the land is subsequently redeveloped need not be managed as radioactive wastes. However this is not the issue when specifying a level of protection for people and the environment
- a case-by-case approach could lead to unwarranted differences between the standards applied and costs incurred at various sites, and be unduly time-consuming for site owners/operators and others
- it is not appropriate to specify one dose or risk level, or one set to radionuclide concentrations levels, to apply to all potential future uses of land
- whatever levels are specified should apply to all sites
- delicensing of nuclear-licensed sites is a special case because of the “no danger” criterion (see Appendix 1 for details of this criterion).

3.1.3

Protection in the future

The way in which future generations and their environment are protected depends on the condition of the land after the management option has been implemented. In general there are two types of land management option:

- those that will leave the site in a state suitable for the present and next planned use
- those that will make the site suitable for any use that the type of land will support, without any restrictions related to the contamination.

The first type of option ensures that people and the environment will remain protected during the present and next use of the site. It relies on record-keeping to ensure that the land is reassessed when a further change of land use is planned. It may also entail monitoring, control measures and regulation. The second type of option does not entail reassessment, monitoring, control or regulation, although records should still be kept (see Principle 5).

At most sites both types of option are feasible in principle. It is recommended that both types of option are included when comparing alternatives (see Chapter 5). In this way the implications of differing degrees of prescription on future use can be explored.

3.2

Principle 2: Stakeholder involvement

3.2.1

General

Site owners/operators should develop and use stakeholder involvement strategies in the management of contaminated land. In general, a broad range of stakeholders should be invited to participate in decision-making.

Stakeholders are all the people with an interest in the situation. They include “institutional” stakeholders, such as regulators, local and national government and senior management within site owner/operator organisations, and others who could be affected by, or have a direct interest in, land management decisions, such as local residents, community-based organisations (CBOs) and non-governmental organisations (NGOs).

The stakeholder involvement principle applies to the whole process of taking decisions on long-term management options and implementing them. It means that site owners/operators should develop, at a very early stage in their consideration of their contaminated land issues, a strategy for involving a range of people in decision-making. The strategy should take into account the potential technical and societal significance of the decision. Judgements about the potential significance of a decision (especially its societal significance) are likely to vary from one group of stakeholders to another. If it is thought that one or more groups might view a decision as significant, the best course of action is for the site owner/operator to consult key stakeholder groups during the development of the involvement strategy. If the issues are largely technical it may be sufficient to involve regulators and to keep other stakeholders informed. In other cases a much wider range of people may need to be invited to participate and, to achieve effective participation, the stakeholder involvement strategy may need to go further than the public consultation processes required by law (see Appendices A1 and A2 for details of these). Collier (2002) addresses the key issues for designing and carrying out an effective programme for involving stakeholders from the local community and the wider public.

Every effort should be made to avoid relying on national security or commercial confidentiality as reasons for failing to involve a wide range of stakeholders or for denying them information. In the case of large scale contaminated land situations, site owners or operators should always consider the views of external stakeholders before selecting a preferred option and seeking regulatory approval. They should demonstrate a commitment to using their very best endeavours to take decisions that fully and transparently reflect these stakeholders’ views, and show how these views have been taken into account.

3.2.2

Timing

In general, stakeholder involvement should be initiated as early as possible. The benefits of early stakeholder involvement include: not wasting time in carrying out technical work on options that most stakeholders will never accept; shorter public consultation processes, with less effort entailed for site owners/operators and regulators; shorter regulatory approval procedures; fewer public protests when work actually starts. Deferring the involvement, for example until after supporting technical work is well underway, can give the impression that a decision has already been taken and negate many of these benefits.

3.2.3

Groups to involve and level of involvement

The range of stakeholders to involve depends on the problem being considered. Ways of identifying the relevant stakeholders are discussed in Collier (2002). If there is substantial uncertainty about which stakeholders should be involved, the best course of action is to invite all (institutional and other stakeholders) to participate. The level of involvement is influenced by the scale and nature of the contamination of the land, but it should be mutually agreed. For smaller problems there may be more emphasis on providing information to non-institutional or external stakeholders about proposals for long-term land management. For larger problems more consultation will usually be warranted. If one or more of the land management options being considered involves transport of substantial quantities of wastes to another site, the community around this site and those along the transport route should be involved. To enable stakeholders to participate effectively there should be ready access to all relevant information.

3.2.4

Resources

The resources available to stakeholders will differ, but this should not be allowed to constrain unduly their ability to participate in the process. The adequacy of financial resources available to non-institutional or external stakeholders (such as individual members of the public) should be discussed with them at the beginning of the process. The time and effort available to such stakeholders should also be discussed, and decision-making scheduled accordingly.

3.3

Principle 3: Identifying the preferred land management option

Site owners/operators should identify their preferred management option (or options) for contaminated land by carrying out a comprehensive, systematic and consultative assessment of all possible options. The assessment should be based on a range of factors that are of concern to stakeholders, including health, safety and environmental impacts and various technical, social and financial factors.

3.3.1

General

Site owners and operators should demonstrate a commitment to considering systematically all the options for the long-term management of contaminated land. In doing this, stakeholders should be involved in accordance with Principle 2. The result of this process should be the identification of one or more preferred options, as an input to decision-making.

The approach to identifying the preferred management option should include the following steps:

- identifying all the options
- removing those that participating stakeholders agree need not be considered in detail
- considering the remaining options in detail
- using key factors (“attributes”) which highlight their differences to find out which is the preferred option.

The recommended approach (see Chapter 5) is based on the concept of “best practicable environmental option” (BPEO), as defined and discussed by the Royal Commission on Environmental Pollution (RCEP, 1988 and 1998). BPEO analysis is used in radioactive waste management on nuclear sites (see, for example, EA, 2001b) and has been applied in integrated pollution control (EA, 1997). It is the most widely accepted way of identifying the “best” option in situations where there is a possibility of harm to people and the environment.

Principle 3 is particularly important for overall strategies for managing all the contaminated land on a site. This means that options for all parts of the site should be considered together and potential strategies for the whole site be developed and compared. The principle also applies to individual cases and specific situations but here the approach can be simpler. It is emphasised that it is not appropriate to deal with a whole site only as a series of small problems that are considered sequentially: an overall site strategy is required.

3.3.2

Options

The first stage of the recommended approach is to identify all envisageable options – ie all options that could possibly be applied to the problem. The list is then reduced to those that are appropriate for more detailed consideration. Options should not be excluded from further consideration only because they appear to be very expensive (or have costs that are greater than existing budgets) or they appear to be technically very difficult to implement. The aim in reducing the list of options should be to end up with a small number (RCEP (1988) recommends 3-6) that embody the key features of the range of courses of action.

As mentioned in Section 3.1, it is important to include at least one option that would return contaminated land to a state fit for any use that the type of land would support. It is also important to include an option in which land is controlled and monitored for the foreseeable future but not used for any particular purpose. Information about technical options to consider is given in Mallet (2002).

3.3.3

Attributes

Attributes are the factors that are used to distinguish between options. A range of attributes is needed that reflect the concerns of the stakeholders. Different stakeholders may see some attributes as more or less important than others. This information reflects their preferences, and it can be a valuable record.

Examples of attributes are: health risks to the public and to workers, impacts on ecosystems, effects on natural resources, the technical difficulty of implementing the options and the degree of experience with the option (and any associated uncertainty). Another important attribute is cost. Cost should always be included as an attribute, but it is helpful to consider this attribute separately from others. This can be done by comparing the options on all attributes except costs, and examining the costs afterwards (see Section 5.5).

3.4

Principle 4: Immediate action

Site owners/operators should take measures immediately to monitor and control all known (or suspected) contamination and continue such measures until an acceptable management option has been identified and implemented.

3.4.1 Requirements

Legal and regulatory requirements, backed up by HSE guidance, require this principle to be applied at nuclear-licensed sites (see Appendix 1). At non-licensed defence sites, monitoring and control actions are required if contamination has been identified or is suspected (see Appendix 2).

3.4.2 Types of action

The type of action taken depends on the scale, nature and complexity of the contamination. Different measures may be needed for different areas. Where the contamination is widespread or historic it is most likely that monitoring and an interim control measure should be implemented, perhaps to persist for some time before a long-term management option is selected. For situations such as spills or other incidents immediate clean up is often preferable. For sites with several different areas of contamination it will be necessary to prioritise them, but low risks should not be used as an argument not to take prompt action to control and monitor contamination. Risk assessment is a useful tool in such cases, and guidance is provided in Smith (2002). No short-term action should be taken that could compromise the selection and implementation of the best long-term management option.

3.4.3 Relationship to other key principles

In taking immediate monitoring and control measures, site owners/operators should have regard to Principle 1 (see Section 3.1) and when measures are in place they should make records of what has been done and why (Principle 5, see Section 3.5). It is not necessary to involve stakeholders in decisions on immediate action (Principle 2, see Section 3.2) but it is desirable to inform them about what has occurred. Principle 3 (see Section 3.3) applies to identifying the management option that is to be implemented in the longer term, which may be a continuation of the initial monitoring and control measures. It will often be appropriate to apply Principle 4 during site characterisation, whereas Principle 3 applies when some characterisation has been performed.

3.5 Principle 5: Record keeping

Site owners/operators should make comprehensive records of the nature and extent of contamination, the process of deciding on the management option for the contaminated land and the findings during the implementation and validation of the option. All records should be kept and updated as necessary.

3.5.1 General

Most stakeholders involved in the SAFEGROUNDS consultation are in favour of the long-term keeping of records by public bodies, in a form that is accessible to the public. At present there is no mechanism for this, but SAFEGROUNDS is advocating that one be devised (CIRIA, 2002). Site owners and operators should ensure that comprehensive records are made, bearing in mind that a mechanism may be introduced in the future. Every effort should be made to avoid relying on commercial confidentiality or national security as reasons for denying the public access to records.

3.5.2

Information to retain

Records should cover all site characterisation work, the process of deciding how to manage the contaminated land, implementing the chosen option and validating its implementation, as well as interaction with stakeholders throughout the process. Other related information (eg records of waste disposal) should be included where possible. It is sensible to co-ordinate the production of this documentation with that of records required for other purposes, eg to meet NII requirements at nuclear-licensed sites. For further details for nuclear-licensed sites and defence sites see Appendices A1 and A2, respectively.

3.5.3

Maintaining records

Although there is no mechanism for the long-term keeping of detailed records by public bodies, various schemes are in place or under development for maintaining records about contaminated land. Local authorities and the environment agencies now maintain a register of land that has been designated as contaminated under Part IIA of EPA 90 and subsequently remediated, and of “special sites”. A voluntary scheme has also been introduced by some land owners for non-radioactively contaminated land, in which “land condition records” are maintained that document the state of the land and that are passed on to new owners upon sale of the land. At nuclear-licensed sites records have to be kept for the duration of the licensee’s “period of responsibility” and passed on to any new licensee.

It is recommended that site owners/operators produce two copies of detailed records: one to be kept by the site owner and passed on to any new owner on sale of the land, and one to be sent to the relevant public body if a mechanism for long-term keeping of records is introduced. It is also recommended that site owners/operators produce several copies of a summary version of the records, to be held by the current owner, the current operator (if not the owner), the relevant local authority, the relevant environment agency, and any new owners of the land. In general, site owners/operators should hold records in the same manner as legal documents related to the site. If the site is to be sold and is to be cleaned up only for limited use, current owners or operators should discuss with the relevant local authority and environment agency the best way of holding all records for input to planning procedures when use changes again.

Documents should be maintained in formats that do not degrade significantly with time. Electronic records have advantages but will require periodic transfer to new systems, and holding of paper copies is advisable as well.

4 Recommended approach for the management of contaminated land

4.1 The structured approach

Figure 4.1 shows the basic steps in a structured approach that will help in putting the key principles into practice. The approach is not intended to be prescriptive: there is a wide range of potential contaminated land situations and the application of the structured approach will need to be tailored to each case. The approach is primarily aimed at long-term management of contaminated land. In some cases the approach will need to be an iterative one, but in others it will be almost once-through.

General guidance on the steps of identifying the preferred option, deciding on the option to be implemented, implementation and validation are given in Chapters 5-8. Further details for nuclear-licensed sites are in Appendix 1 and for defence sites in Appendix 2. Section 4.3 below provides guidance on establishing objectives for the management of contaminated land.

As shown in Figure 4.1, key principles 1, 2 and 5 apply throughout the process of identifying, implementing and validating the best option (or strategy) for managing contaminated land. The extent to which stakeholders other than the site owner/operator and regulators are involved at various stages in the process will vary from site to site and should be commensurate with the technical and societal significance of the contaminated land problem (see Section 3.2.1). Principle 3 applies primarily at the stage when site owners/operators are identifying their preferred option or strategy (see Chapter 5), prior to actually deciding on the option to be implemented (see Chapter 6).

4.2 Relationship of the structured approach to the regulatory regimes

This guidance supplements (but is independent from) current regulatory regimes. These regimes influence some of the steps in the structured approach (Figure 4.1). They affect how the steps are applied in practice; for example regulatory approvals are required for certain actions. Regulatory regimes also constrain the way that the approach is applied. In particular, they can constrain the choice of management options because some regulations set legal standards that must be met during the management of contaminated land.

Different regimes apply to nuclear-licensed sites and non-licensed defence sites, as described by Hill (2002). There are also differences in the regulatory regimes for radioactive and non-radioactive contamination; these are noted throughout the guidance. It should be noted that some aspects of the regulatory regimes for contaminated land (particularly radioactive contamination) are currently under development.

The main regulatory regimes that apply to contaminated land on nuclear and defence sites are those under the Health and Safety at Work etc Act (1974) (HSWA) and associated regulations such as the Ionising Radiations Regulations (IRRs); the Nuclear Installations Act (1965) (NIA); and Part IIA of the Environmental Protection Act (1990)

(EPA). The Radioactive Substances Act (1993) (RSA) is relevant but only applies to disposals of waste. MoD is not subject to RSA but has in place administrative arrangements to achieve a similar standard of control. The Water Resources Act (1991) is important if groundwater could become contaminated by non-radioactive substances.

The HSWA and NIA are applied by the HSE. RSA is administered by the Environment Agency (in England and Wales), the Scottish Environment Protection Agency (SEPA) and the Department of the Environment in Northern Ireland (referred to collectively as the environment agencies). Local authorities are the regulators for Part IIA, but the environment agencies have a key role, particularly at “special sites” (see Hill, 2002, for further details). Site owners and operators should establish dialogue with these regulators at the earliest opportunity and maintain it throughout the process of identifying, implementing and validating the land management option or strategy.

Some guidance has been issued that is relevant to the application of these regimes to contaminated land on nuclear and defence sites. In particular, HSE (HSE 2001b) has published guidance to inspectors about radioactively contaminated land on nuclear-licensed sites and the Environment Agency *et al* (2002b) has issued guidance on the management of radioactively contaminated land on non-licensed sites. Much guidance is available on the management of non-radioactive contaminants (Barry *et al* 1996; DETR, 2000a; DETR, 2000b; Environment Agency 2000a).

Other legal and regulatory requirements will also be relevant, depending on the situation. In particular, if an option generates radioactive waste, the Radioactive Substances Act applies. If a nuclear reactor site is to be decommissioned, then it will be necessary to meet the requirements of legislation on environmental impact assessment (EIAD 1999). Other new developments may fall within the requirements of general environmental impact assessment regulations (EIA, 1999).

It should be noted that the Part IIA regime for non-radioactively contaminated land (EPA 1990) applies only to sites in their current use (including any use for which planning permission has been granted) and only to sites that are contaminated in the sense defined in Part IIA. These are a sub-set of the sites addressed by this guidance. There are differences between what is recommended here as good practice and the minimum likely to be required by local authorities and the environment agencies in implementing Part IIA. It is anticipated that following this good practice guidance will, in general, entail doing more than the minimum required under Part IIA.

4.3

Establishing objectives

Setting out the objectives for the management of contaminated land is important because it helps to focus the identification of the preferred option and subsequent decision-making. The factors to be considered in establishing objectives include: government policy, corporate/organisational policy (both general and for the particular site) and the views of stakeholders such as regulators, local authorities and local people.

It is recommended that environment, health and safety objectives are established separately from those of a commercial or administrative nature. In keeping with the case-by-case approach (see Section 3.1.2), it is recommended that, in general, environment, health and safety objectives should be broad and qualitative rather than specific and numerical. Very specific objectives are unlikely to be acceptable to all stakeholders (see Section 3.1.2) and setting them constrains choices of options for comparison and is not consistent with a BPEO approach (see Section 3.3.1). Examples of objectives are given in Box 2.

Box 4.1

Examples of objectives for the management of contaminated land

Type of site	General objective	Environment, health and safety objective
Nuclear-licensed	Make site suitable for eventual delicensing	Comply with Principle 1
Defence	Make site suitable for sale within the next year or two	Comply with Principle 1

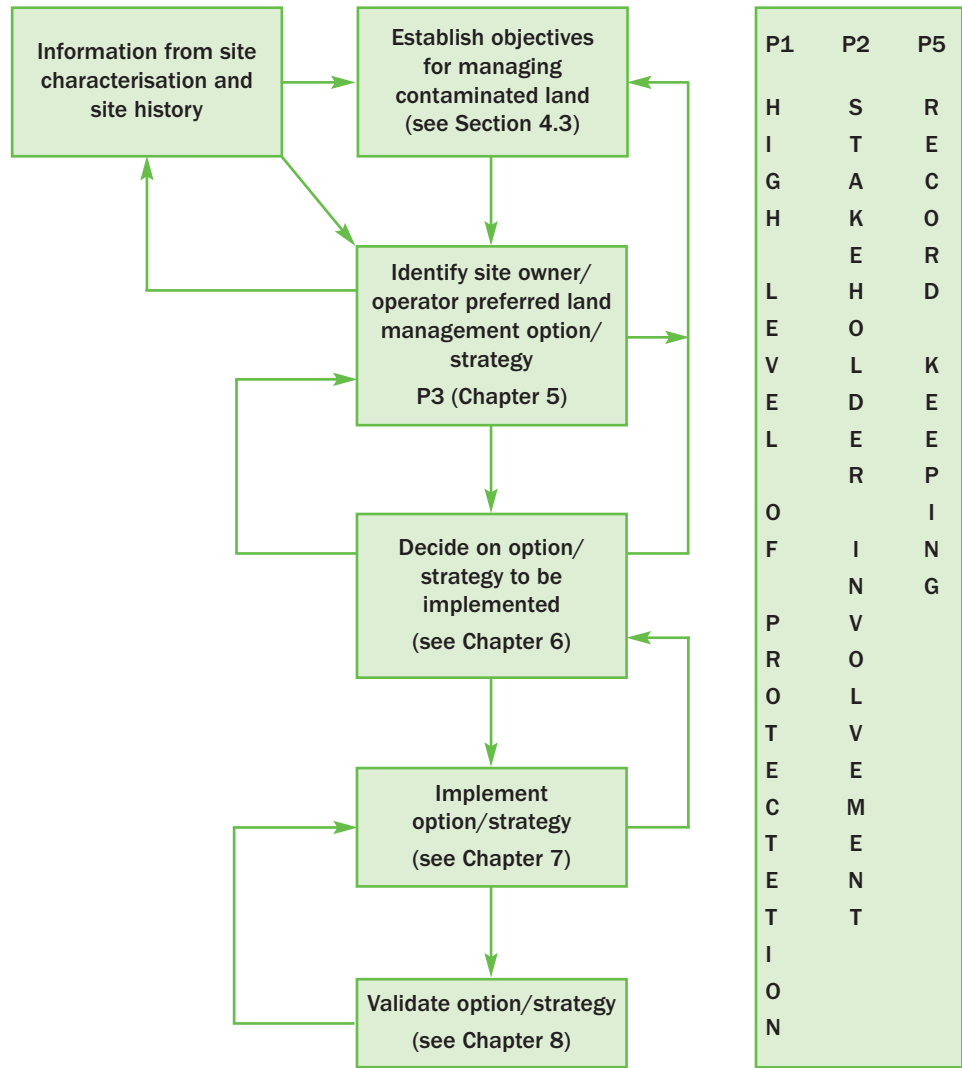
It should be recognised that objectives may need to be redefined as the process of identification and selection of the land management option progresses (see Figure 4.1). This is particularly the case if objectives have been imposed on the site owner/operator by people external to the process. Situations can be envisaged in which there are no options that will exactly meet an imposed objective, or in which the option that would be preferred on a wide range of attributes and by a wide range of stakeholders is not one that will meet an imposed objective. For example, it is possible to envisage a situation in which the relevant Minister has decided that a defence site should be cleaned up and sold within the shortest possible period of time, but the process of identifying the best option indicates that there would be considerable merit in delay. In such a case it is for MoD (and perhaps other stakeholders) to make representations to the Minister to ascertain whether the objective can be amended.

4.4

Funding

Appropriate funding arrangements are needed in order to deal with contaminated land. To achieve this, estimates of the cost of the management of contaminated land should be incorporated into overall liability estimates, and sufficient provisions be made. Fogleman (2000) discusses the general funding issues in legal terms and Finnamore *et al* (2000) give guidance on managing financial risks.

The approach and sources of funding is different for nuclear and defence sites. Funding activities for nuclear-licensed sites are addressed in Appendix 1. For defence sites, it is necessary to decide whether the liability will be dealt with before the land is sold, or passed on with an appropriate adjustment in the value of the land (see Appendix 2).



Note: P1, P2 etc are references to the key principles (see Chapter 2)

Figure 4.1 Basic steps in the structured approach

5

Identifying the preferred option for the management of contaminated land

The recommended approach to identifying the site owner/operator's preferred option is shown in Figure 5.1. Sections 5.1 – 5.5 describe the general application of this approach. Issues specific to nuclear-licensed sites are dealt with in Appendix 1, and defence sites are addressed in Appendix 2. This part of the guidance is particularly important for identification of long-term management options. Its essence is compliance with key Principle 3 (see Chapter 2 and Section 3.3).

The length and complexity of the steps within the approach varies with the scale of the contamination and the information available. The length of the identification process could range from a few days to a few months, and the length of the documentation produced could range from a few pages to a large report. The extent of stakeholder involvement will depend on the technical and societal significance of the problem (see Section 3.2) and will be a major factor in determining how long the identification process takes. Although all possible options are to be assessed (see Section 5.2), many will be eliminated at an early stage and only a few need be compared on the basis of their health, safety and environmental impacts and various technical and social factors (see Section 5.3). The comparison may be qualitative or largely quantitative (see Sections 5.4 and 5.5). Its outcome may or may not be clear cut. The important point is that the comparison is done and that it provides a useful input to decision-making (see Sections 5.6 and 6).

5.1

Information available from characterisation of the site

It is assumed that the site has been characterised to some extent and that contamination has been found or is suspected to be present. The available information about the characteristics of the site and the contamination should be gathered together at the outset and communicated to those stakeholders who will be participating in the process of identifying the preferred option.

Guidance has been developed in SAFEGROUNDS for the characterisation of contaminated land (Baker *et al* 2000). If considerable site characterisation work has been performed, the information available will cover the types, quantities and locations of all substantial areas of contamination. In addition, a conceptual model of the contaminated region will be available. A risk assessment will be available for non-radioactive contamination, and may also be available for radioactive contamination. If more detailed risk assessments are required at this stage, the methods outlined by Smith (2002) can be used. Low estimated risks should not be used as a reason for not considering the long-term management options for the contamination.

The information may be associated with contamination in a single location. Account should be taken of other potential areas of contamination on the same site, as well as the possibility of contaminant migration from the known sources, when deciding how best to manage it (DOE, 1995). Such interdependencies should be addressed in an overall strategy for the management of all contaminated land on a site, although different solutions may be appropriate for different areas of contamination.

If only limited site characterisation has been carried out (eg a reconnaissance survey, or an examination of the site history) much less information will be available. Lack of full information need not hold up the process of identifying the preferred option. It is not essential to have very detailed information to make a preliminary identification, especially where the overall strategy for the whole site is being considered. If it becomes apparent during the option identification process that more information is required, it may be necessary to return to the stage of establishing objectives (see Figure 4.1).

5.2

Identification of all the envisageable options

The “envisageable” options are all those that would be effective in reducing or limiting the risks to people and the environment from the contaminated land in question. In compiling the list of envisageable options it is good practice to take no account of the financial cost or technical difficulty of options, or of factors such as the R&D that would be required before an option could be implemented at the specific site. It is more transparent to consider such factors in the later stages of the process of identifying the preferred option. Those stakeholders who are participating in the process should be involved in identifying the envisageable options.

Information about typical technical options to consider is given by Mallett (2002). These fall into the following basic categories:

- partial or complete removal or destruction of the contamination,
- immobilisation or stabilisation of the contamination, and
- isolation and containment of the contaminated ground.

In terms of the “source-pathway-receptor” approach, the first two categories affect the source, while the third category affects the pathways. If the focus is on an overall strategy for a site on which there are several areas with different types or different degrees of contamination, it is not appropriate to go into great detail for each one. This is particularly the case if site characterisation has been limited. In such instances it may not be worthwhile going much beyond the three basic categories when identifying envisageable options.

As well as considering different technical mechanisms for managing the contamination, it is important that an appropriate range of end uses of the site is considered. This is associated with the principle to protect people and the environment in the future (see Section 3.1.3). Options that involve similar actions but allow greater or lesser scope in the end use of the site should be considered separately.

The list may include options that do not involve any further active management of the contamination, to ensure that the full range of actions is covered. The timing of the implementation of an option is also an important factor. Where appropriate, the options considered should include those that use a period of time to reduce the concentrations of contaminants, by mechanisms like radioactive decay and biodegradation.

When identifying envisageable strategies for a whole site it is not necessary to consider large numbers of combinations of technical mechanisms, scopes for end uses and timings for each contaminated area. The aim should be only to identify sufficient strategies to encompass the range of possibilities. The details for each area can be addressed later, when the broad strategy has been agreed.

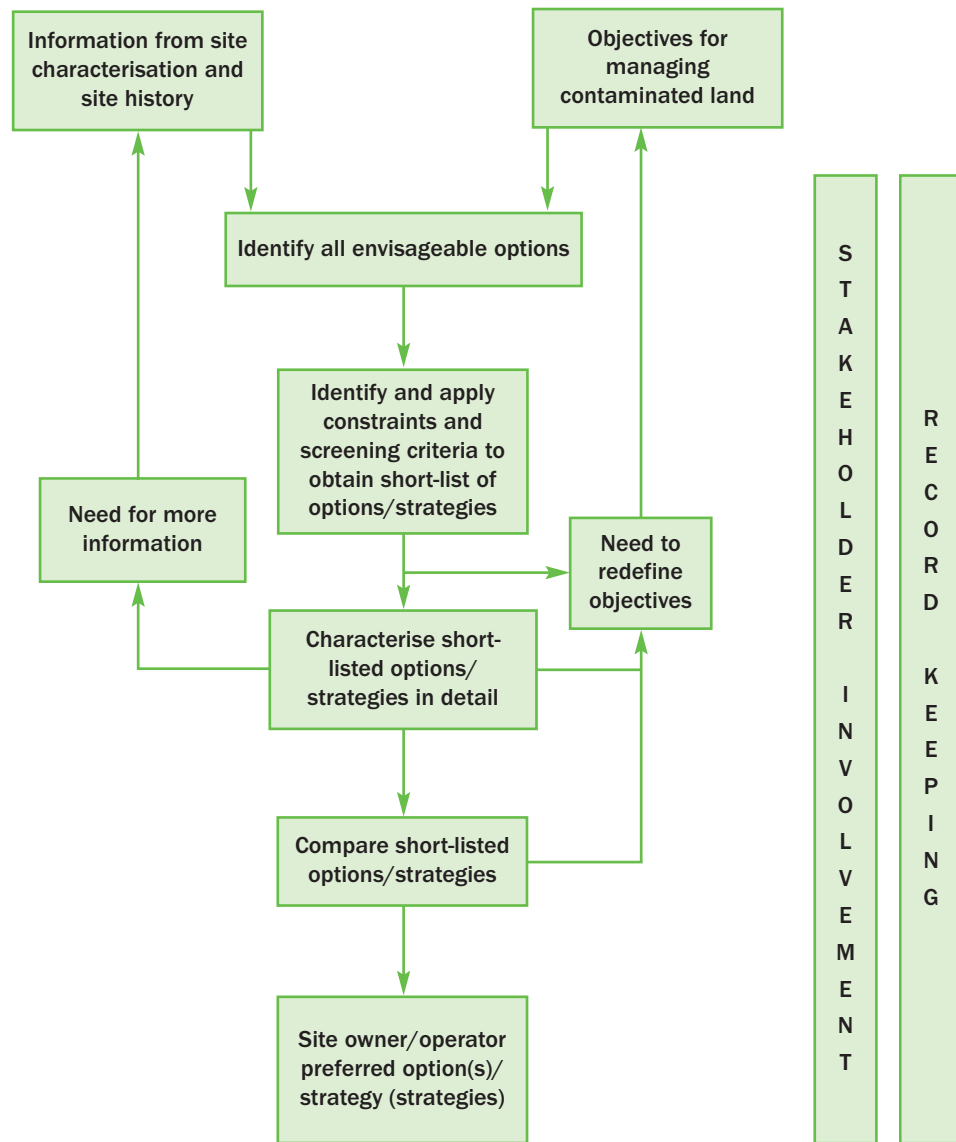


Figure 5.1 Steps in identification of preferred option/strategy

The outcome of this stage of the process will be a list of the envisageable options or strategies for managing the contaminated land, with a brief description of each one. The description need only be sufficient for the screening of options (see Section 5.3) and could be only a few sentences. There should also be a list of the options or strategies that have been rejected as ineffective.

The number of options or strategies that are envisageable depends on the nature of the contamination and the characteristics of the land. If the list is long (say ten options/strategies or more), then it is sensible to reduce it to make the comparison of options or strategies manageable. Whatever the length of the list, it is essential to eliminate those options/strategies that would not meet legal and other immutable constraints, and those that would not meet agreed screening criteria. This is done in the next stage (see Section 5.3).

5.3

Identification and application of constraints and screening criteria

Constraints and screening criteria should be identified using key principles, the objectives for the management of the contaminated land, legal requirements, regulatory guidance and stakeholders' views. They should not be ambiguous and each should relate to a set of issues that do not overlap. Examples of constraints and screening criteria are:

- legal and regulatory limits and constraints (eg dose limits (IRR, 1999), authorised limits on discharges, limits on storage of hazardous substances)
- non-availability of long-term management arrangements for wastes (eg no storage facility or disposal route)
- major conflict with land management objectives (eg immature technology that will not be available on a suitable timescale; scope for end use of site not consistent with local authority development plans, so planning permission unlikely to be granted).

Financial costs should not be used as screening criteria unless participating stakeholders agree to this.

The outcome of this stage of the process should ideally be a few options or strategies that are to be compared in detail (see Section 5.4). RCEP (1988) suggests that it is usually enough to compare between three and six options, but the exact number will depend on the situation. In principle, it is possible that application of constraints and screening criteria will leave only one option but in practice there are usually at least two. If too many options remain after screening, similar ones should be combined.

Information to be recorded includes the reasoning and justification for retaining or rejecting options, and relevant supporting information.

5.4

Identification of attributes and detailed characterisation of options

The remaining options need to be compared on a common basis. This is done using the key issues, expressed as "attributes". A list of attributes should be drawn up, documented and reviewed; participating stakeholders should be involved. The number and detail of the attributes should reflect the extent of the problem and the issues of concern, but it should be recognised that a large number of attributes can make it difficult to compare options and identify differences between them. It is best to consider less than ten main attributes, with sub-attributes as necessary. If a large number of attributes is identified initially, it will usually be possible to reduce the number by excluding those that do not differentiate significantly between options.

Attributes are dependent on the particular contaminated land situation being considered. They should be identified by considering the issues of concern to all stakeholders and be clearly documented. The list should include attributes related to:

- impacts on human health
- impacts on the environment
- the technical performance of the option
- social and political factors
- financial cost.

Attributes should not overlap (ie no two should cover the same issue, although they can be closely related – eg public radiation dose and occupational radiation dose). It is also useful to indicate what is “good” and “poor” performance for the attributes in their naming (eg “low off-site discharges” is more meaningful than “off-site discharges”). As far as possible, attributes should be at a similar level of detail. The assessment can become biased if there are many attributes concerned with one type of issue, eg if there are 10 “technical” attributes and only two related to human health. The degree of compliance with the “precautionary principle” should be included as a social/political factor.

Some attributes may be readily quantifiable (eg cost), whereas others may not (eg social impacts). It is not necessary for all attributes to be quantifiable, as the comparison of options can be on a qualitative basis. However, it is useful if there is a “yardstick” for each attribute, against which the performance of options can be unambiguously measured.

Information that characterises each option in terms of the attributes should be gathered and documented. This is used to give a sound, factual, basis when comparing them. Quantitative, semi-quantitative and qualitative information can be used. An important part of option characterisation is a health and environmental risk assessment (see Smith, 2002). Special attention should be given to characteristics of options that are strongly associated with the type of contamination present. For example, some options may be very effective for some of the contaminants that are present but less effective for others. It is not essential to make detailed estimates of the financial costs of options at this stage; broad-brush cost estimates will be sufficient. Detailed analyses of financial risks are best used in later stages of decision-making (see Chapter 6).

Participating stakeholders should either be involved in the detailed characterisation of options (including risk assessments) or be invited to review the option characterisation methods and results, if possible before options are compared.

5.5

Comparison of options

The systematic evaluation of the performance of each option for the selected attributes allows the options to be compared on a common basis. The information gained is used to identify the preferred option or options. It may show that one option is clearly the best, or that there are several “best” options that cannot easily be distinguished. It could also show that the process needs to be repeated in greater detail, because important uncertainties remain. The comparison of options should be well documented, in such a way that it provides the clearest possible input to the later stages of decision-making.

The key points when comparing options are:

- the method should be systematic, open and transparent;
- the performance of each option should be considered for each attribute;
- the performance of different options should be compared; and
- the robustness of the analysis should be tested.

Various methods can be used to compare systematically the options, depending on the complexity of the problem. These can range from a simple structured discussion of the pros and cons of each option, to detailed techniques such as multi-attribute decision analysis (MADA). The techniques can use qualitative and quantitative information – quantitative data are not necessarily the more “accurate”.

A simple analysis of the information characterising the options may reveal that one option is obviously the best. If there is no clear best option, or if a more detailed analysis is required because of the scale of the problem, options can be scored or ranked. If even further detail is warranted, weighting factors can be applied to the attributes and weighted scores or ranks compared. If the intention is to reflect the intrinsic importance of the attributes, the weighting factors should be established before the options are scored or ranked. Weighting factors are very difficult to determine and can be contentious. It is often necessary to use several sets of weighting factors so as to reflect the range of views of participating stakeholders, or to present non-participating stakeholders with enough information about the implications of judgements about the relative importance of the various attributes. The sensitivity of results to variations in scores and weighting factors can also be examined to investigate the robustness of the analysis. An illustration of different levels of detail in which this method can be applied is given in Box 3.

Particularly when using detailed scoring and weighting, it is recommended that the comparison of options be done in two parts:

- 1 Comparison on the basis of aggregated scores on all attributes except financial cost.
- 2 Comparison on the basis of aggregated scores on all attributes including financial cost.

The reason for this is that the weighting given to financial cost is likely to be the most contentious. Splitting the analysis means that it is possible to present the results in terms of both the “best environmental option” and the “best practicable environmental option”. This is likely to provide a more useful input to later stages of decision-making. In particular, if there are no fixed budget limits, it could allow discussions to take place on the basis of whether the “best environmental option” is affordable. This may be a better way to reach agreement amongst a range of stakeholders than beginning with costs included.

Method 1: Reasoned argument

Option A is the immediate removal of all contamination. It is simple, cheap, does not generate significant volumes of waste and does not impact on the operation of the site. For the small patch of contamination being considered, it is the best.

Method 2: Scoring and ranking options

Attribute	Option A	Option B	Option C
1	Good	Average	Average
2	Poor	Very Good	Average
3	Average	Very Good	Average
Rank	Third	First	Second

Option B seems best, being at least “average” and at best “very good”

Method 3: Detailed scoring, weighting and ranking
(scores are on a scale of 1–5 with 5 being best).

Attribute	Weight (1–10)	Option A	Option B	Option C
1	10	4	2	3
2	1	2	5	3
3	3	3	5	3
Score		9	12	9
Rank		2=	1	2=
Weighted score		51	40	42
Weighted rank		1	3	2

Option B seems best if attributes are not weighted for their relative importance. However, if they are weighted (with a particular viewpoint), Option A is clearly best.

5.6

Outcome of the process

Although this whole section is entitled “identification of the preferred option”, it will be evident from Section 5.5 that the outcome of a comparison of options can be far from clear-cut. There will be instances where two or more options/strategies appear to be equally attractive on a balance of the attributes, or where the preference order depends strongly on how the attributes are weighted and it is not possible to reach agreement amongst participating stakeholders as to which set of weighting factors is most appropriate. All these outcomes provide useful input to the decision on the option/strategy to be implemented (see Chapter 6).

6

Deciding on the option to be implemented

The approach to deciding on the option to be implemented is shown in general terms in Figure 6.1 and discussed below. Figure 6.1 is intended to be descriptive rather than prescriptive: it is a framework for giving guidance on some aspects not a recipe to be followed. Issues specific to nuclear-licensed sites are addressed in Appendix 1 and those specific to defence sites in Appendix 2. The key principles that apply during decision-making are 1, 2 and 5.

The emphasis in this section is on decisions about long-term management options and strategies. The length and complexity of the various steps depends on the scale of the contaminated land problem and on the outcome of the previous stage of identifying the preferred option/strategy (see Chapter 5). They also depend on whether the immediate objective is to actually decide on the option or strategy to be implemented or to reach agreement in principle, for the purposes of financial and other planning for the site.

6.1

Consideration of the site owner's/operator's preferred option(s)

Figure 6.1 shows consideration of the site owner's/operator's preferred option(s) or strategy (strategies) in regulatory and other acceptance procedures as the first step in deciding on the option to be implemented. The procedures that are relevant depend on the nature of the site and could be (see also Appendices A1 and A2):

- those under EIAD 99 (for reactor sites being decommissioned)
- those under EIA 99 (for sites where the proposed development requires planning permission within the Town and Country Planning regime)
- part of periodic reviews by NII (in consultation with the relevant environment agency) of decommissioning strategies for each nuclear-licensed site (for reactor sites not yet being decommissioned, and non-reactor sites)
- those under Part IIA (non-radioactively contaminated land)
- procedures put in place by the site owner/operator organisation (eg by MoD at defence sites).

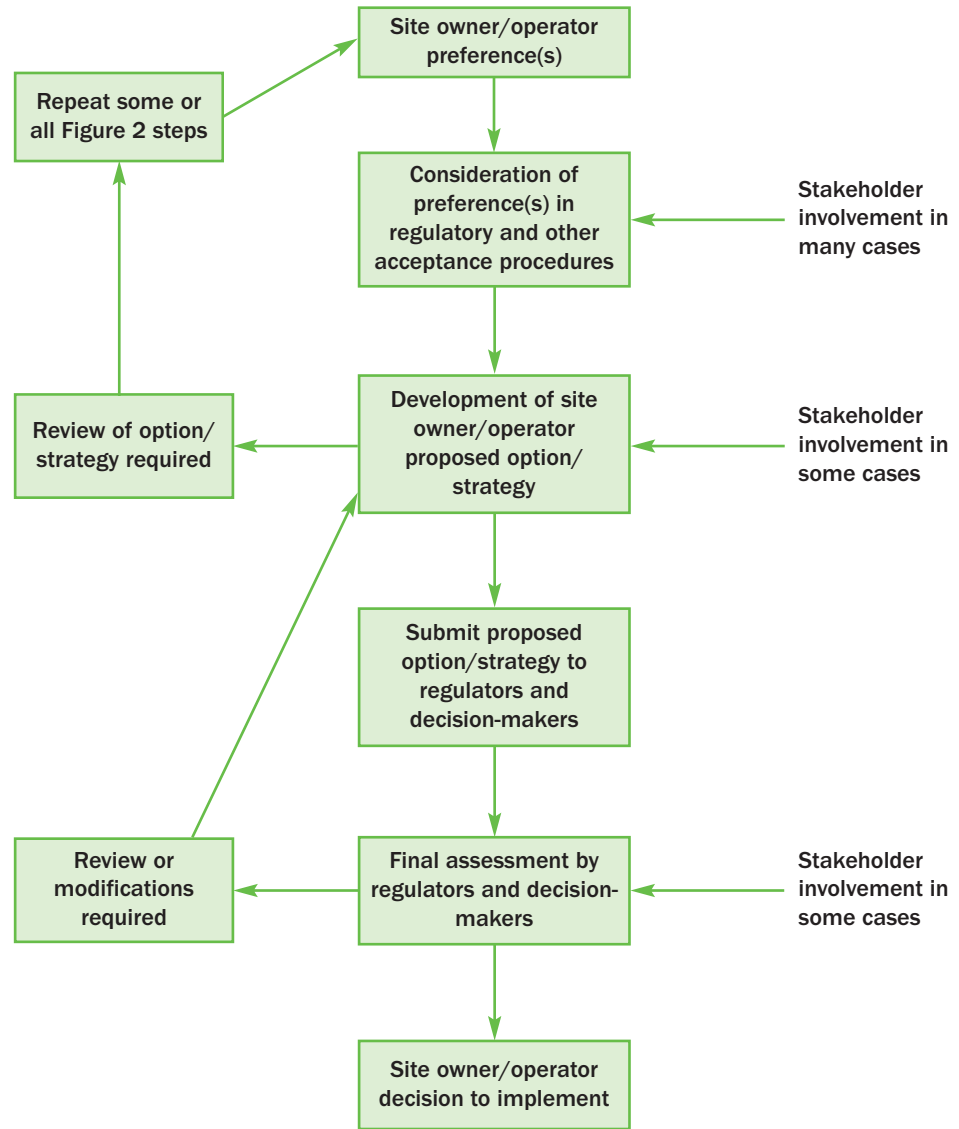


Figure 6.1 Steps in deciding on the option/strategy to be implemented

Most of these procedures involve consultations with stakeholders outside the site owner/operator organisation. These range from the formal public consultations required by EIAD 99 and EIA 99 to informal consultations with regulators as part of site owner/operator procedures. At nuclear-licensed sites the consultations about contaminated land will often only be part of larger consultations on decommissioning plans (see Appendix 1).

It is for site owners/operators to decide how they wish to present the outcome of the identification of their preferred option (see Chapter 5) within these consultations. If there is one option/strategy that is clearly preferred then the documentation of the identification of this option could be presented as it stands. If there is no clear preference, then the site owner/operator may wish to leave the matter open and request views, or to select one option and explain why, appending the documentation on the identification process. In the latter case the reasoning may include factors not considered in the option comparison (eg a detailed analysis of financial risks) and/or the site owner's/operator's explicit views on the most appropriate weights for attributes.

6.2

Development of the site owner's/operator's proposed option

In this step the site owner/operator who put forward the preferred option(s) considers the views expressed by other stakeholders and uses these views to establish the option that they wish to implement. They may or may not consult other stakeholders (eg they may wish to consult regulators, and perhaps local authorities).

Depending on the views expressed in consideration of the preferred option (Section 6.1), developing the proposed option may involve a return to the preferred option identification stage (Chapter 5). If the option is to be implemented soon, there should be no return to option identification unless further information has come forward that would substantially affect the comparison of options, or introduce an option not previously considered at all. If the option/strategy is not to be implemented for some considerable time, then the development of the proposed option/strategy may be a long process. In such cases it is sensible to revisit the identification of the preferred option/strategy in the light of changed circumstances (eg policy changes, technical advances, changes in societal views).

It is important to be open and transparent when developing the proposed option and to document fully what is done. It is good practice to make documentation publicly available.

6.3

Submission of the proposed option

In this step the proposed option/strategy is formally submitted to regulators and decision-makers for approval to implement. At nuclear-licensed sites the submissions for radioactively contaminated land are to NII (with an implementation safety case) and to the relevant environment agency (if authorisations are required to dispose of radioactive wastes); submissions for non-radioactively contaminated land will be to the relevant environment agency (see Appendix 1). At defence sites submissions may be only to internal MoD regulatory departments. Submissions to decision-makers (eg government funding departments, government Ministers, boards of directors) may be made in parallel or in series with those to regulators. It may also be necessary to resubmit planning applications. For land designated as "special sites" under Part IIA copies of submissions should also go to local authorities as designators of such land.

Much of the documentation associated with this step is likely to be in the public domain but some may not be. A special case occurs if a Public Inquiry has been called. In such cases the proposed option is submitted to the Inquiry and regulatory submissions are usually made afterwards, when the result of the Inquiry is known.

6.4

Final regulatory and decision-maker assessment

At this step stakeholder involvement is out of the hands of the site owner/operator, as is release of information into the public domain. Some regulatory assessments entail public consultations (eg assessments of RSA authorisation submissions) and most documentation will be publicly available in the event of a Public Inquiry.

If this guidance has been followed, the outcome of this last step is likely to be approval for the preferred option/strategy or a requirement for small modifications. In rare cases major modifications may be required or the option/strategy may be completely rejected, prompting a return to the preferred option identification stage (see Chapter 5).

7

Implementing the chosen management option

The steps in implementing the chosen management option are shown in Figure 7.1 and are discussed in turn below. The most important key principles during implementation are principles 1, 2 and 5. Principle 1 underlies everything that is done and is applied particularly through appropriate operational health, safety and environmental protection procedures (see Section 7.4). Compliance with Principle 2 entails reporting on progress and plans (see Section 7.5). Compliance with Principle 5 means that records should be kept throughout implementation (see Section 7.6).

7.1

Planning the Implementation

Detailed planning of the practical implementation of the option should be completed before work starts. Planning is especially important for large projects and those that take place on large or complex sites. Much guidance is available on this topic, for example Harris *et al* (1995), Barry *et al* (1996), DETR (2000a), EA (2000a) and HSE (1999). This section is only concerned with issues within the scope of the guidance.

The planning should develop a systematic approach to implementing the chosen option (“who, where, what and when”) using appropriate procedures. Issues to consider include the interdependence of the option with other activities on the site, the staffing and their roles and responsibilities, financial resources, waste management routes and contingencies. Performance measures, such as residual contaminant concentrations, should be made clear, as should quality assurance indicators that demonstrate that procedures were followed.

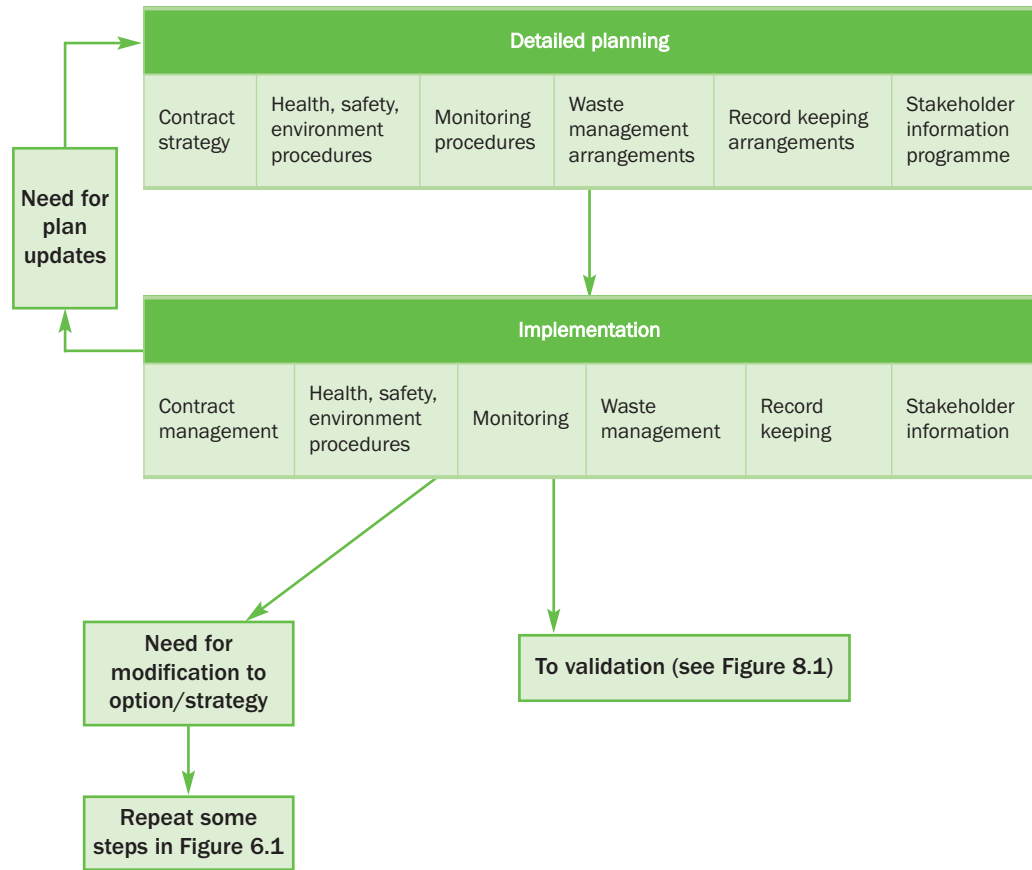


Figure 7.1 *Steps in implementation of the selected option/strategy*

Contingency measures should be specified (eg if contamination is found to be more extensive or at higher concentrations than expected), if necessary on the basis of a risk assessment (which should be separate from assessments undertaken in the identification of the preferred option, although it may draw on them).

Waste management is likely to be a very important consideration if large quantities of contaminated material are to be excavated. Non-radioactive contaminated material in solid form will need to be disposed of at an appropriate landfill (municipal, inert or hazardous waste landfill). Depending on its characteristics, current options for the management of solid radioactive waste are disposal to municipal landfills under “Exemption Orders”, disposal to specified landfills under the “Controlled Burial” regime, disposal to the UK national facility at Drigg, or storage (see HSE (2001b), Environment Agency (2002b)). Waste could also be disposed of on-site, if an authorisation is held under RSA. The route available is largely dependent on the radionuclide concentrations, although the volume may also be a significant factor. The requirements for waste management should have been considered in the choice of land management option. At the planning stage the arrangements for their use should be put in place; it should be noted that this may take some time (many months for disposals to Drigg).

The documented plan will provide a specification for the site owner/operator or contractor to implement the option. If contractors are used, they can also assist in the planning stage. It is recommended that external stakeholders are kept informed about the plans that are being developed (see Principle 2).

7.2

Contractual strategy and contract management

Guidance on contract strategy is primarily required for defence sites and is discussed in further detail in Appendix 2. For these sites the contract is a key document that describes the responsibilities and methods to be applied. The planning stage should address the requirements and roles and responsibilities of contractors and others in the implementation of the option. It is important to agree contingencies should the contamination be found to be more significant than expected. The contract should also address health and safety requirements, specific targets and monitoring requirements. Adversarial forms of contract should be avoided. Hold points and milestones will help to ensure that the implementation of the option is undertaken in a stepwise way and that key stages of the plan are met on time and completed satisfactorily.

7.3

Monitoring

A sampling, monitoring and testing programme will be required during the implementation of the chosen option. For example it will be necessary to ensure that any imported materials conform to specifications, and to sentence any extracted material. The monitoring and collection of samples during the implementation of the option will also provide important data for the validation phase of the management of the contaminated land. The SAFEGROUNDS Site Characterisation Guidance identifies the main elements of a monitoring programme (Baker *et al* 2000), as well as referring to supporting guidance.

Within the monitoring programme, instrumentation and its detection limits should be specified. Prior to commencement, the monitoring instruments should be checked and calibrated. (This is a requirement under the IRRs for radiological instruments.) The areas and volumes over which measurements are averaged should be specified and documented.. The monitoring can be carried out by those implementing the chosen option (eg the site owner and/or the contractor) or by an independent organisation.

The regulatory organisations have sponsored a number of pieces of work to assist them in assessing proposed monitoring programmes (HSE and EA refs to be added). These may also be useful to site owners/operators and contractors.

7.4

Operational health, safety and environmental protection

All actions must be carried out in conformance with regulations under the Health and Safety at Work etc Act. These include the IRRs, COSHH and CDM. Nuclear-licensed sites will have operational procedures in place that should cover all of the requirements of relevant regulations. At defence sites it may be necessary to establish suitable procedures. A Radiation Protection Advisor (RPA) should be engaged for this purpose and any other RPAs that have been involved should be consulted. Additional guidance is available from Barry *et al* (1996), Harris *et al* (1995), HSE (2001b), HSE (1999a) and HSE (1991).

Environmental protection should be considered. Regimes for environmental protection will already be established at nuclear-licensed sites. For other sites, guidance on objectives and methods is available from Harris *et al* (1995), for example.

7.5

Reporting progress, updating plans

It is good practice to keep external stakeholders, particularly local authorities and local people, informed of progress during implementation of major contaminated land operations. At nuclear-licensed sites regular progress reports to Local Liaison Committees provide a means of doing this. At defence sites special mechanisms may need to be devised. Progress reporting should include any changes to implementation plans, or to the option being implemented. Option modifications may be required as a result of what is found during implementation or, if the implementation period is long, because of changes in circumstances.

7.6

Record keeping

Records are best kept throughout the process of implementing the option, not completed retrospectively at the end. Relevant records are likely to include surveys, working methods and other operational records. Important information includes residual contaminant concentrations and distribution, any groundwater contamination, the physical characteristics of the site, the quantity and characteristics of any waste that was removed and any ongoing requirements (for monitoring, etc). It is important to record any deviation from the planned implementation of the option. These records form key quality assurance documentation. Guidance on quality assurance in relation to contaminated land is presented in DOE (1997).

8

Validating what has been done

The purpose of validation is to check that the management option for the contaminated land has been implemented correctly, so that it will achieve the desired high level of protection of people and the environment (Principle 1, Chapter 2). The steps involved are shown in Figure 8.1. The first two steps are the carrying out of monitoring and surveys (see Section 8.1) and the evaluation of the results of these (see Section 8.2). These results should be communicated to stakeholders, some of whom will be involved in deciding whether the option has been implemented correctly (Principle 2). Records should be kept of all validation activities (Principle 5 and see Section 8.3).

8.1

Monitoring and surveys

Monitoring is usually required after the option has been implemented as well as during it. There are specific requirements for monitoring at nuclear-licensed sites. At defence sites MoD has to be satisfied that work is completed in accordance with contractual conditions. Completion surveys and independent monitoring can be required by regulators, for example in order to discharge a planning condition, or surrender a Pollution Prevention and Control permit (which has replaced waste management licensing). In some circumstances there will be a need for third party independent monitoring under the conditions of a contract for the implementation of the option, or because it has been agreed with stakeholders that this will be done.

A description of typical of monitoring, planning and requirements is given in Harris *et al* (1995), and approaches are recommended in EA (2000a). Guidance in Baker *et al* (2000) is also relevant. The post-implementation monitoring should make use of, and be consistent with, the approach used during implementation if possible. It is good practice to keep stakeholders informed throughout the process.

8.2

Evaluation of results

The results of validation monitoring and surveys will be evaluated by the site owner/operator, regulators and perhaps by other stakeholders. The outcome could be agreement that the option has been fully and correctly implemented, or a requirement for further implementation work. The Land Quality Assessment described in Part IIA guidance is a useful reference to determine that the state of the site meets the intended objectives.

8.3

Record keeping

It is particularly important to keep records of validation monitoring and surveys and of the evaluation of results. While each organisation involved (site owner/operator, regulators, independent monitoring organisations) will need to keep their own records, it is recommended that one organisation takes the responsibility for holding a complete set. It will usually be most appropriate for site owners/operators to do this and to include material about regulatory and independent validation in their own summary records (see Section 3.5.3).

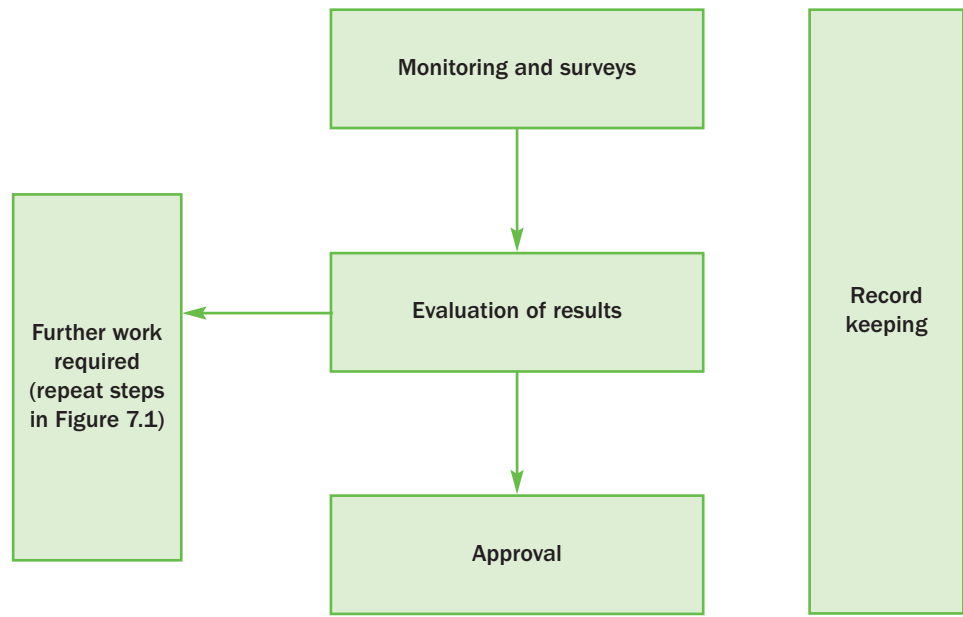


Figure 8.1

Steps in validation

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Legislation

Acts

Nuclear Installations Act, 1965 (as amended)

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Other Statutory Instruments

The Radioactive Substances (Phosphatic Substances, Rare Earths etc) Exemption Order 1962. SI 1962 No. 2648.

The Radioactive Substances (Substances of Low Activity) Exemption Order 1986. SI 1986 No. 1002.

Glossary

Attribute	A factor that is used to compare the performance of different <i>options</i> . Attributes should be mutually exclusive and reflect issues of concern to stakeholders. It can be helpful, but is not necessary, if a quantitative measure of performance is associated with an attribute. Attributes generally fall into the following categories: health and safety, environmental, technical, social and cost factors.
Characterisation of sites	Establishing information on the presence and characteristics of contaminants, details of the environment in which they are present and potential pathways to man and other environmental receptors. This can be achieved by various investigative methods. Guidance on site characterisation has been developed by SAFEGROUNDS (Baker <i>et al</i> , 2000).
Constraint, screening criterion	A basic requirement that must be met for any <i>option</i> to be considered in detail. Constraints/screening criteria should be capable of being agreed to by all <i>stakeholders</i> , be mutually exclusive and unambiguous. They can be identified by considering the SAFEGROUNDS <i>key principles</i> and other factors such as legal or regulatory requirements. Financial issues should not be used as constraints unless all stakeholders agree to this.
Contaminated land	Any land on or under which radioactive or non-radioactive contaminants are suspected to be present at concentration levels above the natural and artificial background concentration levels that are typical of the location of the site. This is not the same as the statutory definition in Part IIA of the Environmental Protection Act, 1990 which defines the presence of contamination by the possibility of significant harm or the pollution of controlled waters.
Decommissioning	The set of actions taken at the end of a nuclear facility's operational life to take it permanently out of service. It includes actions to systematically and progressively reduce the level of hazard on a site and may include the physical dismantling of facilities. The ultimate aim of decommissioning of a <i>nuclear-licensed site</i> is to make the site available for other purposes. The endpoint for decommissioning may be <i>delicensing</i> or re-use of the site for nuclear purposes, or the keeping of the site under institutional control.
Defence site	In this guidance, non-nuclear sites that have been or are being used for defence activities and for which a change of use and/or ownership is planned. Nuclear sites that are operated for MoD by contractors and that are licensed and regulated by HSE under the Nuclear Installations Act are <i>nuclear-licensed sites</i> .

Delicensing	The process of releasing a <i>nuclear-licensed site</i> from regulation under the Nuclear Installations Act and of releasing the operator from his period of responsibility for any nuclear liability.
Environment	The environment includes, but is not limited to, people's property (eg houses and land), existing and potential resources (eg groundwater, water quality, air quality) and natural ecosystems. In this guidance, <i>people</i> are regarded separately from the environment. The distinction is made for consistency with health and safety, and radiological protection, terminology.
Envisageable options	All the options that would be effective for managing the <i>contaminated land</i> .
Future	The period over which the potential effects of the <i>contaminated land</i> need to be considered when evaluating the <i>options</i> that may be applied to it. Many contaminants have long half-lives in the environment, and so it may be necessary to consider hundreds of years or more.
Future use	The range of uses to which the <i>contaminated land</i> will be able to be put after the selected <i>option</i> has been implemented successfully. The range of future uses may be restricted to reduce the potential hazards associated with residual contamination. Alternatively, the site may be made available for any future use, in which case lower levels of residual concentrations of contaminants are likely to be required.
High level of protection	The level of potential impacts on <i>people</i> and the <i>environment</i> that all stakeholders agree can be tolerated. SAFEGROUNDS does not recommend a particular level of protection, rather it is recommended that the level of protection should be defined on a case-by-case basis.
Key principle	A fundamental principle that should be adhered to during <i>land management</i> . Through consultation, SAFEGROUNDS has developed five key principles on the protection of <i>people</i> and the <i>environment</i> , <i>stakeholder</i> involvement, the identification of the preferred <i>land management option</i> , taking immediate action and record keeping.
Licensee	The organisation that is the holder of the nuclear site licence on a <i>nuclear-licensed site</i> . The licensee is responsible for nuclear safety on the site and for discharging all the obligations and liabilities associated with the nuclear site licence.
Management of contaminated land	The taking of any actions to control, monitor or remove (wholly or partially) contamination once it has been discovered and all the processes that lead up to decisions to take such actions.
Nuclear-licensed site	Sites that are regulated by HSE under the provisions of the Nuclear Installations Act 1965 (as amended) with a nuclear-site licence. The Act applies to fixed sites for the purposes of constructing and operating nuclear reactors and other prescribed nuclear installations. The guidance applies to operating sites and those being <i>decommissioned</i> , whether or not they are to be <i>delicensed</i> .

Objective	An aim set for the management of contaminated land. Objectives are set by considering factors such as government policy, corporate/organisational policy and the views of <i>stakeholders</i> . It is recommended that environment, health and safety objectives are established separately from those of a commercial and administrative nature.
Option	A method, approach or technology that can be used for <i>land management</i> . Options can include, but may go further than, some or all of the actions defined as “remediation” in Part IIA of the Environmental Protection Act, 1990. In evaluating options, consideration should always be given to “doing nothing more” to the contamination or to removing contamination to background levels. See also <i>strategy</i> .
Owner/operator	The organisation with responsibility for the site and any associated <i>contaminated land</i> . At <i>nuclear-licensed sites</i> the operator is the <i>licensee</i> . Owners/operators are responsible for taking final decisions to implement the <i>proposed option</i> for <i>land management</i> .
People	Those individuals that could be affected by <i>contaminated land</i> . People are distinguished from <i>environment</i> following health and safety and radiological protection convention. Separate consideration may be given to “workers” (who receive a direct financial benefit from the <i>owner/operator</i>) and the public (who do not). Consideration should also be given to people at present and in the <i>future</i> .
Preferred option	The option that is identified by an <i>owner/operator</i> as their preferred one following a comprehensive, systematic and consultative assessment in which all the <i>envisageable options</i> are considered.
Preferred strategy	The strategy that is identified by an <i>owner/operator</i> as their preferred one following a comprehensive, systematic and consultative assessment of potential strategies derived by considering the <i>options</i> for the various areas on a site.
Proposed option	The <i>option</i> that is formally submitted by an <i>owner/operator</i> to regulators and decision-makers for approval to implement, following the comparison of options, identification of a <i>preferred option</i> , and consideration of this preferred option in regulatory and other acceptance procedures.
Proposed strategy	The <i>strategy</i> that is formally submitted by an <i>owner/operator</i> to regulators and decision-makers for approval to implement, following the comparison of strategies, identification of a <i>preferred strategy</i> , and consideration of this preferred strategy in regulatory and other acceptance procedures.
Records	Information including details of site <i>characterisation</i> work, the process of deciding on the <i>land management</i> option/strategy, implementing the option/strategy and validating its implementation, as well as interaction with <i>stakeholders</i> throughout the process. There is a <i>key principle</i> about the keeping of records.
Risk assessment	A systematic process that establishes the existence, nature and significance of risk. Different methods are used to evaluate different types of risks. The approach to assessing risks to

	<p><i>people's health</i> and to the <i>environment</i> from non-radioactive contamination is largely described in regulatory guidance. The approach to assessing risks to <i>people</i> and the <i>environment</i> from radioactive contamination is different and an approach is outlined in the guidance.</p>
Safety case	<p>Documentation for a nuclear installation that demonstrates safety. Safety cases must be produced and maintained during the design, construction, manufacture, commissioning, operation and <i>decommissioning</i> of the installation.</p>
Score	<p>The performance of an <i>option</i> in respect of a particular <i>attribute</i>, when options are being compared. Scores can be assigned using an absolute (ie compared with a scale including ideal and unacceptable levels of performance) or relative (ie relative to the performance of other options) measure of performance. The latter approach is sometimes referred to as ranking.</p>
Site	<p>A contiguous area of land on which <i>contamination</i> is known or suspected to be present. In most cases, a site will have a single <i>owner/operator</i>. Sites considered in this guidance are further classified as <i>nuclear-licensed sites</i> or <i>defence sites</i>.</p>
Stakeholder	<p>A person or organisation that has an interest in (or is affected by) the <i>contaminated land</i>. There are various groups of stakeholders: institutional stakeholders include the <i>owner/operator</i>, regulators and government departments. External stakeholders are all those outside the owner/operator organisation. Those stakeholders involved in decisions on the management of contaminated land are participating stakeholders.</p>
Strategy	<p>A broad plan for the management of all the <i>contaminated land</i> on a <i>site</i>, probably comprising of several <i>options</i>.</p>
Weighting factor	<p>A weighting factor accounts for the importance of an <i>attribute</i> relative to others when <i>options</i> are being compared. This is usually done by multiplying <i>scores</i> for an attribute by the chosen weighting factor. Several sets of weighting factors are often needed, so as to reflect the views of various <i>stakeholders</i>.</p>

Acronyms and symbols

ALARA	as low as reasonably achievable
ALARP	as low as reasonably practicable
BNFL	British Nuclear Fuels plc
BPEO	best practicable environmental option
Bq	Becquerel – a unit of radioactivity (one nuclear transformation per second)
CBO	community based organisation
DE	MoD Defence Estates Organisation
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions (no longer exists; most of its responsibilities relevant to this guidance have been transferred to DEFRA, the remainder to DTLR)
DRPS	Dstl Radiological Protection Services (formerly Defence Radiological Protection Services)
DTI	Department of Trade and Industry
DTLR	Department for Transport, Local Government and the Regions
EA	Environment Agency
EIA	environmental impact assessment
EIAD	Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations, 1999
HSE	Health and Safety Executive
HSWA	Health and Safety at Work etc. Act, 1974
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IRR	Ionising Radiations Regulations, 1999
LLW	low-level radioactive waste
LQA	Land Quality Assessment (see Appendix 2)
LQS	Land Quality Statement (see Appendix 2)
MADA	multi-attribute decision analysis
MoD	Ministry of Defence
NGO	non-governmental organisation
NIA	Nuclear Installations Act, 1965 (as amended)
NII	Nuclear Installations Inspectorate, part of HSE
NRPB	National Radiological Protection Board
Part IIA	Environmental Protection Act, 1990: Part IIA Contaminated Land (inserted by the Environment Act, 1995)

PPC	Pollution Prevention and Control regime
RCEP	Royal Commission on Environmental Pollution
RPA	Radiation Protection Advisor
RSA	Radioactive Substances Act, 1993
SAFEGROUNDS	SAFety and Environmental Guidance for Remediation Of Uk Nuclear and Defence Sites
SEPA	Scottish Environment Protection Agency
SI	Statutory Instrument
SoLA	Substances of Low Activity Exemption Order (made under RSA)
Sv	Sievert, a unit of dose from ionising radiation

This version is now superseded by version 2 (W29)

A1

Further guidance for nuclear-licensed sites

Foreword

This appendix contains further guidance on the management of contaminated land on nuclear-licensed sites. Its focus is on strategic aspects of the long-term management of contaminated land. Short-term management of contaminated land is dealt with in existing regulatory guidance and in site licensees' established systems for health, safety and environmental protection.

Various parts of the guidance in Appendix 2 for defence sites are also likely to be relevant to nuclear-licensed sites but, to avoid duplication, are not included here. Readers whose interest is in nuclear-licensed sites may therefore wish to use Appendix 2. In doing so they should bear in mind that the regulatory regimes for nuclear-licensed sites and defence sites are different.

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A1.1

Sites and contaminants

A1.1.1

Sites

A “nuclear-licensed site” is defined as:

- any site in respect of which a nuclear site licence is for the time being in force
- any site in respect of which, after revocation or surrender of a nuclear site licence, the period of responsibility of the licensee has not come to an end.

Where “nuclear site licence”, “licensee” and “period of responsibility” have the same meaning as in Section 26 of the Nuclear Installations Act 1965. The term “delicensing” is used to mean the release of the land from regulation under the Act and the release of the operator from his period of responsibility for any nuclear liability.

All the nuclear power station sites are nuclear-licensed sites, as are the Sellafield site (at which spent nuclear fuel is reprocessed), the Drigg radioactive waste disposal site, the UKAEA research establishments (eg Harwell, Dounreay) and sites that are operated for MoD by contractors (eg dockyards and atomic weapons establishments). The SAFEGROUNDS site characterisation guidance (Baker *et al*, 2000) contains a complete list of nuclear-licensed sites and a map of their locations.

A1.1.2

Contaminants

Contaminated land at nuclear-licensed sites might contain radioactive substances, non-radioactive substances or mixtures of the two. The contamination might have arisen from nuclear and non-nuclear operations during the time for which it has been a licensed site, or from its past, non-nuclear use (for example, a number of nuclear-licensed sites were used for military purposes before nuclear installations were built on them). Baker *et al* (2000) and Hill *et al* (2001) describe the kinds of radioactive and non-radioactive contaminants that may be present.

A1.2

Contexts for decisions on management of contaminated land

There are five possible contexts for decisions on the management of contaminated land on a nuclear-licensed site:

- 1 As part of the on-going safe management of the licensed site, with no intention to change the use of the land.
- 2 As part of the on-going safe management of the licensed site, with the intention of re-using the land for nuclear purposes (eg new plant).
- 3 As part of decommissioning of part of the site, with the intention of re-using the land for non-nuclear purposes, without any delicensing.
- 4 As part of decommissioning of part of the site, with the intention of re-using the land for non-nuclear purposes, after delicensing.
- 5 As part of decommissioning of the whole site, with the intention of re-using the land for non-nuclear purposes, after delicensing.

In contexts 2, 3, 4 and 5, the “decision” could be about what the licensee wishes to do and be required for liability estimation and financial provisioning, rather than being a decision about what will definitely be done to manage the contaminated land in the longer-term. In most contexts, no decision can be taken to actually implement a management option until all the various steps up to and including the gaining of final regulatory approval have been achieved (see Section A1.4).

A1.3

The regulatory regime

The principal regulatory regime is that of the Nuclear Installations Act 1965, as amended¹ (NIA), which covers all aspects of nuclear safety. The principal regulator is the Health and Safety Executive's Nuclear Installations Inspectorate (HSE's NII). Nuclear site licences contain a number of conditions and it is mainly through the enforcement of these conditions that NII regulates nuclear safety. There are 36 standard conditions in nuclear site licences and they cover safety in normal circumstances and in the event of an accident or other emergency (HSE, 1994; HSE, 1999b).

The Health and Safety at Work etc Act 1974 (HSWA 74) also applies at nuclear-licensed sites, as do the regulations made under it. Those of particular relevance to contaminated land are the Ionising Radiations Regulations 1999 (IRR) and the Control of Substances Hazardous to Health Regulations 1999 (COSHH). HSE enforces the Act and the regulations.

Guidance as to what NII expects for nuclear plant safety is given in the HSE's "Safety Assessment Principles for Nuclear Plants" (HSE, 2001a) and for management of radioactive materials and radioactive waste in another publication (HSE, 2001b). The guidance is for the NII's own inspectors but is published to inform licensees and others. The guidance on radioactive waste management (HSE, 2001b) contains an appendix on radioactively contaminated land. Also relevant is the guidance to NII inspectors on decommissioning (HSE, 2001c).

Part IIA of the Environmental Protection Act 1990 applies if the land on a nuclear-licensed site is contaminated with non-radioactive material in the sense defined in the Act. Nuclear-licensed sites that are contaminated to this extent will be designated as "special sites" and the relevant environment agency will be responsible for them in respect of Part IIA (the Environment Agency (EA) for sites in England and Wales, the Scottish Environment Protection Agency (SEPA) for sites in Scotland). Some guidance associated with Part IIA has been issued (DETR 2000a and 2000b) and more is in preparation. Part IIA only applies to sites in their current use and does not contain provisions that are relevant to delicensing land. The environment agencies can also apply other legislation to regulate non-radioactively contaminated land, for example the Water Resources Act 1991, and the Pollution Prevention and Control (PPC) regime for dealing with wastes.

The Radioactive Substances Act 1993 (RSA) applies to disposals of radioactive wastes on and from nuclear-licensed sites and is relevant to any wastes disposed from contaminated land and any secondary wastes arising from the management of contaminated land. The environment agencies are the regulators for RSA and consult HSE.

For nuclear reactor sites that are to be decommissioned the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (EIAD) apply. These are administered by HSE.

1 See Tromans and Fitzgerald (1997) for an unofficial text of the Act and all the amendments made up until 1997.

A1.4

Applying the key principles in the regulatory framework

The focus in this appendix is on the long-term management of contaminated land on nuclear-licensed sites. This is because shorter-term management of such land is part of the routine safe management of the licensed site and existing guidance and procedures are sufficient and will be enforced by the NII. (Appendix B of HSE (2001b) provides further details, including advice on the content of the safety cases that are required for radioactively contaminated land).

A1.4.1

NII requirements for radioactively contaminated land

Unless it is a disposal authorised under RSA, radioactively contaminated land (or emplaced radioactive material) on a nuclear-licensed site is as an “accumulation of radioactive waste” and it should be managed as such (see Appendix 8 of HSE (2001b)). NII expects licensees to demonstrate that they are managing² radioactively contaminated ground in compliance with all the conditions of the nuclear site licence. The conditions that are particularly relevant are numbers 4, 14, 23, 25, 32 and 34 (see HSE (1994 and (1999b)). These require licensees to control or contain nuclear matter, including radioactive materials and radioactive waste, to record the amount of material and its location, and to justify and demonstrate the adequacy of the arrangements to maintain safety by means of a safety case.

To achieve the necessary control, NII requires that the licensee has a strategy for the management of radioactively contaminated land. The remainder of this section of the appendix is about applying the key principles (see Section 2 of the main text) in the development of that strategy. The most relevant key principles are 1, 2 and 3. In using the appendix it should be borne in mind that the key principles do not cover the full task of managing the land to meet NII requirements (see footnote 2).

A1.4.2

Developing a long-term strategy for managing contaminated land

It is recommended that the licensee develops one overall long-term strategy for managing contaminated land that includes both radioactive and non-radioactive contamination (and mixtures). This is because such a holistic approach will be the most efficient and transparent. Non-radioactive contamination has to be considered in the strategy for radioactively contaminated ground because it may have the potential to influence both radiological safety and the effectiveness of management methods for radioactively contaminated land. Furthermore, HSE and the environment agencies consult each other so, if a licensee has one strategy for both regulators to assess, this could shorten approval processes. In the case of other stakeholders, having one strategy can make consultation simpler and quicker.

NII will expect the contaminated land management strategy to be integrated with the decommissioning strategy for the site (HSE, 2001b). It is Government policy and an NII requirement that every licensee has a decommissioning strategy. It is reviewed and revised regularly, and the detail in it increases as the time for the start of decommissioning approaches. The detailed plans and safety cases for decommissioning a site require information from, and make reference to, the decommissioning strategy (HSE, 2001c).

² In NII usage the term “management” has a wider meaning than it does in this guidance. It includes everything that has to be done to ensure safety and thus covers matters such as preventing land contamination, having suitably qualified personnel, training them, supervising them etc.

The steps in reaching a final decision on the decommissioning strategy to be implemented at a particular site can be described as shown below (see also Figure 6.1 in the main text).

- 1 Development of a contaminated land strategy, a waste management strategy and strategies for other decommissioning activities.
- 2 Development of the licensee's preferred decommissioning strategy, integrating the land and waste strategies with the other decommissioning activities.
- 3 Formal consultation on, and regulatory acceptance procedures for, the licensee's preferred decommissioning strategy. For reactor sites that are to be decommissioned these will include EIAD procedures, with the production of, and public consultation on, an environmental impact assessment (EIA).
- 4 Development of the licensee's proposed decommissioning strategy.
- 5 Production of implementation safety cases for submission to HSE, RSA authorisation submissions for EA/SEPA, other authorisation submissions for EA/SEPA (eg under PPC).
- 6 Regulatory assessment of safety cases and authorisation submissions, with public consultation on RSA authorisation submissions.
- 7 Final regulatory approvals to proceed with decommissioning.
- 8 Licensee decides to implement decommissioning strategy.

Licensees should work with their regulators throughout these steps, ie with NII, other parts of HSE, and the relevant environment agency.

These eight steps would apply whether the whole site or only part of the site is to be decommissioned and delicensed in the near future (ie contexts 4 and 5 in Section A1.2). In the latter case Steps 3-8 would focus on the part of the site that is about to be decommissioned and delicensed, with the decommissioning strategy for the remainder of the site being provided as background. The steps would also largely apply if the aim is to develop and implement a long-term management strategy for contaminated land, without any delicensing taking place in the foreseeable future (contexts 1, 2 and 3 in Section A2). In this case Steps 3-8 would be for the contaminated land strategy only, but set against the background of the site decommissioning strategy, and Step 3 might be a less formal consultation, without any EIA. There are likely to be several iterations of Steps 1 and 2, as site and waste characterisation progresses in the period up to the planned start of decommissioning.

Although full implementation safety cases are not needed until Step 5, some safety assessments and environmental impact studies would normally be carried out as part of strategy development. They are particularly important at Step 3, where the licensee will need to justify the choice of strategy in comparison to alternatives. This is a formal requirement of EIAD procedures and is needed in other cases to satisfy ALARP and BPEO principles (HSE, 2001b). It is preferable to include comparisons of alternative strategies at Steps 1 and 2, then carry the results through to Step 3, rather than only starting to do comparisons at Step 3. As explained in Section 5.1 of the main text, it is not necessary to have detailed site characterisation information in order to do these comparisons, nor to carry out detailed safety assessments and environmental impact studies. EIAD provides guidance on the content of a decommissioning EIA and has a procedure for making a preliminary submission to obtain the views of HSE and the EIAD consultees on the scope of an EIA for a particular site. Smith (2002) provides advice on health and environmental risk assessments.

A1.5

Applying Principle 1: Protection of people and the environment

All the guidance in the main text (see, in particular, Section 3.1) applies at nuclear-licensed sites. There is a further legal and regulatory requirement if the licensee wishes to delicense part or all of the site. The requirement is that HSE has to be satisfied that “there has ceased to be any danger from ionising radiations from anything on the site” (see NIA). This is commonly known as the “no danger” criterion. The licensee’s obligation to manage radioactively contaminated land safely continues until the site is delicensed.

At present, the only way to be reasonably sure of satisfying the “no danger” criterion is to remove all radioactivity above the ubiquitous natural and artificial background (unrelated to site activities). This can be done either by physically removing soil and other material (for off-site disposal or for passively safe storage on a licensed site), or by waiting until levels have decayed to such an extent they are indistinguishable from background before delicensing (with monitoring and control throughout the decay period). This way of satisfying the “no danger” criterion places considerable constraints on the choice of management option for the contaminated land. Licensees, and other stakeholders, may feel that it is undesirable to restrict a comparison of options in this way.

One consideration is that in the future other ways may become available to satisfy the “no danger” criterion. This could occur if HSE were able to establish generic numerical levels of radioactivity in ground and groundwater that are above background but low enough to be considered to give rise to no danger to people or the environment, whatever the land is used for in the future. The Health and Safety Commission plans to launch a consultation exercise on delicensing criteria in late 2002 (DTI, 2002).

Meanwhile, licensees could try to develop their own “no danger” levels for their site, in consultation with stakeholders. In doing so they would need to recognise that, even if they arrived at levels to which most stakeholders could agree, there could be legal challenges to an interpretation of “no danger” that relied on such levels.

One way to address this issue in decision-making is for licensees to consider long-term land management options that involve removal of all activity above background levels and options that might allow delicensing if other ways to satisfy the “no danger” criterion became available. They could then include in their comparison of options one or more attributes to represent “ability to delicense”, and score the options accordingly (see also Section A1.7).

A1.6

Applying Principle 2: Stakeholder involvement

The guidance in the main text (see Section 3.2 in particular) applies. Regulators will already be involved but licensees will need to discuss with other external stakeholders at what point in the steps in Section A1.4.2 they wish to begin their involvement in the decision making on the long-term contaminated land management strategy. The remainder of this section deals with involving stakeholders other than regulators and those from the licensee's own and other nuclear industry-related organisations. Collier (2002) provides advice on who to involve and how.

If the whole or part of the site is being decommissioned and delicensed, stakeholders could become involved at Step 1, or they may wish to wait until Step 2 when they could deal with all the elements of the decommissioning strategy together. Starting involvement at Step 3, when the preferred strategy has been decided, is likely to be too late to be effective and is not recommended (see also DTI (2002)). If there is to be no delicensing in the immediate future, stakeholder involvement is best started at Step 1 (see Section 3.2.2 of the main text).

If an EIA is being produced, either to comply with EIAD or for other reasons, it is best to involve stakeholders during its production. This will increase the chance of avoiding criticism and delays at a later stage. As a member of European Commission staff stated recently in connection with nuclear projects: *".....the developer should not regard an EIA as an unavoidable imposition. He should regard it as an opportunity to establish a full and open dialogue with all local bodies and representatives. The final EIA should not be a product that he will need to defend against public criticism, but a joint developer/public document that all sides can endorse and support"* (Taylor, 2001).

In all cases, it is recommended that stakeholders are involved at Step 4, the development of the licensee's proposed strategy, prior to the production and submission of implementation safety cases (Step 5) and to formal public consultations on authorisations (Step 6). To comply with Principle 2, stakeholders should be kept informed throughout Steps 7 and 8, and throughout implementation and validation.

A1.7

Applying Principle 3: Identifying the preferred management option

Principle 3 refers to options, but in this appendix the main concern is with strategies, ie combinations of the options for various areas of the site. In building up alternative strategies for managing the contaminated land on a site, it will often be necessary to look at different options for the various areas. If the problems are complex, it is sensible to compare options for each main area, then use the results to select the options to be included in potential strategies. If the problems are not so complex, it is possible to formulate potential strategies just by choosing practicable combinations of the options for the various areas. In both cases, a small number of potential strategies should be developed and compared in accordance with Principle 3 and the guidance in Chapter 5 of the main text.

If the whole or part of the site is being decommissioned and delicensed, it may be possible to omit the comparison of contaminated land strategies per se and only compare complete decommissioning strategies (ie contaminated land, plus waste management plus other decommissioning activities). If this is done, it is preferable to compare contaminated land options at an early stage, to feed into the development of alternative decommissioning strategies.

Two approaches are possible if it is proposed to delicense the whole site, or part of it. One is to use the need to remove radioactive contamination above background levels as a constraint on the choice of options for the land that is to be delicensed. The other is to consider contaminated land options that include those that could allow delicensing if other ways of satisfying the “no danger” criterion became available (see Section A1.5).

In the latter case, one or more attributes to represent “ability to delicense” would then be included in the comparison of options and/or strategies. If the ability to delicense at all is the issue, then one attribute might suffice. If the issue is the timescale on which delicensing could be achieved, then several attributes, each relating to the ability to delicense in a different time period, may be needed. The importance attached to these attributes will vary from one site to another, depending on objectives for using the land in question. In this way it should be possible to see the advantages and disadvantages of each option/strategy as far as delicensing is concerned, in perspective with their other pros and cons. This procedure could also be used if no delicensing is yet planned but may be proposed in future. This would help to avoid situations in which further remedial actions are found to be needed at a later stage.

It is recommended that the financial costs of options and strategies be compared using undiscounted values (which highlight overall cost differences) and discounted values (which highlight short-term cost differences).

A1.8

Applying Principle 4: Immediate action

No further guidance is required on applying this key principle at nuclear-licensed sites. Immediate action to record, monitor, control and, where appropriate, remediate contaminated land is necessary to fulfil regulatory requirements. This is required irrespective of work to develop long-term management strategies.

A1.9

Applying Principle 5: Record-keeping

Compilation and maintenance of comprehensive records is fundamental to the process of managing contaminated land on nuclear-licensed sites. Record-keeping is enforced through the site licence and HSE can specify particular requirements. However, these records may not have the same scope as those envisaged in this guidance (see Section 3.5 of the main text). For example, although the amounts and locations of all radioactive material on a site must be recorded, there may be no explicit requirement to include all site characterisation information for non-radioactive contamination, nor to include information on the process of deciding how to manage contaminated land. Also, there is at present no requirement for a second copy of records or a summary to be made, potentially to be held by a public body (see Section 3.5 of the main text).

It is recommended that licensees should, as part of the development of a long-term contaminated land management strategy, establish the format of the records required to meet Principle 5. These records should then be made in parallel with the records required by the site licence conditions, so that they are consistent with them and common material can be included where appropriate.

A1.10

Funding

Licensees must make financial provisions to deal with nuclear liabilities, of which contaminated land is just one component. Certain privately owned companies (eg British Energy) have segregated funds; government-owned organisations (eg BNFL, UKAEA, MoD) have other arrangements. Arrangements for government-owned civil nuclear organisations are expected to change in the next year or two, when the government establishes a “Liabilities Management Authority” (DTI, 2002). It is possible that the new arrangements will involve the establishment of a government-held segregated fund or a “statutory segregated account”. It is important that the full costs of managing contaminated land on nuclear-licensed sites, up to and including delicensing, are taken into account when estimating liabilities, and that arrangements ensure that funds for dealing with contaminated land are available when required.

This version is now superseded by version 2 (W29)

A2

Further guidance for defence sites

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A2.1

Background

A2.1.1

Sites

This appendix relates to the management of contamination on non-nuclear sites owned by the Ministry of Defence (MoD) which have been selected for a change of use and/or ownership. These include sites operated by military units, storage and research facilities and testing ranges. Processes similar to those which have led to the contamination of MoD land, such as the manufacture, repair and disposal of luminised instruments, have also been practised elsewhere by private organisations. This guidance may be of value in the management of land that has been contaminated by these similar processes. Further information about defence sites can be found in RWMAC (2000), Environment Agency (2000c) and Baker *et al* (2000).

A2.1.2

Radioactive contaminants

A2.1.2.1

Luminising wastes

The process of luminising, which enabled instruments to be efficiently used in darkness, is the principal source of radioactive contamination on MoD land. This practice involved painting equipment parts with radioactive material, generally radium-226 mixed with an appropriate phosphor. The efficiency of the light emitting phosphor decreased with time resulting in regular removal and replacement of the paint. This process was undertaken widely on operational sites, including airfields, and by the Royal Electrical and Mechanical Engineers (REME) workshops. The residual luminising wastes and instrument parts were historically disposed of on small site tips, often as contaminated ash following incineration. Contaminated ash was also used in pathways and as ground cover and buried in soil. Radium resulting from luminising processes has also been found as a residual contamination in drains and structures. The long radioactive half-life and insolubility of the radium-226 (in the chemical form used for luminising), together with its high radiotoxicity, result in residual luminising material being the major radioactive contaminant on MoD sites.

The use of radium as a luminising agent declined in the 1960s and it was replaced by the use of shorter-lived and less radiotoxic radionuclides: promethium-147 and later tritium. This, together with greater controls, has reduced the potential of more recent operations to give rise to contamination. Luminising wastes in the form of residual instrument parts can also be found both on MoD and private sites where aircraft and ships have been scrapped for material recovery.

A2.1.2.2

Minor uses

The MoD has used equipment containing a variety of small radioactive sources including: tritium in night sights; caesium-137 and other radionuclides in electronic valves; various radionuclides in calibration sources; and thorium in optical instruments. Unsealed sources of various radionuclides have been used as tracers for specific applications and thorium has arisen in welding residues. Additionally there is potential for sources of enhanced natural activity to be found on MoD sites where it has been imported for construction purposes, eg smelter residues containing uranium and thorium utilised as railway ballast. Ground contamination from such minor sources is not prevalent on MoD sites. However the potential for the presence of such sources should be considered on a case by case basis, both during site characterisation and during the assessment of land management options.

A2.1.3 Non radioactive contamination

A2.1.3.1 Hydrocarbons

Hydrocarbons have been used widely on MoD sites as fuel, lubricants and solvents. There is thus a potential for ground contamination from spillages, leakage and the historic disposal of small quantities of unwanted material.

A2.1.3.2 Explosives

Explosives and explosive ordnance are inherent to MoD operations. MoD applies stringent accounting procedures for the use and storage of these. Nevertheless, explosive ordnance and ammunition can be on land used for training purposes and research facilities.

A2.1.3.3 Other contaminants

Other contaminants commonly found on MoD land include asbestos, metals and general waste from workshops, storage and operational facilities. On certain sites more unusual contamination could be encountered, including chemical weapon residues.

An additional characteristic of defence sites is the relatively high probability that mixed contaminants are present. Thus in identifying and assessing potential management options it is necessary to consider whether interaction between the various contaminants could lead to a potential for unacceptable circumstances to develop. For example, the handling of radioactive wastes in close proximity to flammable residues could result in the release of radioactive material from the site in the event of fire.

A2.1.4 The LQA programme

MoD has initiated a prioritised land quality assessment (LQA) programme for the whole of the defence estate. In parallel with this, MoD is producing a corporate environmental management system across the defence estate. The intention is that the LQA programme will provide the basis for further assessment and management of the MoD's contaminated land liabilities within the framework provided by the corporate environmental management system.

MoD applies a risk-based, phased approach to land quality assessment. Phase 1 comprises the production of a desk-based assessment of land quality that includes the review of site records, site reconnaissance, interviews with staff and a review of archives and databases. From this, past and present sources of potential contamination and the associated potential risks are identified, together with appropriate management options. As part of this assessment, organisations who hold historic information are requested to examine their records and identify any radioactive material holdings. Later phases include intrusive and non-intrusive investigation and, where appropriate, remediation.

Each LQA phase is reported as an LQA report and separate Land Quality Statements (LQSs) that are public domain documents. The LQA report contains a risk assessment based on the source-pathway-receptor approach. At the phase 1 stage the risk assessment is always qualitative, whereas at later stages a tiered risk assessment approach is followed. The LQS provides a broad overview of the land quality assessment findings.

MoD use the LQA programme to provide a means of auditable decision-making with respect to the management of contaminated land and associated environmental

liabilities. The decision making process includes the identification and appraisal of management options, partially based on a BPEO approach, and the production of cost estimates. This commercial management information is reported separately and circulated internally. Where appropriate, MoD includes stakeholder inputs from outside the ministry. This guidance is intended to supplement the LQA procedures.

A2.2

Regulatory regime

Most of the acts and regulations that apply generally in the UK to the management of contaminated land (see Section 4.2 of the main text) apply to defence sites. Of particular relevance are:

- Health and Safety at Work etc Act 1974 and regulations made under it including the Ionising Radiations Regulations 1999 and the Control of Substances Hazardous to Health Regulations 1999
- the Environmental Protection Act 1990 particularly Part IIA (inserted by the Environment Act 1995), and the Contaminated Land (England) Regulations 2000 (and the corresponding regulations in Scotland and Wales)
- the Town and Country Planning Act 1990 together with the Town and Country Planning (Environmental Impact Assessment, England and Wales) Regulations 1999 (and the corresponding regulations in Scotland).

The Health and Safety Executive (HSE) are the regulator for the Health and Safety at Work etc Act and the regulations made under it. Its provisions apply in full to the management of contaminated land on MoD sites, and to both MoD and its contractors.

Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) applies if defence sites in their current use are contaminated in the sense defined in the Act. Sites contaminated to this extent will be designated as “special sites” and regulated for Part IIA purposes by the relevant environment agency (the Environment Agency (EA) in England and Wales, the Scottish Environment Protection Agency (SEPA) in Scotland).

The Environmental Impact Assessment Regulations apply to defence sites that are being developed, in the same way that they would apply to any civil site. If MoD is the developer, it will be required to submit an EIA for any project that requires one under the regulations.

MoD is exempt from the requirements of the Radioactive Substances Act 1993 (RSA) but in normal circumstances the MoD applies the requirements of the Act to its processes. Where an authorisation would be required under RSA the MoD enters into an arrangement with the relevant environment agency which is called “a letter of agreement”. This applies the same conditions to the processes as would an authorisation, and in effect allows the environment agency to regulate the process.

With specific contaminants other regulations may apply or be of significance. For example, when the contaminant is radium the conditions and limitations in the Radioactive Substances (Phosphatic Substances, Rare Earths etc) Exemption Order 1962 may be used in the management of some radioactive wastes. The Special Waste Regulations are relevant to disposal of wastes containing some non-radioactive, and some radioactive, contaminants.

Statutory controls apply directly to MoD as site owners and operators. Occupational health and safety regulations also apply to organisations contracted to MoD to undertake work on contaminated defence sites.

A2.3

Use of the structured approach

The structured approach shown in Figure 4.1 of the main text is applicable to defence sites and it is recommended that it be used within the LQA programme (see Section A2.1.4). Section A2.3.1 outlines the contexts for decisions about contaminated land on defence sites, which affect how the approach can be applied. Section A2.3.2 discusses establishing objectives for the management of contaminated land (see also Section 4.3 of the main text). Applying the key principles (see Chapter 2 of the main text) is dealt with in Sections A2.4–A2.8, which include further guidance on identifying the land management option or strategy preferred by MoD as site owner and current operator. Subsequent steps in the structured approach are addressed in Sections A2.9–A2.12.

A2.3.1

Contexts for decisions on the management of contaminated land

The principal context in which decisions are required on the management of contaminated land on defence sites is when it has been established that the contamination represents an environmental liability and that something needs to be done. This could occur for:

- sites that are to remain in continued use by MoD
- sites that MoD are preparing for sale
- sites for which purchase arrangements are in place or being negotiated.

Decisions may also be required where a preliminary identification of preferred management options has been made through the LQA programme (see Section A2.1.4) but further work is needed to refine them and to proceed to identify the proposed option or the strategy for the whole site (see Figures 4.1 and 6.1 of the main text). There will also be circumstances where a desk study has identified there is a potential for ground contamination and further information is required to establish environmental liabilities. The guidance in the main text and in this appendix applies in all these contexts but particularly when it is known that there is an environmental liability but no preferred management option or strategy has yet been identified.

In the case of land that is to be sold, MoD has two approaches. In the first the MoD prepare the land for sale and in the second the land is sold with information and with an agreement which allows the price to be adjusted to take account of the remediation works undertaken by the purchaser. Where MoD prepare the land for sale they remain in control and are able to ensure appropriate stakeholder participation in decision making. Where MoD enters into an arrangement where the contamination management process is led by the purchaser they do not control the process. Under these circumstances it may not be possible for MoD to ensure that the stakeholder involvement is fully addressed, although MoD maintain an interest and monitor the works to completion, in order to ensure that the remediation is undertaken appropriately.

A2.3.2

Establishing objectives

Objectives for the management of the contaminated land (see Section 4.3 of the main text) are likely to have been set in whole or in part before the process of identifying the preferred management option begins. Some objectives may derive from Ministerial decisions, for example about the period available before a sale has to be completed, type of future land use or future operational issues. For the reasons given in Section 4.3 of the main text, it will often be best to set aside very specific imposed objectives when identifying the preferred management option, then return to them in deciding on the option to be implemented (see Section A2.9). This is particularly true of any

objectives related to one specific future use of land scheduled for sale. Environment health and safety objectives should be broad and qualitative, not specific and numerical (see Section A2.4 and Section 4.3 of the main text).

It is best not to include commercial objectives, such as maximising the sale value of the land or minimising financial risks at a very early stage in decision making. It is more efficient and more transparent to first identify the option that is preferred from a health, safety and environmental point of view, with broad costs as one factor, then to consider commercial matters in detail at a later stage (see also Sections A2.6 and A2.9).

A2.4

Applying Principle 1: Protection of people and the environment

The guidance in Section 3.1 of the main text applies in full to defence sites. Section 3.1 states that levels of protection should be defined on a case-by-case basis, and should emerge from a comparison of options for the management of contaminated land, rather than being defined a priori.

Historically, for radioactive materials, statutory control levels relating to concentrations in Schedule 1 of RSA were used to set or judge criteria for residual contamination. In the case of radium the relevant level is 0.37 Bq/g. Schedule 1 levels still have relevance as desirable attributes of a land management option because it means that, once the option has been implemented, any subsequent developer will not be subject to registration or authorisation under RSA. However, Schedule 1 levels were derived for and apply in radioactive waste management and are not appropriate for defining levels for the protection of people and the environment when deciding on land management options.

More recently, NRPB has issued guidance on radiological protection objectives for land contaminated with radionuclides (NRPB 1998). This recommends that protection of future site occupiers and workers undertaking decontamination operations should be optimised and based on the principle of ALARA (as low as reasonably achievable, economic and social factors taken into account). A further recommendation is that a constraint should be imposed on optimisation which results in the critical group associated with the site (the most exposed element of the population) not being subject to a risk of death per year greater than 10^{-5} . It also suggested the requirement for optimisation could be relaxed if risks were 10^{-6} or less although if risks could be reduced further with little expenditure of resource such measures should be taken. As a result the risk level of 10^{-6} has been used by MoD as a criterion to judge the acceptability of potential residual contamination.

To comply with the guidance in the main text, the NRPB 10^{-5} per year risk level should be used as a constraint when identifying the preferred option (see Section 5.3 of the main text). Achieving a residual risk level of 10^{-6} per year should be regarded as a desirable attribute of candidate options when they are compared (see Section 5.4 of the main text), but should not be used as a fixed objective, constraint or screening criterion, because this is unlikely to be acceptable to some groups of stakeholders and could place undue restrictions on the selection of options to be compared (see Section 3.1 of the main text).

A2.5

Applying Principle 2: Stakeholder involvement

The guidance in the main text on stakeholder involvement applies (see, in particular, Section 3.2) and further information is given in Collier (2002). Other issues specific to MoD sites are as follows.

A2.5.1

Sites remaining in MoD ownership

For MoD retained sites where land use changes are scheduled it is the responsibility of MoD to initiate stakeholder involvement and to ensure that the necessary range of interested individuals and organisations are consulted. Where a site is to remain in MoD ownership land management options may be limited to long term monitoring and maintenance, particularly where contamination is of a stable nature. Stakeholders in these circumstances may be few in number, possibly limited to regulators, representatives of the workforce and site neighbours. Whilst there is a need for MoD to maintain security on sites that are currently operational this is not justification to restrict interaction with stakeholders. The need for security and its impact on stakeholder involvement requires assessment at an early stage on a case-by-case basis, and the development of a suitable strategy.

A2.5.2

MoD sites for redevelopment

MoD sites released for redevelopment can attract considerable interest, especially if they are located in urban areas. Such sites are often large in relation to alternative sources of land that are available and as such are attractive for housing, commercial premises, retail parks and mixed developments. In these circumstances it may be better for the developer to lead stakeholder involvement with support from MoD. The MoD involvement is also likely to diminish as the project progresses. There may, however, be a need for MoD to initiate stakeholder involvement at an early stage prior to the selection of the developer. Developments of this nature can attract considerable interest due to their potential impact on existing communities and this interest is likely to be amplified where contamination is present.

Stakeholders in these circumstances may well include: parish and local authority representatives; regulators; utilities; community associations; NGOs; local pressure groups; and individual members of the public. If a development is to be successfully pursued with general acceptance or approval of the community, it is necessary that they be allowed access to information at an early stage. The information that can be made available includes the LQA reports and LQs prepared by the MoD, and outline details of the proposed development.

Stakeholder involvement may entail several meetings, identification of potential contamination management options and the development of alternative land management strategies. It is important for stakeholders to be made aware at an early stage of defence Ministers' role in decisions and the constraints that this may impose (see also Section A2.6.2). Strong opinions and concerns from stakeholders on environmental issues should be considered when comparing options. The contamination management and development impacts on the community during works and in the future should also be reviewed with the stakeholders. Regular reviews with interested stakeholders should be planned to advise on progress and to identify and address any ongoing concerns and impacts.

A2.5.3

Environmental Impact Assessment

Where the sale and development will lead to a requirement for an environmental impact assessment (EIA) the stakeholder involvement should be pursued in a manner such that it supports the development of the EIA. The EIA should be able to address issues of concern, which are raised by the stakeholders. This is more likely to result in the EIA process being completed in a timely manner (see also Section A2.9).

A2.6 Applying Principle 3: Identification of preferred land management option

The guidance in the main text (see, in particular, Chapter 5 and Figure 8.1) applies in full to defence sites. This section discusses issues that are specific to, or may need more emphasis at, these sites. It is for MoD to determine exactly how the recommended process of identifying their preferred option is to be fitted into LQA procedures.

A2.6.1 Identification of envisageable options

A particular point to bear in mind at defence sites is the need to consider a range of end uses for the land, especially when the site is to be sold (see Section 5.2 of the main text). This is to avoid situations where only one end use is considered initially and it is subsequently found that this use is unacceptable (for example, as a result of objections by stakeholders outside MoD, or because contamination is found to be greater than originally thought). If not enough end uses are included at the beginning then it will be necessary to repeat all of the identification of the preferred option stage, whereas if a range of end uses is considered initially a more limited iteration is likely to be enough (see Figure 5.1 of the main text).

A2.6.2 Constraints and screening criteria

Particular care is required in establishing constraints and screening criteria (see Section 5.3 of the main text). It is recommended that all proposed constraints be examined at the outset to allow an agreement to be reached with stakeholders as to their impact and how they should be managed in the options identification process.

Constraints that may have to be considered on defence land include:

- ministerial decisions
- environmental issues such as the presence of a rare habitat or designated SSSI
- availability of suitable waste disposal facilities for materials that may arise in management processes
- MoD operational requirements, which may in themselves limit management options
- road and access infrastructure, which may limit the movement of heavy vehicles and therefore the transport of wastes and access to heavy plant.

Waste containing radium at an activity concentration of 4.9 Bq/g can be disposed of to a suitable landfill, under the Radioactive Substances, Phosphatic Substances, Rare Earths etc Exemption Order 1962. Waste above that concentration requires authorised disposal as LLW under RSA. The only disposal route for the most active LLW is the BNFL Drigg facility in Cumbria. This has a limited capacity to accept radium and an annual activity limit is set for material arising from MoD land holdings. Waste with activity greater than 4000 Bq/g alpha and 12000 Bq/g beta is classified as ILW and no disposal route is available. Such material requires authorised transfer to a suitable secure storage facility.

In disposing of such material it is also necessary to consider the time constraints associated with such processes. It can take over 12 months to complete disposals to BNFL Drigg. If waste is accumulated during remediation works it has to remain on the site of arising in secure storage until such time as it can be consigned. This could be a constraint on the redevelopment potential for some sites.

It is recommended that financial costs are not used as constraints or screening criteria unless participating stakeholders agree to this. It is preferable to allow expensive options to proceed through the comparison and be ranked accordingly. If the cost of the preferred option exceeds the budget that appears to be available this should be dealt with in deciding on the option to be implemented (see Section A2.9).

A2.6.3

Attributes

The attributes used when comparing options should include: impacts on human health, impacts on the environment, technical performance of options, social and political factors, and financial cost (see Section 5.4 of the main text). Within social factors, a particular consideration may be the potential blight of a contaminated site on adjacent property and businesses. The cost estimates used should be broad ones; detailed analyses of financial risks are best left until deciding on the option to be implemented (see Section A2.9). For the reasons given in Section 5.5 of the main text, it is recommended that the comparison of options be done in two parts: one in which costs are not considered and one in which they are considered.

A2.7

Applying Principle 4: Immediate action

The MoD is currently pursuing a programme of land quality assessment (see Section A2.1.4) that largely addresses this principle. This procedure identifies the sources of contamination and where necessary site investigations and surveys are undertaken to confirm the extent and characteristics of the contamination present. The LQA includes risk assessments to identify hazard to receptor linkages and to evaluate the severity of impacts. Risks are ranked to allow immediate control of hazards that may pose an unacceptable risk to the identified receptors. This enables action to be taken which is consistent with the risks posed by the hazards. In some circumstances immediate action may be appropriate such as preventing uncontrolled access to areas where radioactive contamination is located. In other cases where contamination is relatively benign and immobile it may only be necessary to impose limited management controls to prevent disturbance.

The existing procedure, with the guidance in Section 3.4 of the main text, is sufficient to address this principle.

A2.8

Applying Principle 5: Record-keeping

The existing MoD LQA programme goes some way to creating initial records on the identification and management of contaminated land. However where remediation processes are undertaken either by MoD prior to the sale of land or by a developer as a part of the sale agreement, MoD should maintain interest in the land. This is to ensure that adequate records are available regarding the final land quality and the level of residual risk that may be posed. As the polluter MoD can retain responsibilities for the quality of the land and adequate records will be necessary on which to form the basis of any future decisions (see also Section 3.5 of the main text).

The LQA programme now encompasses a large number of sites. MoD is now investigating new software to improve its holding of information about contaminated land. This will integrate LQA reports already completed with information from other sources, including remedial works already carried out, in order to provide a comprehensive record. It is recommended that the information available should be developed into a managed database. The information available in the factual reports and LQS is unrestricted and as such this could be available within the public domain as part of database structure. Such a system should also contain details of any contamination management processes that have been completed, waste disposal records and the final quality of the land. The database would encompass the records from MoD involvement with the site. However changes made during subsequent ownerships would be difficult to capture for record purposes.

It would be beneficial for MoD to regularly review the manner in which the records for the retention of contaminated land are maintained nationally. At some time in the future MoD information may need to be replicated on a national database that is regularly updated.

A2.9

Deciding on the option to be implemented

A2.9.1

General

The steps in deciding on the option to be implemented are illustrated schematically in Figure 6.1 of the main text and discussed in Chapter 6. Where the land is to be sold for redevelopment, the step of “considering the preferred option/strategy for managing the contaminated land in acceptance procedures” (see Figure 6.1) includes the MoD decision on whether they will carry out remediation prior to sale or whether the land will be sold and remediation carried out by the purchaser.

In the latter case development of the proposed option/strategy is carried out by the purchaser, who also takes the final decision to implement. MoD will normally retain a role to audit the works and ensure that any liabilities have been discharged. The preferred option identified by MoD should be used to guide purchaser’s proposals. There may be information from initial stakeholder (including regulator) consultation undertaken by MoD. All such information should be passed to the purchaser. Ideally, the process of developing the chosen option should be open and transparent. Communications procedures between the purchaser, MoD and stakeholders should be clearly established.

Detailed financial aspects are addressed in consideration of the preferred option/strategy in MoD acceptance procedures and in development of the proposed option/strategy for managing the land. It is in these steps that it is appropriate to use analyses of the financial risks of options/strategies, to address the commercial objectives for the site and to take into account real or apparent budget constraints.

Regulators, especially the relevant environment agency, should be consulted in the step of considering the preferred option/strategy and again prior to the decision to implement (see also Section A2.9.2 below). If planning permission is required it should be sought and approval gained prior to the decision to implement. If an EIA is required it is best to begin its preparation early, so that consultation has taken place before the final assessment of the proposed option/strategy by decision-makers. The final decision to implement can only be taken when MoD and other approvals have been given. All MoD decisions on implementation are subject to Ministerial ratification.

A2.9.2

Regulatory approvals

For defence sites where remediation involves radioactive material excavation, it will be necessary to obtain authorisation to accumulate and dispose of radioactive waste from the relevant environment agency, or equivalent agreement where remediation is undertaken directly by MoD (see Section A2.2). A minimum period of three months and a more usual period of six months should be allowed between submissions and obtaining an authorisation.

If non-radioactive wastes are to be relocated on-site then a pollution prevention and control (PPC) permit or an exemption from the PPC regime will be required. Radioactive waste disposal on site is only appropriate if an authorisation is held under RSA.

A disposal route for both radioactive and non-radioactive waste needs to be identified. For low level waste disposal is likely to be to BNFL Drigg. Annual input restrictions operate at Drigg and a disposal allocation needs to be established prior to submission of a formal application. Landfill tax exemption can be obtained.

Where civil engineering and construction works are involved the Construction (Design and Management) Regulations 1994 will apply to all but the smallest projects (defined as a duration of 30 days or less and involving four or less people on site at any one time). Notification to HSE is required for larger projects and the client is required to appoint a Planning Supervisor for the design and planning stage. A Principal Contractor is appointed for the construction phase.

A2.10

Implementation

This section should be used in conjunction with Chapter 7 (and Figure 7.1) of the main text.

A2.10.1

Planning

There are a large number of issues to be considered in the implementation of the selected land management option on defence sites. Detailed planning of the implementation is a requirement for all but the simplest operations. Practical considerations may include the following.

A2.10.1.1

Management and control

- ongoing stakeholders communication and procedures
- ongoing liaison with statutory bodies and regulators
- financial management and forecasting
- progress reporting
- contract strategy and contract risk register
- project management structure
- interfaces with any existing site management structure
- interfaces with any existing site controls and procedures
- resource identification (managerial and site staffing)
- contractor pre-qualification (if appropriate)
- dispute resolution
- project programming and identification of milestone and hold points.

A2.10.1.2

Technical

- preparation of technical specification for works
- waste disposal plan and disposal arrangements (if appropriate)
- identification of residual contamination target levels
- identification of physical end point requirements including reinstatement provisions
- environmental monitoring and validation requirements
- contingency arrangements
- provision of necessary services and facilities.

A2.10.1.3

Safety

- preparation of project health safety and environment plan and safety case where appropriate
- specification of appropriate safety documentation and assessments
- category of works in respect of the potential for on site and off site releases and impacts
- identification of the safety review and endorsement structure

- review of the adequacy of site safety facilities to support the work (change rooms, dosimetry, health physics, emergency services)
- identification of how project safety structure control integrates with site safety structure.

On many defence sites the existing site controls and skills may not be adequate to address contamination issues and will rely on external resources available elsewhere within MoD. In these cases planning will require additional management input to identify the necessary resources.

A2.10.2

Contract strategy

The contractual arrangements for remediation of defence sites can take many forms. These include:

- management/remediation direct by MoD agencies, for example Dstl Radiation Protection Services. This arrangement is for smaller scale remediation projects on active MoD sites or where the nature of contamination is such that civilian contractors do not have the necessary expertise
- MoD direct engagement of specialist contractors to undertake remediation work. This is generally the case on larger sites. Contractor engagement on such projects is normally under the GC (Government) Works form of contract
- purchaser led remediation with contractors being engaged under a variety of contract forms.

The conditions of contract will form part of the package of contract documentation which will generally include a specification, drawings and bill of quantities. In compiling the documentation consideration should be given to managing risk and unforeseen elements. This is discussed further in the next section.

The specification will detail the requirements of the work to be undertaken. It may require implementation of particular methodologies such that the definition of the works is comprehensive. On the other hand the specification may include performance requirements which the contractor is to meet. In this case the contractor develops the detailed methodology within the prescribed framework to achieve the performance objectives. In practice the contract may include a combination of both specific and performance requirements.

The specification should detail the requirements of contractor submissions and the programme for approvals. The organisations undertaking the approvals should be specified (eg MoD project manager, Environment Agency etc). These submissions will generally comprise method statements and related risk assessments and the lead in time for their preparation, modification and review can be substantial.

Management of the contract and supervision of works undertaken by the contractor requires particular skills. These may be wholly available within the MoD organisation or support from consultants may be sought. Developer led schemes are more likely to require specialist consultants inputs. Roles and responsibilities of the various parties should be carefully defined. Where MoD sell sites subject to remediation by developers the number of advisors on the MoD and developers project teams can be large and good co-ordination and communication is required.

A2.10.3

Management of contract risk

The specific risks that are associated with the remediation of contaminated land on defence sites are:

- the accuracy of the prediction of quantities of materials which have to be removed or treated
- the accuracy of the prediction of contamination concentrations
- the accuracy of the spatial distribution of the contamination and its potential interaction with subground structures and the water table
- other unknown factors which relate to the existence of the contamination and its properties, particularly within inaccessible areas such as building fabrics and below floor slabs and hardstanding.

A well planned, executed and reported site characterisation programme is therefore essential. This coupled with a sound estimate and financial risk analysis should reduce the risks to both the MoD/developer and contractor.

If the contractor takes the risks associated with the remediation process, generally as a result of a fixed price contract, the price is likely to be made up by the base cost predicted by the contractor plus an additional risk sum. The risk sum may need to be minimised in order to be competitive in a tendering exercise. If the risks do not materialise then the contractor makes an enhanced profit. However the reverse could also occur when the risk sum is insufficient and the contractor loses money. Fixed price forms of contract are generally considered adversarial and unsuitable for remedial works involving radioactive contamination.

If the MoD or developer takes the risk, generally as a result of a re-measured reimbursable contract, then the costs at the start of the job are uncertain. There is also less incentive for the contractor to work efficiently and economically.

The most appropriate contract arrangement may be where the basic remediation requirements are defined and costed in the contract documents by way of a priced bill and additions are priced and agreed separately on an equitable basis between the employer and contractor. There are contract forms such as the Institution of Civil Engineers New Engineering Contract which have mechanisms for distribution of risk between employer and contractor and procedures for recording and agreeing variations. For larger projects it may be appropriate to include for hold points within the contract.

As part of the project planning and budget allocation it is desirable to allow for risks by providing contingency funding. Indeed without an adequate appraisal and costing of risks the budgeting process cannot be considered to be complete. The base cost established on the best predicted estimates of the work necessary can be easily obtained. However the true cost of the project may exceed this if risks materialise.

Remediation of defence sites involves a number of areas of uncertainty and it is particularly important that risk sums are adequately assessed and a sufficient contingency provided to support the project. It is unlikely that all the risks identified will materialise and costing on such a basis would result in an unreasonably large contingency. A systematic or argued approach to the make up of a contingency sum should be adopted. Contingencies are likely to be greater when insufficient characterisation of the contamination has been undertaken.

Uncertainties can be managed to some degree by remediation capping insurance. Such policies can be tailored to cover for additional onsite contamination, offsite-contamination, and statutory authority changes to remediation requirements during the course of the works. The policy cost will be proportional to the risk and can be substantial. Such insurances may not be commercially available on some sites.

A2.10.4

Operational health, safety and environmental protection

The IRRs apply to work with radioactive materials on defence sites. The regulations require managerial controls, physical controls, risk assessments, work place monitoring, worker dosimetry, medical surveillance for classified workers and the appointment of personnel to advise and control the work who are competent in the requirements of radiation protection.

A radiation protection advisor (RPA) should be appointed by each employer who has personnel working with ionising radiation and a notification should be made to HSE. There may be a number of RPAs engaged by different organisations on the same project and liaison between RPAs is essential. It is normally specified in contracts that, in the event of a dispute, the MoD RPA's decision is final.

A risk assessment must be undertaken for each element of the work involving radioactive materials and contingency plans formulated if identified by the assessment. The SAFEGROUNDS Site Characterisation Guidance (Baker *et al*, 2000) provides information on restriction of exposure, personnel monitoring, safety management arrangements and environmental protection.

A2.10.5

Waste management issues

Remediation works on defence sites and particularly those scheduled for sale usually involve excavation and disposal of radioactively contaminated soils. In this case consideration needs to be given to the following:

- the sentencing of waste materials and agreement on averaging volumes. Further guidance is provided in Environment Agency (2002b)
- waste categories
- compliance with the Radioactive Material (Road Transport) Regulations.

These matters will need to be addressed in the application for an authorisation under RSA and also in the quality plan where wastes are to be disposed at Drigg.

On the majority of defence sites MoD retain ownership of radioactive wastes until the land transfer has been completed. The agreement for disposal to Drigg therefore has to be developed between MoD, BNFL and, where appointed, the remediation contractor (who will normally be the waste consignor). The responsibilities for waste management and execution of duty of care requirements needs to be clearly established. MoD retain Dstl Radiation Protection Services or environmental consultants to oversee and audit the waste management process.

Contaminated soils including radioactive material exempt from control and suitable for landfill disposal should be exempted from landfill tax. An application for landfill tax exemption should be made to HM Customs and Excise.

A2.10.6

Monitoring

Sampling monitoring and testing requirements both during and following implementation should be specified. Examples are given in the following table. The monitoring can be carried out by those undertaking remediation or managing the site. Some independent third party monitoring is recommended, particularly on larger schemes, as detailed in Section A2.11.3.

Work Element	Monitoring requirements
Excavation and off site disposal of soils	Monitoring, sampling and testing to determine material is compliant with: <ul style="list-style-type: none"> • acceptance limits for receiving sites • transport regulations.
On site disposals of soils	Monitoring, sampling and testing to confirm material complies with licence or permit limits for on site disposal
Discharges of liquids	Measuring the quantity and quality of discharges to watercourses or sewers to confirm compliance with discharge consents
Imported materials, especially soils	Testing to determine compliance with specification
Worker assessment	Monitoring, testing and assessment to demonstrate exposure limits are not exceeded
Public health/offsite impacts	Monitoring and testing to demonstrate no unacceptable off-site impacts, may include dust, vapour and noise monitoring
Groundwater protection	Routine monitoring of groundwater to determine no adverse impacts caused
Meeting performance levels/targets	Regular monitoring, sampling and testing to determine, for example that: <ul style="list-style-type: none"> • following excavation clearance levels have been met prior to backfilling • requirements stipulated in authorisation and PPC permits are being followed and that there is suitable information to enable their surrender.

A2.10.7

Reporting

It is good practice to keep external stakeholders, particularly regulatory authorities and local people, informed of progress during implementation of remediation works. Communications procedures should be clearly established, as there are normally a large number of organisations involved in remediation of defence sites. Progress reports are considered a useful way of disseminating information, including monitoring data. Records should be kept available for inspection throughout the contract period.

A2.11

Validation

A2.11.1

Completion surveys

Completion survey requirements should be established on a project by project basis. The term completion could reflect a number of scenarios depending on the risk management strategy being implemented. Examples include:

- completion of remediation of a site in a number of phases, where one phase is to be completed and validated before the next can begin
- a scheme where on-going environmental monitoring is necessary after the remedial works have been completed
- schemes where end-point criteria can be readily demonstrated on completion of remedial works.

Completion requirements are usually tied-in to specified regulatory conditions, for example revocation of an authorisation under RSA, discharge of a planning condition, or surrender of a PPC permit.

In general completion surveys will be an aggregation of construction phase monitoring information plus any “final” survey to demonstrate overall compliance. For sites with radiological contamination this might include a radiological survey of all remediated areas, supplemented by a grid of sampling and testing. For chemical contamination a grid of sampling and testing is a possible solution. Such “final” surveys should be co-ordinated with third party checks (see Section A2.11.3).

A2.11.2

Post construction monitoring

Certain risk management solutions may require post construction monitoring to demonstrate their continued performance. Examples where post construction monitoring may be required include:

- evaluation of long term improvement in groundwater quality following contamination source removal
- demonstrating the on-going integrity of source isolation methods (eg capping or cut-off walls)
- determining long-term performance of treatment systems.

Such schemes are those where contaminants remain, or the end-point of remediation treatment is uncertain. A plan for post construction monitoring needs to be developed and implemented under these circumstances.

Post construction monitoring may be required over a period of many years. The end point may be determined by compliance with a form of regulatory control.

A2.11.3

Third party checks

There is a growing recognition that third party checks can provide additional confidence to stakeholders that end-point criteria have been met. Third party checks would be completed by an organisation independent of the site owner, remediation contractor or supervising body.

The extent of such checks will be dependent upon the sensitivity of the site and the degree of confidence that all parties have in the process. For instance, if dust impacts to adjacent residents have been identified as a risk management issue, then some third party agreement of the dust sampling and monitoring process, coupled with some independent sampling and testing may provide a level of confidence satisfactory for all stakeholders. Communication of such data is an important consideration.

An independent check that remediation criteria have been reached is advised. This may constitute independent radiological surveys on completion of parts or all of a site. Depending on the nature and distribution of contaminants, sampling and testing may also be appropriate.

It is necessary to clearly define the brief of any third party testing organisation, both to control the distribution of information and to ensure the methods used are compatible with those of the main works monitoring and testing regimes. Any third party checks do not invalidate the “clearance statements” made by the contractor for the works, because this could affect the warranties issued by the contractor. The contract should state what is to be done if third party checks find that the remediation has not been completed satisfactorily. Where the MoD RPA has carried out the check, and the contract states that this RPA’s opinion is final, further work will be required by the contractor.

A2.12

Making records during implementation and validation

Throughout the remediation process it is necessary to have confidence that the monitoring procedures are being implemented and that the resulting data is assessed in accordance with the work plans and method statements. This approach forms part of an audit trail which is used to provide transparency of the process of scientific and technical evaluation and implementation. A recording procedure should be established for each project.

Records should clearly document the limitation of particular techniques, and any uncertainties which may arise. Some of the uncertainties associated with evaluation of data are given in the SAFEGROUNDS *Site characterisation* Guidance (Baker *et al*, 2000). Practical limitations to techniques on defence sites may include:

- surface radiological surveys may be unable to detect “deep” contamination
- reduced sensitivity of radiological survey in areas of hard-standing due to the shielding effect of surfacing materials.

A2.12.1

Types of records

A considerable volume of monitoring and recording data will be generated during the remediation process. The bodies responsible for collection and assessment of the data (normally the remediation contractor and MoD/developer and their consultants) will need to ensure that the record format accords with that agreed prior to works commencement.

The type of record made available during the progress of works and on completion will vary depending on the audience. A summary report should be considered, which can be supplemented with technical appendices containing the numerical data. Graphs, tables and figures are useful ways of summarising and presenting large volumes of data.

For projects exceeding a few months in duration progress reports summarising accumulated data should be prepared. Results obtained should be compared to compliance levels and any trends noted. Explanation should be provided for any non-compliance, and any changes in the monitoring strategy and programme noted.

A2.12.2

Land quality statement

A Land Quality Statement (LQS) is a record document which is prepared in each LQA phase, including on completion of remediation works, on defence sites (see Section A2.1.4). It provides a framework for:

- describing the site, and summarising its setting and history
- summarising the scope and findings of radiological and chemical contamination investigations
- summarising the objectives and agreed end-points for remediation
- describing the remediation and validation works undertaken
- documenting the condition of the site and providing an assessment of any residual environmental risk.

As a minimum the LQS for later phases of work will contain information relating to:

- the location and nature of works undertaken

- the quantity and types of waste generated and their disposal routes
- results of clearance surveys

Preparation of a final LQS is consistent with the requirements of, for example, the Environment Agency in order to seek revocation of an authorisation under RSA. It is recommended a draft report is submitted to regulators for comment.

The LQS is a tool which can have multi-functional uses. As well as providing evidence to regulators to enable discharge of any applicable permits, licenses, planning conditions and authorisations, it can also be used to:

- meet the requirements of a health and safety file where works are carried out under the Construction (Design and Management) Regulations 1996
- provide condition information in respect to land development, transactions and insurances.

The LQs should be retained within the document management system of MoD, the site owner and or occupier, the relevant environment agency and the planning authority.