

# **Appendix B**

## **Further Guidance for Defence Sites**

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# B1 Background

## B1.1 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].

## B1.2 RADIOACTIVE CONTAMINANTS

### B1.2.1 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.

### B1.2.2 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, e.g. 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.

## **B1.3 NON RADIOACTIVE CONTAMINATION**

### **B1.3.1 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.

### **B1.3.2 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.

### **B1.3.3 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.

## **B1.4 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 (LQs) 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.

## B2 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.

## **B3 Use of the Structured Approach**

The structured approach shown in Figure 1 of the main text is applicable to defence sites and it is recommended that it be used within the LQA programme (see Section B1.4). Section B3.1 outlines the contexts for decisions about contaminated land on defence sites, which affect how the approach can be applied. Section B3.2 discusses establishing objectives for the management of contaminated land (see also Section 4.3 of the main text). Applying the key principles (see Section 2 of the main text) is dealt with in Sections B4-B8, 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 B9-B12.

### **B3.1 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 B1.4) 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 1 and 3 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.

## B3.2

### 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 B9). 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 B4 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 B6 and B9).

## B4

### 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).

## **B5 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.

### **B5.1 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.

### **B5.2 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 B6.2). 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.

### **B5.3 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 B9).

## **B6 Applying Principle 3: Identification of Preferred Land Management Option**

The guidance in the main text (see, in particular, Section 5 and Figure 2) 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.

### **B6.1 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 2 of the main text).

## **B6.2 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 B9).

## **B6.3 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 B9). 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.

## **B7**                      **Applying Principle 4: Immediate Action**

The MoD is currently pursuing a programme of land quality assessment (see Section B1.4) 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.

## **B8**                      **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.

## **B9** **Deciding on the Option to be Implemented**

### **B9.1** **GENERAL**

The steps in deciding on the option to be implemented are illustrated schematically in Figure 3 of the main text and discussed in Section 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 3) 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 B9.2 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.

### **B9.2** **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 B2). 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.

## **B10 Implementation**

This section should be used in conjunction with Section 7 (and Figure 4) of the main text.

### **B10.1 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.

#### **B10.1.1 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.

**B10.1.2****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.

**B10.1.3****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.

**B10.2****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 (e.g. 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.

## B10.3

### 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.

## **B10.4**

### **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.

## **B10.5 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.

## **B10.6 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 B11.3.

<b>Work Element</b>	<b>Monitoring Requirements</b>
Excavation and off site disposal of soils	Monitoring, sampling and testing to determine material is compliant with: <ul style="list-style-type: none"> <li>• acceptance limits for receiving sites</li> <li>• transport regulations</li> </ul>
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"> <li>• following excavation clearance levels have been met prior to backfilling</li> <li>• requirements stipulated in authorisation and PPC permits are being followed and that there is suitable information to enable their surrender</li> </ul>

**B10.7****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.

# B11 Validation

## B11.1 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 B11.3).

## B11.2 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 (e.g. 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.

**B11.3****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.

**B12****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.

**B12.1****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.

**B12.2****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 B1.4). 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.