

PRACTITIONER GUIDE

Contaminated Land Management: Land Quality Assessment (LQA) Management Guide

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Who Should Read this: MOD staff and Contractors responsible for the assessment and management of land contamination and associated liabilities.

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Document Aim: MOD policy on land contamination is set out in JSP 418, Vol 2, Leaflet 2, Contaminated Land. This Guide is intended to provide assistance to MOD staff and contractors responsible for the assessment and management of land contamination and associated liabilities.

1. Document Synopsis: This Guide sets out the Land Quality Assessment (LQA) process and provides detailed guidance on carrying out LQAs. It identifies the points at which decisions are required and provides guidance on the best way to address the issues involved.
2. Every establishment within the MOD estate is unique. Therefore, this Guide does not attempt to advise on every technical issue involved in an LQA. Once the need for a LQA has been identified specialist advice should be sought immediately before commencing the LQA. Consultation at an early stage is essential.

Contaminated Land Management Land Quality Assessment (LQA) Management Guide

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Abbreviations

CLEA	Contaminated Land Exposure Assessment
COSHH	Control of Substances Hazardous to Health
DE	Defence Estates
DWS	Drinking Water Standard
EMS	Environmental Management System
EQS	Environmental Quality Standards
IEMA	Institute of Environmental Management and Assessment
JSP	Joint Service Publication
LCR	Land Condition Record
LQA	Land Quality Assessment
LQS	Land Quality Statement
MOD	Ministry of Defence
NAAFI	Navy Army Air Force Institute
PPC	Pollution Prevention and Control
PUS	Permanent Under Secretary
RPC	Regional Prime Contract
SGV	Soil Guideline Value
SiLC	Specialist in Land Condition
TLB	Top Level Budget Holders

Contaminated Land Management Land Quality Assessment (LQA) Management Guide

INTRODUCTION

Purpose of This Guide

- 1.1 MOD Policy on land contamination is set out in JSP 418, Vol 2, Leaflet 2, Contaminated Land. This Guide is intended to provide assistance to MOD staff and contractors responsible for the assessment and management of land contamination and associated liabilities. This guide sets out the Land Quality Assessment (LQA) process and provides detailed guidance on carrying out LQAs. It identifies the points at which decisions are required and provides guidance on the best way to address the issues involved.
- 1.2 Every establishment within the MOD estate is unique. Therefore, this Guide does not attempt to advise on every technical issue involved in a LQA. Once the need for a LQA has been identified specialist advice should be sought immediately before commencing the LQA. (Contact points for these specialist services are given in Annex A). Consultation at an early stage is essential.

REQUIREMENT FOR LAND QUALITY ASSESSMENT

Background

- 1.3 Occupation of land may give rise to contamination and pollution that can present significant legal and financial liabilities for landowners and site owners and operators such as MOD. Legal liabilities can result from a breach of statutory legislation leading to fines or imprisonment else they can result from action brought under civil law. The latter concerns nuisance, negligence and trespass all of which can be used to seek redress in circumstances involving the migration of contamination and the generation of dust and noise, etc.
- 1.4 Contamination of land, and pollution of waters by way of the condition of land, arises principally from various historic process and land management practices. These have led to deposition in, on or under land of substances, such as oils and tars, heavy metals, organic compounds and soluble salts, radioactive materials, ordnance and mining materials; and from the landfilling of waste without adequate precautions against leaching or the escape of landfill gases. For the purpose of this guide, the following definitions apply:
 - Contamination: The presence of a substance, agent or energy with the potential to cause harm to human health and/or the environment
 - Pollution: The anthropogenic introduction into the environment of substances, agents or energy in sufficient quantity or concentration as to cause hazards to human health, harm to living resources and ecological systems and damage to infrastructure or amenity.
- 1.5 The presence of contamination may lead to:
 - a. Harm to the health of users and occupiers of land, for example because of the presence of asbestos fibres, toxic metals or carcinogenic compounds.
 - b. Harm to the environment, which may have implications for ecosystems.
 - c. Harm to water quality. This includes surface water, and also groundwater - abstraction of which makes up 35% of the total public supply.
 - d. Direct physical harm to human beings, for example through explosion of landfill gas or contamination of food.
 - e. Harm to structures, e.g. through chemical attack on building materials.
- 1.6 The requirement to take action depends on the nature and extent of any contamination that may be present, the magnitude of the associated health and environmental risks and the effectiveness of the management response.

MOD has a duty to assess and manage contaminated land liabilities associated with the historical and current operations within the UK, her dominions and overseas theatres of operation. To meet this duty, the MOD initiated LQAs in 1995. This Guide provides best practice guidance on the LQA process. The latter provides a risk based management framework for auditable, robust and defensible management decision making.

- 1.7 A LQA quantifies land contamination risks and the associated liability (health, environment, legal and financial) which is relevant to a wide range of defence activities, including H&S at Work, Environmental Protection, Estate Development, Planning applications etc.

Statutory Regulation

- 1.8 Central to the UK's regulation of contaminated land is Part 2A of the Environmental Protection Act 1990 and the Town and Country Planning Acts. Part 2A together with the relevant Contaminated Land regulations and statutory guidance for England, Scotland and Wales introduced a statutory regime for the identification and remediation of contaminated land that enshrined the principles of 'polluter pays' and 'suitable for use'. The Contaminated Land Regime came into effect in England, Scotland and Wales on 1 April 2000, 14 July 2000 and 1 July 2001 respectively. In September 2006, Part 2A was modified and extended to include land that is contaminated by virtue of radioactivity. In Northern Ireland regulatory functions were transferred to the Environment and Heritage Service (EHS) with the introduction of the Waste and Contaminated Land Order (WCLO) (NI) 1997 which brings legislation on waste and contaminated land broadly into line with the rest of the UK. WCLO Part III Contaminated Land has yet to be enabled.
- 1.9 The Contaminated Land Regime is focused on land which, has been contaminated in the past. A range of other regulatory regimes do however deal with contaminated land the main ones being: Planning and Development Control, Pollution Control and Pollution Prevention Control (PPC), Waste Management licensing, Statutory Nuisance, Water Resources (Water Resource/Control of Pollution legislation) and Radioactive Substance Act and so Part 2A should not be considered in isolation. It must be remembered that the intention is for contaminated land to be dealt with primarily through the Planning and Development Control Regime.
- 1.10 Local Planning Authorities are responsible under the Planning Acts for the preparation of local development frameworks and for the control of development. In doing so, they have a duty to take account of all material considerations, including contamination. It is their role to plan for uses that are appropriate in the light of all the relevant circumstances, including applying and enforcing any necessary conditions. Such conditions may require that land is remediated in the course of development to an appropriate standard, taking account of its intended use, and that, if necessary, it is properly maintained thereafter.
- 1.11 A range of other regulatory regimes have been or are being introduced to prevent new contamination. The most significant are: - PPC Regulations and Waste Management Licensing.
- 1.12 Whilst the Contaminated Land Regime only applies in instances where contamination/pollution is not regulated by other controls, such as a waste management licence or PPC permit, it is such that liability is retrospective and is limitless in time.
- 1.13 Under the Part 2A regime, Local Authorities are required to identify the contaminated land in their area according to the following definition:

“(a) significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) pollution of controlled waters is being, or likely to be, caused.”

The Local Authority is the enforcing authority for all sites which are not deemed ‘special sites’. The Environment Agency is the enforcing authority for ‘special sites’.

The designation of a **Special Site** cannot take place until the land in question has been formally identified as **Contaminated Land** by the Local Authority and it meets one or more of the descriptions prescribed in the Regulations. The descriptions for Special Sites include:

- Any **Contaminated Land** at current military, naval, and airforce bases and other properties, including those of visiting forces;
- The Atomic Weapons Establishment;
- Certain lands at Greenwich Hospital;
- All land currently or formerly used for the manufacture, production, or disposal of chemical and biological weapons and related materials, regardless of current ownership;
- Land used in the manufacture of explosives; and
- Land which is contaminated land wholly or partly by the presence of radioactivity.

The descriptions for Special Sites exclude:

- Off-base housing;
- Off-base Navy Army Airforce Institute (NAAFI) premises;
- Property disposed of to civil ownership and occupation; and
- Privately owned training areas and ranges which are used occasionally by the MOD.

1.14 The Government considers it appropriate for detailed investigations of any potential 'special site' to be carried out by the EA/SEPA/EHI acting on behalf of the LA. All Regulators will encourage landowners to carry out voluntary inspections. Where there is evidence that MOD is the polluter and the appropriate person to bear the responsibility for managing the contamination, MOD is committed to carrying out investigation on a voluntary basis.

1.15 Consequently, the regime has implications for land owned, (freehold and leasehold), occupied, leased to third parties, sold or purchased by MOD.

MOD Policy

Legislation

1.16 It is MOD policy to comply with the Environmental Protection Act 1990, the Environment Act 1995, other relevant statutory provisions and any additional requirements arising from international treaties and protocols to which the UK is a signatory. Overseas MOD will apply UK standards where reasonably practicable and in addition comply with relevant 'host nations' standards. Crown or defence exemptions to legislation are only to be invoked where required to maintain operational effectiveness.

1.17 In terms of land contamination, MOD policy is to assess the land quality across the MOD estate in order to provide a proper knowledge of the condition of the estate and ensure that it is 'suitable for use'. Where it is identified that unacceptable risk is posed by the presence of contamination, action must be taken to reduce and control the risks to an acceptable level.

1.18 MOD will meet its statutory commitments and take voluntary action where a risk of significant harm to health and safety or the environment is confirmed and the MOD is the 'appropriate person' to bear the responsibility for remediation action. Remediation actions will be agreed with the appropriate Regulatory Authorities.

General LQA

1.19 Each TLB has a duty to the Secretary of State to ensure that there are processes in place to protect the health, safety and welfare of personnel, contractors and visitors on their establishments and to protect the environment. In order to discharge their duties with regard to land contamination each TLB should:

- Ensure that there is a funded prioritised LQA programme in place to assess the areas of the estate for which they are responsible for to identify any potential unacceptable risks.
- Ensure that where it is identified that an unacceptable risk is posed by the presence of contamination, action is taken to reduce and control those risks to an acceptable level.

- Have a process in place to monitor and report the management of land contamination risk.

Process maps for each phase of the LQA process are included in the appropriate section of this document.

- 1.20 Once a LQA is complete, each TLB is responsible for ensuring the LQA information is kept up to date for land and property retained by MOD. It is good practice that a Land Quality File is maintained at site level that documents the findings of LQAs, ground investigations and other relevant information with regard to land contamination. A Land Condition Report (LCR) Annex 3 – Record of Desk Studies and inspections is an appropriate form on which to catalogue this information. However completing a LCR does not negate the requirement to undertake a LQA.
- 1.21 The LCR is a standardised UK specific document that provides a cost-effective way of documenting and referencing key land quality information such that it can be easily updated and accessed for the purpose of undertaking or updating LQAs. A LCR does not include results or information based on judgement or particular circumstances, however it does provide the ideal starting point for a LQA and their maintenance will reduce the time and cost involved in preparing LQAs. Carrying out a LQA requires a multi-disciplinary approach and the involvement of appropriately trained and experienced specialists. As such LQAs should only be undertaken by or under the supervision of the LQA specialists documented at Annex A. LCRs can be readily undertaken through Regional Prime Contracts (RPCs).
- 1.22 A LQA provides a snap-shot in time and the risk assessment and land contamination management strategy within a LQA is tailored to individual site conditions and proposed use. The risk assessment with the LQA has a limited shelf life and should be reviewed whenever there is a significant change to site activity, change in relevant legislation, change of statutory guidance or a pollution incident occurs. Where an investment decision is to be made based on a pre-existing LQA the parameters and assumptions within the LQA should be checked to ensure they are still valid.
- 1.23 It is MOD policy to maintain an Environmental Management System (EMS) based on ISO 14001 covering all activities on the defence estate (see JSP 418, Vol 1, Chapter 11). The establishment EMS provides a cost effective vehicle for regularly reviewing land contamination risks and triggering a formal update when required. Land contamination hazards identified by the LQA or other site investigations should be transferred to the site hazard register and significant risks to the integrated site risk assessment. Where the LQA identifies significant land contamination risks, these should be regularly reviewed as part of the site Environmental Management system (EMS).

Remediation

- 1.24 Current MOD policy on contaminated land is to undertake decontamination where there is an unacceptable risk to health and safety or the environment. For disposal sites, remediation is generally confined to the removal of ordnance, and other defence specific contaminants such as chemical agents, radioactive and microbiological materials, where a civilian contractor might not have the relevant experience. Again further details are available in JSP 418, Volume 2, Leaflet 1.

Site Disposal

- 1.25 Defence Estates (DE) has Estate Surveyor's Delegation for the MOD estate and is responsible for all land transactions. Unless otherwise agreed DE will not accept a site for disposal without:-
- Explosive Ordnance Clearance (EOC) certificate and/or clearance risk assessment together with the works required to produce the certificate and/or risk assessment.
 - An independent Land Quality Assessment (LQA) Phase I desktop study covered by a collateral warranty.
 - A Closure Risk Assessment (CRA)
- 1.26 Establishments known or suspected to be contaminated can have a significantly reduced potential disposal value. Often they are still suitable for MOD industrial usage and may remain an asset if retained and managed appropriately. Remediation may be a requirement of any future MOD development on a retained establishment. When deciding which establishments to release from MOD ownership, it is important to understand the nature and magnitude of the contaminated land liability.

- 1.27 Demonstrating that an establishment has not been contaminated will add to its value, through greater market demand and the avoidance of commercial blight. Establishments that have been remediated may not achieve the same value as those that have remained uncontaminated.
- 1.28 A robust independent LQA undertaken at the time of disposal is essential if a defence against compensation claims arising from any post disposal contamination by the new or subsequent land owner(s) is to be provided. It will also enable MOD to take advantage of the mechanisms available under the new Contaminated Land Regime for the transfer of the financial liability in respect of clean up to the purchaser. The LQA must be supported by a Collateral Warranty in order to provide the necessary assurance to a purchaser, their funders and insurers.

Site Acquisition, Leasing and Redevelopment

- 1.29 For MOD purchases of land since the beginning of 1990 where the seller has given MOD permission to carry out its own investigations of the condition of the land, unless there are any other considerations it is likely that MOD will be deemed to have accepted liability for any necessary remediation. For MOD disposals the prospective purchaser should be given the opportunity to undertake his own survey.
- 1.30 MOD will need to establish the land quality prior to purchasing, leasing or redeveloping an establishment. Robust LQAs produced by competent persons and organisations are therefore required. For redevelopments under Private Finance Initiatives (PFIs) the LQA must be supported by a collateral warranty as the PFI partner will wish to rely upon the assessment.
- 1.31 Therefore, it is essential to consult DE before producing a LQA for the disposal of a site or the development of an establishment under a PFI particularly where the latter may involve the disposal of land. Guidance on the site closure process is available from the Design and Maintenance Guide 12, Site Closure Guide produced by DE.

Objectives and Approach to Land Quality Assessment

- 1.32 Information on land quality for a site is required to inform development decisions and where necessary, identify appropriate remediation options and pollution prevention and control measures. The objective of a LQA is to quantify the contaminated land risks and the associated liability (health, environmental, legal and financial liabilities) on a logical and rational basis. This is to achieve both economy in the expenditure of resources and confidence in the end result such that the LQA provides the basis for defensible and auditable decision making.
- 1.33 All LQAs should be carried out in accordance with industry best practice and follow the model procedures set out in CLR 11.
- 1.34 The objective can be best achieved by adopting a phased approach. The phases are as follows:
- | | |
|---------|--|
| PHASE 0 | Preliminary Risk Based Strategic Land Quality Appraisal and Prioritisation |
| PHASE 1 | Desk Study |
| PHASE 2 | Site Investigation |
| PHASE 3 | Management Option Appraisal/Decisions |
| PHASE 4 | Implementation of Management Option(s) (Management Response) |
- 1.35 Each of the above phases are presented in Table 1, alongside key activity steps, CLR11 procedures and key good practice.

Table 1

LQA Phase	Activity Steps	Model Procedures (CLR11)	Key Good Practice
<p><u>Phase 0</u> Establish objectives and undertake preliminary LQA and prioritisation</p> <p><u>Output:</u> LQS and Prioritisation</p>	<p><u>Step 1:</u></p> <ul style="list-style-type: none"> Undertake preliminary assessment and prioritisation of site Establish and agree management objectives. 	<p>Preliminary Risk Assessment</p> <ul style="list-style-type: none"> Identify context and objectives for risk assessment Establish outline conceptual model for site Identify potentially unacceptable risks Identify further actions 	<ul style="list-style-type: none"> CLR 2 Guidance on preliminary site inspection (DoE, 1994a) CLR 3 Documentary Research on Industrial Sites (DoE, 1994b) CLR 6 Prioritisation and Categorisation Procedure for Sites that may be Contaminated (DoE, 1995) CLR 11 Model Procedures for the Management of Contaminated Land (EA, 2004) Guidelines for Environmental Risk Assessment and Management (DETR, EA and IEH, 2000) Contaminated Land Risk Assessment. A guide to good practice (CIRIA 2001) CLAN 4-04 Letter from MAFF to Part 2A Authorities (Defra, 2004) Best Practice Guidance for Site Characterisation (CIRIA, 2003) Techniques for the Characterisation of Land Contamination (EA, In prep)
<p><u>Phase 1:</u> Desk Study</p> <p><u>Output:</u> LO Report, LQS, Technical Note</p>	<p><u>Step 2</u></p> <ul style="list-style-type: none"> Establish former uses of the site Collect regulatory and other relevant data, including reports and LCR Undertake site walkover <p><u>Step 3</u></p> <ul style="list-style-type: none"> Identify potential contaminants, sources, receptors and pathways <p><u>Step 4</u></p> <ul style="list-style-type: none"> Establish conceptual contaminant-pathway - receptor model <p><u>Step 5</u></p> <ul style="list-style-type: none"> Undertake preliminary qualitative assessment of potential risks 		
<p><u>Phase 2</u> Site Investigation</p> <p><u>Output:</u> LO Report, LQS, Technical Note</p>	<p><u>Step 6</u></p> <ul style="list-style-type: none"> Design implement site investigation and update conceptual model <p><u>Step 7:</u></p> <ul style="list-style-type: none"> Quantitatively estimate risks using generic assessment criteria If necessary, quantitatively estimate risks using site specific assessment criteria <p><u>Step 8</u></p> <ul style="list-style-type: none"> Evaluate risks <p><u>Step 9</u></p> <ul style="list-style-type: none"> Identify and evaluate risk management options based on risk management objectives and cost effectiveness 	<p>Generic Quantitative Risk Assessment</p> <ul style="list-style-type: none"> Identify pollutant linkages that can be assessed using appropriate generic assessment criteria Refine conceptual model Identify potentially unacceptable risks Identify further actions 	<ul style="list-style-type: none"> Technical Aspects of Site Investigation, (EA, 2000) BS 10175: Investigation of potentially contaminated sites - Code of Practice(2001) CLR 4 Sampling Strategies for Contaminated Land (DoE, 1994) Development of appropriate soils sampling strategies for land contamination (EA, 2001) Guidance for the safe development of housing on land affected by contamination, EA and NHBC RDP66 (2000) Methodology for the derivation of remedial targets for soil and groundwater RDP 20, EA (1999) Communicating understanding of contaminated land risks (Sniffer, 1999) CLR 12 Quality Assurance in environmental consultancy (DoE, 1997)CLR11 Model Procedures for the management of Land Contamination (EA, 2004) CLR 7-10 Contaminated Land Exposure Assessment Model (EA and DEFRA, 2000) CLR 13-15 Radiological Contaminated Land Exposure Assessment Guidance (Defra, 2006)
		<p>Detailed Quantitative Risk Assessment (only to be undertaken where necessary)</p> <ul style="list-style-type: none"> Identify tools and criteria to estimate and evaluate risks from particular pollutant linkages (derive Site Specific Criteria) Identify potentially unacceptable risks Identify further actions 	

Table 1

LOA Phase	Activity Steps	Model Procedures (CLR11)	Key Good Practice
<p><u>Phase 3</u> Management Options Appraisal and Decisions</p> <p><u>Output</u>: Business Case</p>	<p><u>Step 10</u></p> <ul style="list-style-type: none"> Select preferred option and submit to regulatory authority for approval. 	<p>Options Appraisal</p>	<ul style="list-style-type: none"> Remedial treatment for contaminated land (CIRIA, 1995) Remedial treatment action data sheets (EA, 2001) Cost benefit analysis in remediation of contaminated land (EA, 1999) Financial risk management for contaminated land (CIRIA, 2002) CLR 11 Model Procedures for the management of contaminated land (EA, 2004) CL:AIRE: Contaminated Land: Applications in Real Environments
<p><u>Phase 4</u> Management Response Implementation (Implementation, validation/verification, monitoring and maintenance)</p> <p><u>Output</u>: Verification Reports, Monitoring Reports</p>	<p><u>Step 11</u>:</p> <ul style="list-style-type: none"> Detailed design and implementation of risk management measures and validation of effectiveness <p><u>Step 12</u></p> <ul style="list-style-type: none"> Implement monitoring and maintenance programmes and close projects 	<p>Implementation of Remediation Strategy</p>	<ul style="list-style-type: none"> Design and Practice Guide – Contaminated Land: Investigation, Assessment and Remediation (ICE, 1994) Verification of Remediation of Contaminated Soils and Water (EA, In prep)

The various model procedures, activities, steps and key good practice guidance associated with each of the above phases is summarised in Table 1 with specific guidance on each phase provided in the subsequent chapters to this guide.

- 1.36 It will not be necessary to carry out every phase for each site. For instance the potential environmental, health and safety risks identified at Phase 0 may be sufficiently quantified not to warrant proceeding to Phase 1 and so on. The need for further investigation and remediation must be commensurate with the objectives of the LQA and the degree of confidence required in the decisions.
- 1.37 The decision on whether to progress a LQA to the next phase must be taken after consultation with key stakeholders and based on advice from the relevant specialists at Annex A. Checklists for reviewing the conceptual model and proposals for further detailed investigation are given at Annex B
- 1.38 The cost of and time taken to complete each phase will be dependent upon the nature of the site activities, setting, accessibility and to an extent the size.
- 1.39 Guidance on reporting formats for LQA Reports, Technical Notes and Land Quality Statements (LQS's) are presented at Annex C.

Confidence

- 1.40 The overall aim is to ensure that the quality of information used and the overall degree of confidence associated with the analysis of that information providing a robust basis for decision making. A Phase 0 enables a land owner to take a holistic view of the potential for unacceptable risks posed by land contamination and to develop a prioritised management programme. Phase I or Phase II LQAs provide the increasing depth of assessment leading to increased confidence in the validity of the assessment. Once the context and objectives have been agreed the LQA process can cease once the environmental liabilities have been identified and are considered to be acceptable. Where this can be shown at an early stage of the LQA process, then no further assessment is required.
- 1.41 In addition to being prepared by competent persons LQAs should be reviewed and signed off by Specialists in Land Condition (SiLC) whenever the LQA is to be relied upon for a regulatory or commercial purpose. Whilst the SiLC scheme is currently focussed on the LCR the competencies required for accreditation equally apply to LQAs

Investment/Disposal Decisions

- 1.42 The primary management responsibility for land contamination on the defence estate lies with the lead occupying TLB through their CO/HofE. Land contamination is a key factor in any decision to invest in or divest MOD land as it has implications for the use of the land and valuation. It is essential that the LQA is sufficiently robust to provide for auditable and defensible decision making on the part of the TLB. Equally, it is important that the TLB consults the local DE Advisor (DEA) who will be able to advise on the marketability of the land and requirements for handover to DE. Advice on the technical aspects of the assessment and management of contaminated land is available from DE and the specialist contacts listed in Annex A.
- 1.43 Policy advice on contaminated land is available from DE through the Estate Strategy and Policy Directorate and the Construction Support Team - Environmental Management Group (CST-EMG).

Collateral Warranty

- 1.44 Collateral Warranties extend the duty of care of the author of the LQA report to a third party such as a purchaser or PFI partner. This is important, as purchasers, PFI partners and/or their funder(s) will seek reassurance that LQAs are reliable and Collateral Warranties which pass on the Consultant's professional Duty-of-Care to the purchaser or PFI partner and their funder(s) are often a condition of purchase or lease under a PFI. Hence, it is usually the case that purchasers, PFI partners and their funders require internal MOD investigations to be checked and verified by independent third parties often at MOD's expense. Therefore, it is essential to consult DE when producing a LQA for the disposal of a site or development of an establishment under a PFI.

1.45 The exact form of the warranty, i.e. whether it is an agreement or a deed, the number of assignments possible and any associated costs will be dependent upon the circumstances, but for site disposal purposes the minimum requirement and conditions acceptable to DE is:

Provision of Collateral Warranties in the standard agreed form, at no additional cost, to the PFI Partner (where appropriate), first purchaser and/or tenant of the whole site or part thereof to a limit of two parts, and to the first funder of those parties. Further collateral warranties should also, at the reasonable request of MOD, be provided in the standard agreed form to second purchasers and/or tenants and their funders of all or part of the site ("Secondary Warranties") at a reasonable fee per warranty not to exceed £1000. Should any party eligible to benefit from the Secondary Warranty require variations from the agreed standard form, the Consultant shall be entitled to levy additional fees and/or expenses to reflect the reasonable costs in negotiating such variations. The level of Professional Indemnity (PI) cover and form of the Collateral Warranty shall be agreed between the Consultant and the party eligible for the warranty.

Management Responsibilities

1.46 Retained Estate:

- Commanding Officer (CO) or Head of Establishment – management of contaminated land risks at site level.
- TLB – monitoring and reporting on the management of contaminated land liabilities at regional and national level.

1.47 Sites for Disposal or Inter TLB transfer

- TLB – A Land Quality Assessment (LQA) Phase 1 desktop study (covered by a collateral warranty) and management of contaminated land liabilities until site transferred to DE, other TLB or other third party.
- DE Regional Business Unit – management of contaminated land liabilities once transferred from the TLB.

1.48 Alienated Estate

- DE Regional Business Unit – determination of MOD contaminated land liabilities, and management of contaminated land liabilities. This includes cases where the site had been cleared to the standards of the day, but now requires further remediation.

1.49 Explosive Ordnance

- Explosive ordnance risks must be considered as an integral part of the LQA process. The model Explosive Ordnance Clearance Certificate in JSP 364, Explosive Ordnance Manual, provides a template for recording factual information on EOC carried out on a site and should inform the LQA risk assessment.

1.50 The following pages and accompanying flow diagrams illustrate the requirements of each phase of a LQA

CONTAMINATED LAND MANAGEMENT - LAND QUALITY ASSESSMENT PROCESS

PHASE 0 - PRELIMINARY RISK BASED STRATEGIC LAND QUALITY APPRAISAL AND PRIORITISATION

Introduction

2.1 The first stage is for each TLB to carry out a risk based assessment of all their land holdings to identify potential environmental, health and liability risks and formulate a prioritised LQA programme.

Methodology

2.2 The screening assessment and prioritisation provides a systematic assessment of the risk to human health and the environment such that the outcome is both auditable and defensible.

2.3 There are a number of published methodologies for accomplishing this, most notably the DoE/DETR Contaminated Land Report (CLR) 6, (Appendix 1) "Prioritisation and categorisation procedure for sites which may be contaminated".

2.4 CLR 6 is based on the Source-Pathway-Receptor concept model also known as pollutant linkage model and takes into account the spatial correlation between potential contamination sources and potential receptors.

2.5 The CLR 6 methodology is split into two parts:

- Part 1 provides an initial screening assessment that uses published data such as geology and OS maps and can be undertaken by competent staff under the direction of the TLB.
- Part 2 involves the use of more detailed information relating to the pathways and receptors and requires competent specialist environmental staff.

2.6 Unfortunately, CLR 6 was generated at the early stages of development of the existing regime for management of Contaminated Land in the UK, and hence has a number of weaknesses that limit its application:

- concentrates on determining categories of site with respect to the sites present suitability for use.
- is predominantly aimed at detailed site inspection and assessments rather than the more cost effective screening approach.
- includes data gathered from a site visit to complete an assessment, or otherwise identifies a pessimistic assessment of the possible suitability of use.

2.7 DE has developed a Phase 0 Preliminary Risk Based Land Quality Assessment methodology based on CLR 6 that addresses the deficiencies and can provide a TLB with a strategic appraisal of the land quality and a prioritised LQA programme.

2.8 The methodology has been tailored to specifically address issues on the MOD estate and comprises 4 discrete stages:

- Site sensitivity review and assessment;
- Historical data and maps/plans review;
- Site activity assessment; and
- Overall assessment.

2.9 The output of the Phase 0 will allow sites to priorities for further investigation

See table below:

Priority Assessment	Comment assuming likely or high likelihood of pollutant linkage occurrence	Action Required
Priority 1	Site probably not suitable for present use and / or environmental setting. Contaminants probably or certainly present and probably have an unacceptable impact on identified sensitive receptors.	Urgent further assessment/remediation.
Priority 2	Site may not be suitable for present use and / or environmental setting. Contaminants probably or likely to be present, and may have an impact on identified sensitive receptors.	Further risk assessment
Priority 3	Site considered likely to be suitable for present use and / or environmental setting. Contaminants may be present but unlikely to impact sensitive receptors identified.	No immediate action needed while site remains in present use and remains undisturbed. Site specific controls implemented to reduce the risks from land contamination.
Priority 4	Site considered suitable for present use and / or environmental setting. Contaminants may be present but very unlikely to have an unacceptable impact on key targets.	No further risk assessment while site remains in present use and remains undisturbed. General site controls sufficient to manage land contamination risks.

2.10 This approach will enable the TLB to take a holistic view of the land quality across their estate and develop a coherent, defensible and prioritised management programme that will target resources where there is greatest need. This will minimise the risk of both regulatory action and nugatory work and allow effective budgeting.

2.11 It will also provide sufficient information to assist the local authorities in discharging their statutory obligations in terms of inspecting the land in their area and minimise the risk of sites being inappropriately identified as 'Contaminated Land'.

2.12 It is therefore, essential that advice and support is sought from both the appropriate specialist organisations listed in Annex A at the outset of the screening and prioritisation process.

Factors Influencing Screening and Prioritisation

2.13 A number of factors influence this prioritisation namely:

- Contamination potential;
- Site sensitivity; and
- Site Disposal schedule.

Contamination Potential

2.14 This is defined by the nature of activities that have occurred and are occurring on the site, the period of operation of these activities, the likely nature and extent of potential contaminants including landfill gas.

2.15 Potentially contaminative activities both past and present include "special uses" exclusive to military establishments and "industrial uses" found in other sectors of industry. The following sections are not intended to be exhaustive lists and TLBs need to consider each establishment individually and seek appropriate specialist advice.

Special Uses:

- a. Munitions filling, assembly and storage, both chemical and conventional.
- b. Luminising workshops where radium paints were used.
- c. Storage and maintenance of specialised military equipment containing radionuclides such as radium and thorium.
- d. Firing ranges.
- e. Weapon and combat training.
- f. Other military processes, including those associated with nuclear weapons and reactors.

Industrial Uses:

- a. waste disposal.
- b. waste burning in open facilities.
- c. equipment dismantling.
- d. ship refitting.
- e. bulk chemical storage.
- f. chemical plant.
- g. mechanical engineering including engine cleaning.
- h. manufacturing processes.
- i. equipment maintenance.
- j. petroleum products including storage and distribution.
- k. railway infrastructure.
- l. laundries.
- m. paints.
- n. anti-fouling coatings.
- o. electrical equipment maintenance and PCBs.
- p. asbestos disposal.
- q. metal treating and plating.
- r. timber processing.
- s. laboratories.
- t. aircraft and airfield de-icing.
- v. other industrial processes.

2.16 Further information on the contaminants typically associated with the selection of activities listed above are provided in the DoE Industry Profiles (1995) and Contaminated Land Report 3 (Documentary Research on Industrial Sites). Specific technical guidance on contamination associated with MOD and Chemical Weapon (CW) sites is provided by Research and Development reports published by the Environment Agency (See Appendix 1).

Contaminant Groups

2.17 The nature of contamination can be divided broadly into two groups; organic and inorganic. Organic contaminants include petroleum, oils, lubricants (POL) and solvents. Inorganic contaminants include metals (arsenic, lead, cadmium etc). Organic contaminants are generally more mobile than inorganic ones.

2.18 Prevention is the best approach, and contamination incidents attended to quickly can prevent the spread of the contaminant and significantly reduce the risk to human health and the environment and the cost to the TLB of remediation. Investigation of recent and/or potentially mobile contamination must be an immediate priority.

2.19 Equally there is a need to identify and prevent contamination entering establishments from adjacent non-MOD properties.

2.20 The Phase 0 process map illustrating the process to be followed is presented as Figure 1.

PHASE 0: PRB LAND QUALITY APPRAISAL AND PRIORITISATION FLOW CHART

Responsibilities

- TLB personnel are to compile all site based information
- TLB Personnel are to assess information to produce Phase 0

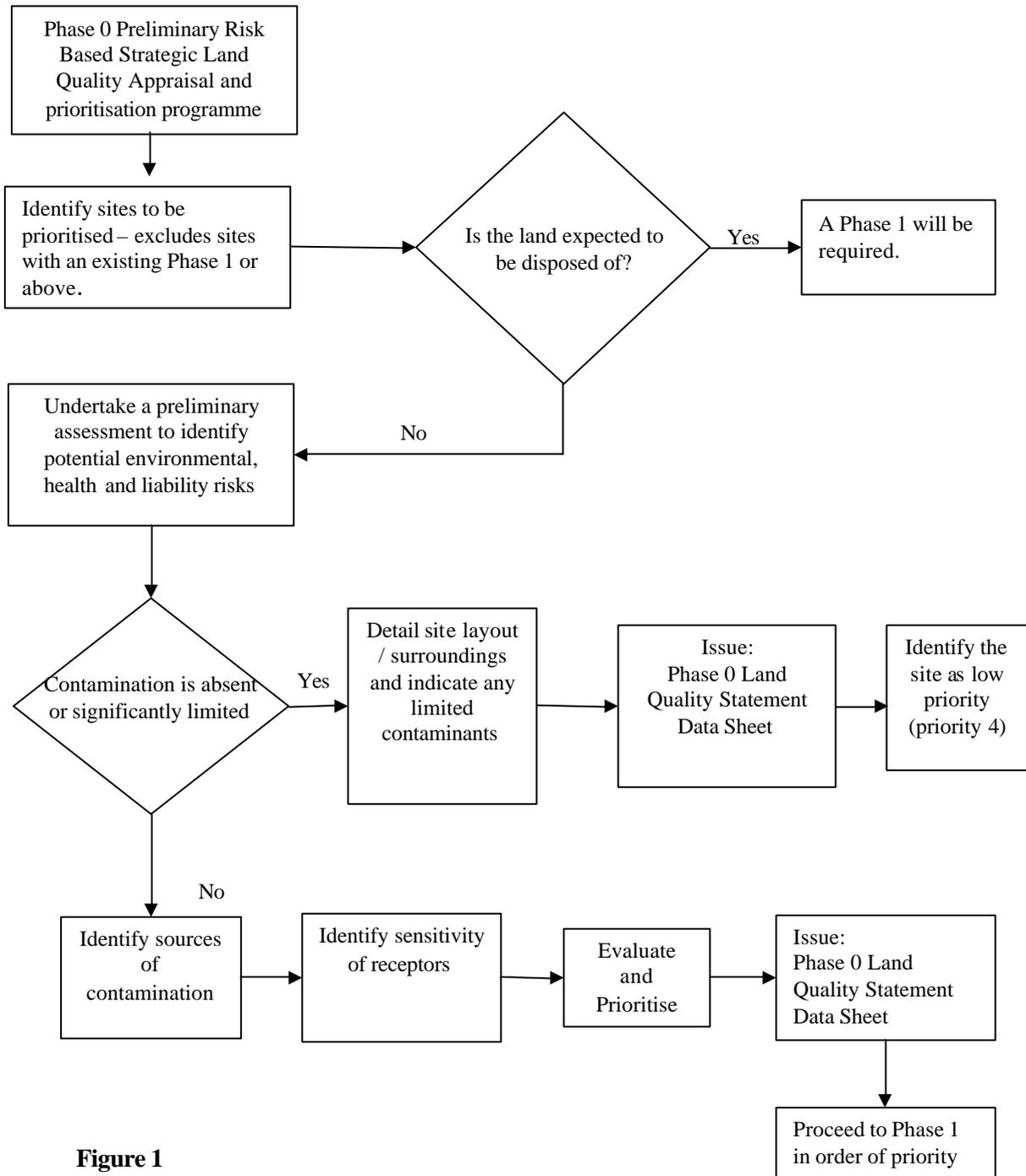


Figure 1

PHASE 1 - DESK STUDY

Introduction

- 3.1 Where the Phase 0 assessment identified the need for further assessment, or a site was identified for disposal, the next phase of assessment is the Phase 1 Desk Study. This phase involves a site reconnaissance and review of factual data concerning the site history, geology, hydrology, hydrogeology, regulatory issues, planning and site operations, etc. This identifies the potential sources of contamination, likely pathways and receptors and establishes, albeit qualitatively, the conceptual contamination model and potential health and environmental risks.
- 3.2 A LQA Desk Study normally contains three elements:
- Land Quality Report
 - Land Quality Statement
 - Technical Note

Details of the recommended reporting format and content is provided in Section 8 and Annex C.

- 3.3 The LQA Report will contain predominantly factual information and the qualitative risk assessment and is an unrestricted document.
- 3.4 The Land Quality Statement (LQS) provides a non technical summary of the likely land quality of an establishment and includes the potential risks to controlled waters such as groundwater and surface waters. It indicates the historical records available, details of known environmental pollution and any remediation that has taken place. The LQS also provides an indication of the suitability of the land for redevelopment.
- 3.5 The Phase I LQA Desk Study must provide not only an assessment of the potential risks and contaminated land liability but also evaluate the management response options, provide cost estimates for each option and provide a defensible recommendation. This is normally presented separately in a Technical Note, which is a Restricted - Commercial document.

Methodology

- 3.6 The Desk Study Research and Compilation shall include:
- Site Reconnaissance: to comprise an appraisal of the site infrastructure, drainage and services and site operating procedures both past and present. This should also include an evaluation of environmental issues requiring urgent attention.
 - Review and assessment of factual data: this involves collation and appraisal of all the available desk-based information relating to the site. The latter should involve the construction of a conceptual site model and a qualitative risk assessment which include the use and presence of explosive ordnance and radiological material at the site. From this, the potential environmental, health and liability risks can be established and management options appraised and a recommendation made. Detailed checklists are available in CLR2 and EA Technical Report P5-042/TR/01 (refer Appendix 1).

Conceptual Site Model

- 3.7 A conceptual model is a pictorial and descriptive representation of the area of contamination, the surrounding above and below ground environment, and the processes (e.g. volatilisation, leaching) acting on substances that are present. The conceptual model plays a key role throughout the LQA. It describes and summarises the pollutant linkages that may be present on a site. Generic technical guidance on conceptual models can be found in the Environment Agency's R&D publication NC/99/38/2 (refer Appendix 1).
- 3.8 For LQA purposes the conceptual model must include the following elements:
- A summary table of identified pollutant linkages
 - A textual explanation of each identified pollutant linkage and its constituent parts
 - A site plan and schematic cross-sectional diagram presenting likely contaminant distribution, migration pathways and receptor location.

- 3.9 These outputs are required in order to identify data requirements for further stages of investigation or for evaluation of the significance of the identified pollutant linkages. Section 6 of this guide provides instruction on how these outputs should be constructed.
- 3.10 Qualitative Environmental Risk Assessment. This seeks to qualify the potential environmental risks and classifies the liability. The environmental risk assessment utilises the source-pathway-receptor methodology, which considers the potential significance of the source coming into contact with the receptor and the potential for harm to be realised (see Section 7). The findings must be presented within a summary table, an example of which is provided at Annex D.
- 3.11 Guidance on reporting formats is provided at Annex C. Checklists for reviewing the conceptual model and proposals for further detailed investigation are given at Annex B

Desk Based Information

- 3.12 The LQA Sponsor (designated TLB representative) is responsible for coordinating/facilitating the compilation of the information required for the LQA. Such information will include, but not be limited to:
- a. EOD (Explosive Ordnance Disposal) Clearance Certificates and/or risk assessments as appropriate.
 - b. DRPS (Dstl Radiological Protection Service) Clearance Reports and authorisation records.
 - c. Plans indicating the establishment boundary, area and building locations past and present.
 - d. Locations of dumping areas, including official, unofficial and anecdotal reports.
 - e. Description of the uses of the establishment past and present, including individual building usage, petroleum areas, MT areas, chemical stores, workshops, transformers, boilers, cleaning equipment, etc.
 - f. Plans showing past and present drainage and sewerage arrangements, including any soakaways and oil traps, etc.
 - g. Usage of burning grounds.
 - h. Asbestos Register
 - i. Control of Substances Hazardous to Health (COSHH) Register.
 - j. Records which may detail any spills, etc. or statements indicating records have been carefully checked and no pollution instances have been recorded.
 - k. Records of previous Site Investigations or contamination remediation.
 - l. Anecdotal evidence and interviews with establishment personnel and tenants regarding work histories and knowledge of processes, practices and past incidents.
 - m. Information on pre MOD usage of the establishment (PROM and MOD Historical Branch).
 - n. MOD Historical Branches, Library Whitehall, JARIC and Service Museums.
 - o. DE Construction Support Team, Environmental Management Group for any centrally held data on military specific contaminants
- 3.13 DPRS must be contacted and instructed to undertake a search of their records for the following information which must be provided to DE:
- Details of and reports relating to the storage of radioactive sources on site, both current and historical
 - Radiological survey reports, internal and external to buildings
 - Reports pertinent to historical radiological contamination remediations, internal and external to buildings, and the final destination of any remediated radioactive material be it on, or off site.

- Reports relating to on site disposals of radiological sources including landfilling and burning grounds.
- 3.14 Detailed checklists are provided by Contaminated Land Report 2 and the Environment Agency Technical Report P5-042/TR/01 (See Appendix 1).
- 3.15 Specialists should undertake the interrogation and compilation of available non-MOD records to obtain details of the following:
- a. Previous editions of OS Maps showing the history of the establishment, back to “green field” status.
 - b. Details of the location and history of any previous industrial usage on the establishment. This can entail, but is not necessarily limited to, visits to the Public Records Office.
 - c. Public Register records relating to the site and neighbouring land, including, but not limited to:
 - Licensed and unlicensed waste disposal or similar activities taking place on or near the establishment
 - IPPC Authorisations
 - LAPC Authorisations (Due to be phased out by 2004)
 - Consents or enforcements under the Planning (Hazardous Substances) Act 1990
 - Authorisations under the Radioactive Substances Act 1993
 - Information regarding contaminative uses from the Planning Register
 - Consents to discharge
 - Details of pollution incidents
 - Breaches or prosecutions under environmental legislation
 - d. British Geological Survey plans and borehole records indicating the geology and hydrogeology of the establishment.
 - e. Groundwater vulnerability maps.
 - f. Any neighbouring land use, past or present, which may have contaminated the establishment or vice-versa.

Policy Process and Responsibility

- 3.16 Responsibility for instigating a LQA rests with the TLB responsible for the establishment. Technical advice on LQA and assistance with procuring independent help is available from DE and the contacts given in Annex A. Generic guidance on the format of LQA Reports, Technical Notes and LQS's (Annex C).
- 3.17 The Top Level TLB retains overall responsibility for the establishment, this includes all Health, Safety and Environmental issues in addition to being responsible for ensuring access to the site, the provision of key personnel and that the necessary documents etc are compiled and made available (see 2.9 above). The Top Level TLB is responsible for compiling background information as detailed in 2.11 and 2.12 above. The Phase One LQA should only be undertaken by competent specialists, be they MOD specialists or independent vetted specialists under their management.
- 3.18 The Phase 1 Process Map illustrating the processes to be followed, including notes providing guidance on the issues to be considered is presented as Figure 1.

PHASE 1: DESK STUDY FLOW CHART

Responsibilities

- TLB personnel are to compile all site based information
- Specialists are to assess information to produce Phase 1 LQA Report, Technical Note and LQS including collateral warranties where required

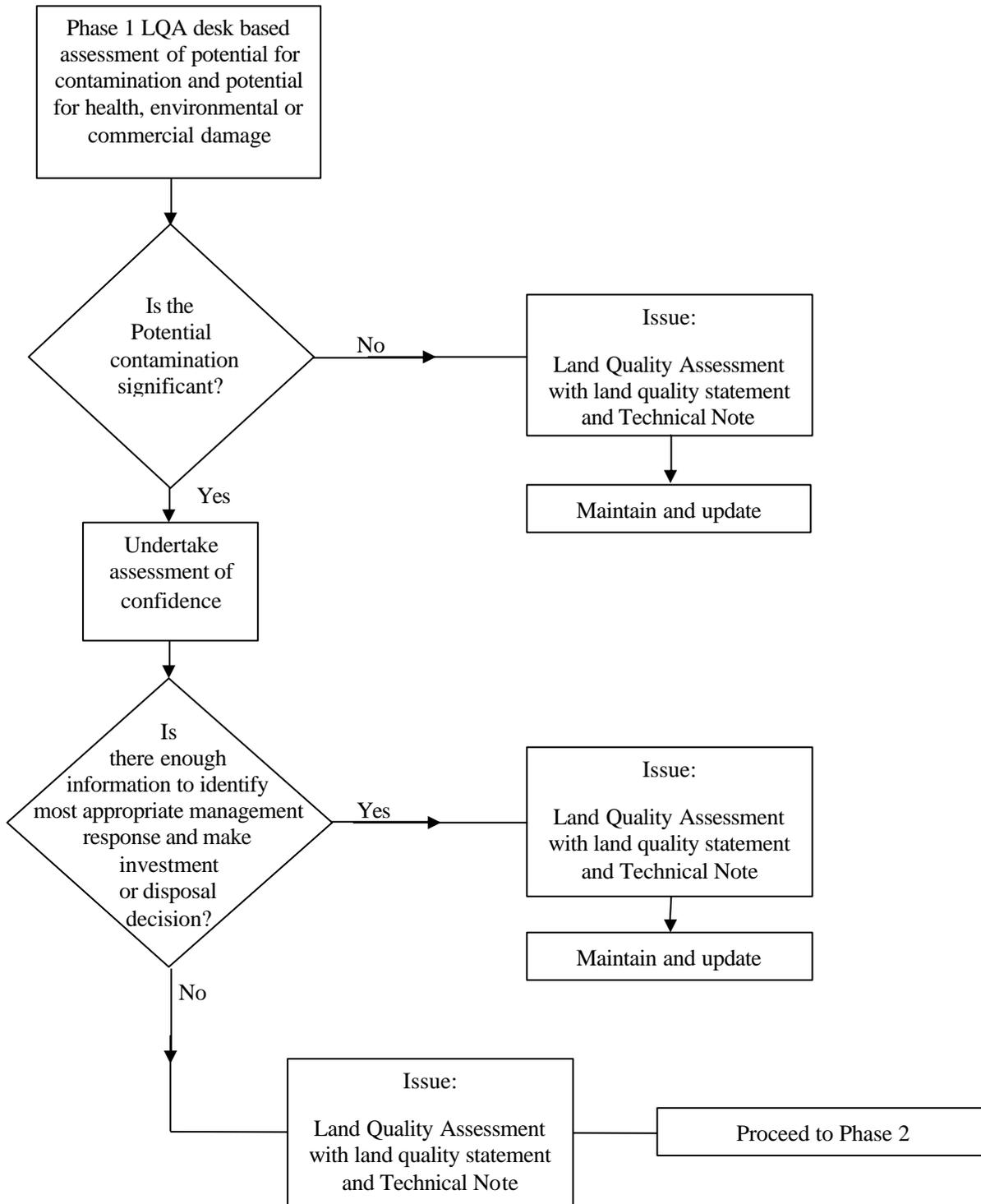


Figure 1

PHASE 2 - SITE INVESTIGATION

Introduction

- 4.1 The evaluation of the Phase 1 LQA Desk Study will determine the need and scope for a Phase 2 LQA intrusive and/or non-intrusive site investigation.
- 4.2 The aim is to confirm the presence and quantify the nature and extent of contamination, assess the significance of the contamination in terms of the contaminated land liability, provide an appraisal of the management options together with reliable order of cost estimates and recommendations. The options looked at will include, but not be limited to, institutional controls, remediation and further investigation and/or monitoring. These may be tackled in a single stage or in a number of targeted phases that may be spread over a number of months or financial years.

Methodology

- 4.3 Phase 2 LQAs build on the Phase 1 LQA and can be expensive and disruptive. Therefore, it is important to ensure that only those establishments where the information is specifically required are investigated in detail. For this reason, a phased approach to this stage of the investigation process is recommended. As soon as sufficient information is obtained the investigation should cease.
- 4.4 Phase 2 LQAs can involve intrusive investigations such as excavating trial pits by hand or excavator (e.g. JCB), drilling boreholes with drilling rigs, taking vapour samples and the obtaining of other probe data as well as non-intrusive operations such as geophysical surveys. Soil, water and vapour samples can be taken to laboratories or analysed on site in mobile facilities. Analysis should be undertaken by a MCERT accredited process where applicable.
- 4.5 The Phase 2 LQA should be used to validate and/or amend the Phase 1 LQA conceptual model and risk assessment. The latter may involve a Travel Risk Assessment as explained in Section 7
- 4.6 Phase 2 LQAs must take account of the regimes that address land contamination particularly Part 2A of the Environmental Protection Act 1990, Water Resources Act 1991, and development control under the Town and Country Planning Acts. To this end it is essential that the statutory guidance for Part 2A, (Appendix 1 refers) is applied together with the Contaminated Land Report (CLR) Series 7 to 15 (Appendix 1 refers). These relate to the Contaminated Land Exposure Model (CLEA) jointly published by the Environment Agency and DEFRA and deal with the assessment of risks to human health as a result of long term exposure to soil contamination. Other risk assessment models may also be suitable and specialist advice should be sought.
- 4.7 On sites with suspected complex contamination, it is beneficial to conduct a reconnaissance survey before designing the detailed investigation. This system should produce the most cost-effective results. Checklists for reviewing the conceptual model and proposals for further detailed investigation are given at Annex B

Policy, Process and Responsibility

- 4.8 EOD clearance is required prior to a Phase 2 LQA and this is the responsibility of the incumbent TLB to initiate.
- 4.9 The TLB is responsible for providing access to the site. Undertaking a site investigation requires very specialist skills and this work should only be undertaken by either competent MOD specialists or independent vetted specialists under their management. The type of work undertaken varies on each establishment and continuous specialist supervision is important.
- 4.10 Technical advice on the nature, extent and procurement of a Phase 2 LQA on a site-specific basis is available from the contacts listed in Annex A. Generic guidance on site investigation and sampling is provided by various publications such as CLR 4 "Sampling strategies for Contaminated Land" and BS10175:2001 Investigation of potentially contaminated sites – code of practice. A summary of relevant guidance is provided at Appendix 1. However, this list is not exhaustive and it is essential that specialist advice be sought prior to any Phase 2 LQA work being commissioned.

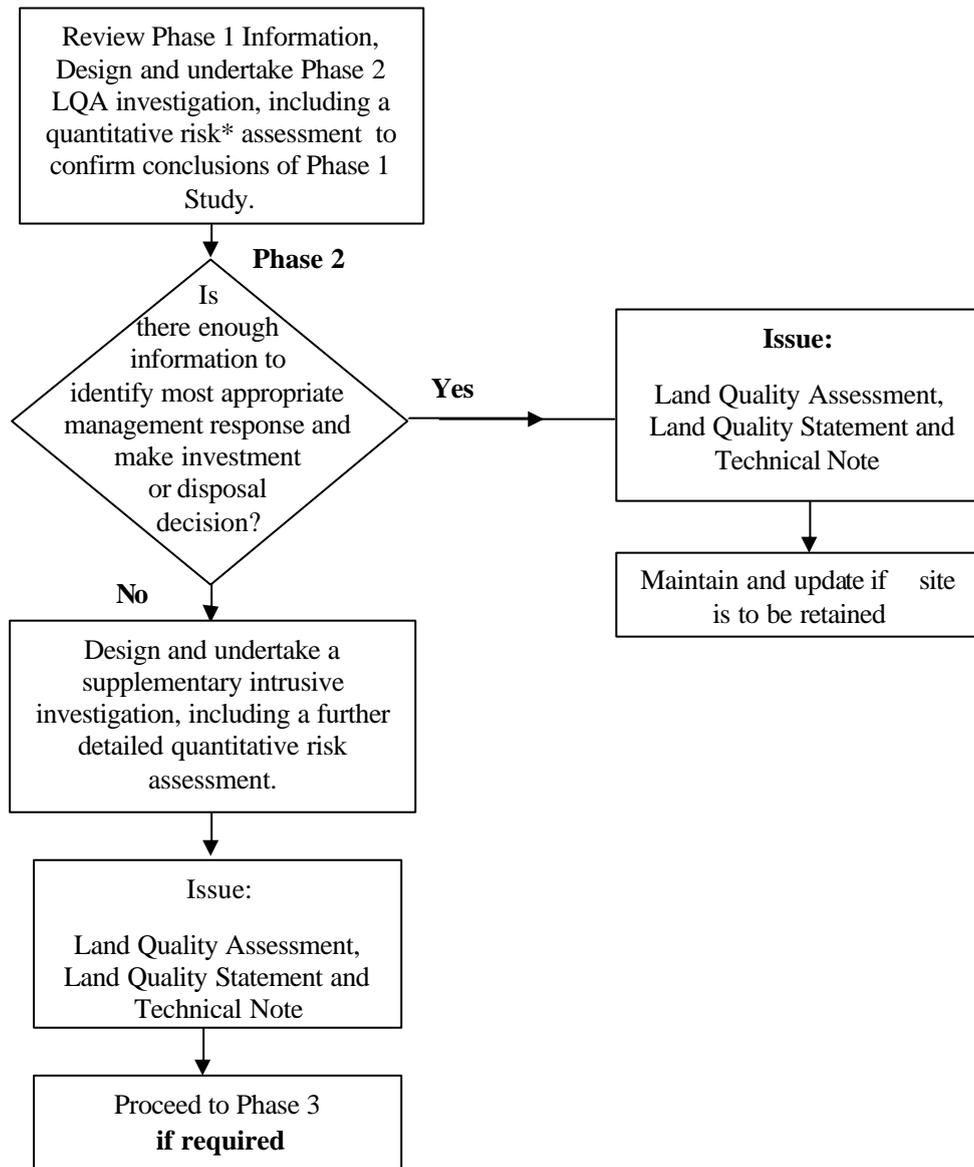
- 4.11 The TLB responsible for the investigation and assessment of alienated land is DE.

4.12 The Phase 2 Process Map illustrating the processes to be followed, including notes providing guidance on the issues to be considered is presented as Figure 2.

PHASE 2: SITE INVESTIGATION FLOW CHART

Responsibilities

- Decisions made by TLB with advice from relevant MOD specialists (see Annex A)
- Work to be undertaken by competent specialists with necessary knowledge and experience



* This may include either a generic quantitative risk assessment and/or detailed risk assessment

Figure 2

PHASE 3 - MANAGEMENT OPTION APPRAISAL AND DECISIONS

Introduction

- 5.1 If the findings of the Phase 2 LQA confirm that there is an unacceptable risk posed by the presence of contamination, then action must be taken to reduce and control those risks to an acceptable level. This will involve some form of management response, such as remediation.
- 5.2 Remediation of contamination can be expensive and therefore all viable management responses, including institutional controls must be considered. The latter are most effective on establishments operating an EMS.

Policy, Process and Responsibility

- 5.3 TLBs maintain responsibility for funding property management at establishments up to the point of transfer to DE. Hence, remediation decisions are a TLB responsibility for operational establishments.
- 5.4 Current MOD Policy is to undertake remediation where there is a significant (unacceptable) risk to health, safety and the environment taking account of the current or intended use. In the case of sites in disposal, it is generally confined to defence specific contaminants, such as chemical agents and explosive ordnance, where it is unreasonable to expect a civilian contractor to be able to undertake the work. Otherwise, sites are sold in an un-remediated condition with a view to the purchaser undertaking the remediation necessary to make the site suitable for its intended use. In the case of radiological contamination it is MOD policy to require independent verification of purchaser-managed remediation. Further clarification of MOD Policy on remediation is available from JSP 418 and the Site Closure Guide.
- 5.5 Please note that the Regulatory Authority must be informed if a risk of significant harm is identified. In the instance that notification is required, MOD's relevant subject matter experts (see Annex A) should be notified in order to advise on appropriate consultation and any required future action.
- 5.6 The Department has no reliable information on the legacy of contamination for which it might be responsible on sites that have been sold over the years. Where a site is claimed by a purchaser or other landowner to have been contaminated by MOD or its predecessors, it will be the responsibility of DE to verify whether the site has been previously owned or occupied by MOD, take legal advice on the terms of historic sales, determine whether MOD is liable for decontaminating the land and assess the remediation measures required.
- 5.7 Claims will be addressed on a case by case basis. Where MOD is found to be liable for contamination on alienated land DE is responsible for securing the funding for any necessary remediation measures. This includes cases where the site had been cleared to the standard of the day but now requires further remediation.
- 5.8 Sites that were known to be contaminated at sale and had restrictions on their use written into the sale agreement will need to be considered carefully by DE staff to identify the extent of the liability taken on by the purchasers and any that may fall on to MOD and the relevant service.
- 5.9 In some sale arrangements, MOD has accepted a contingent liability that recognises it has retained part of the risk in the transfer of property to a purchaser at disposal. In these circumstances the service benefiting from the disposal will assume liability for any contingency payment.

Prioritisation

- 5.10 Resources for remediation are severely limited and therefore prioritisation of establishments is important. The prioritisation must take account of the risks to human health and the environment and the ability for MOD to manage them using institutional controls in the intervening period. Consultation by the TLB with DE and other specialists listed at Annex A at this stage is essential.
- 5.11 DE can provide further advice on land disposal strategy and related technical advice on the appropriate management responses, including remediation techniques and strategies. Further guidance is available from Contaminated Land Report (CLR) 11 Model Procedures for the Management of Contaminated Land: Introduction and Overview (refer Appendix 1).

5.12 The Phase 3 Process Map illustrating the processes to be followed, including notes providing guidance on the issues to be considered, is presented as Figure 3.

PHASE 3: MANAGEMENT RESPONSE DECISIONS FLOW CHART

Responsibilities

- Decisions to be made by TLB with advice from MOD specialists (see Annex A) as required
- Clean-up Option Study to be undertaken by MOD specialists (see Annex A)

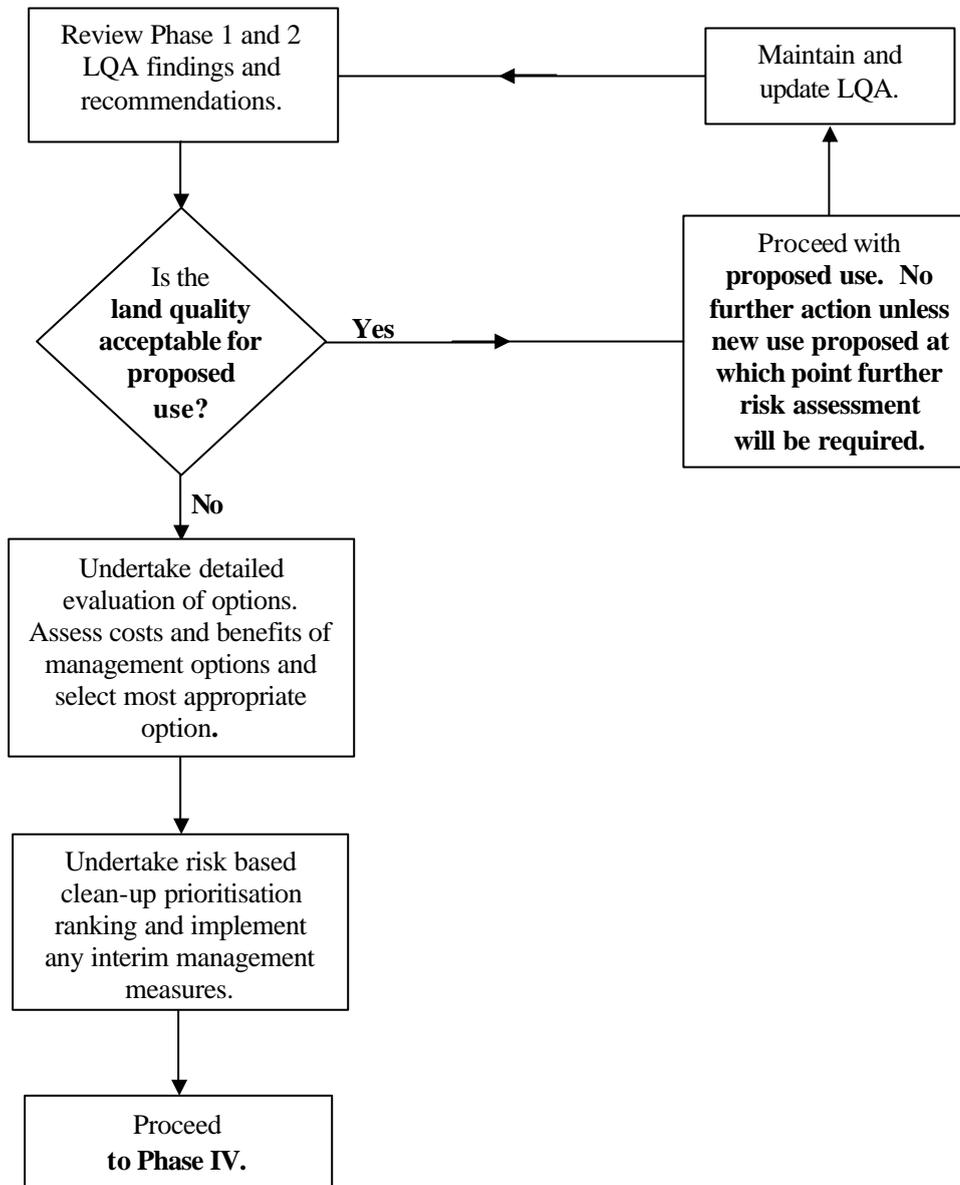


Figure 3

PHASE 4 - MANAGEMENT RESPONSE IMPLEMENTATION

Introduction

- 6.1 Management responses include do nothing, the use of institutional controls, such as standing orders and the permit to dig system, as well as remediation. The type of response will be dependent upon the level of risk and the nature of the hazard. In the case of remediation, the strategy, clearance levels and end point need to be agreed with the appropriate regulatory authority. Specialist technical advice must therefore, be sought prior to remediation (Annex A gives a list of suitable contacts). DE can advise on the technical aspects and application of all remediation techniques and both procure and manage a remediation project on behalf of a TLB. Equally, DE can advise on whether institutional controls are the most appropriate response.
- 6.2 Remediation will be of reduced value if not properly documented. Quality control must be managed throughout the design and implementation of a remediation programme. A post remediation validation survey must therefore be carried out together with a post project review and the lessons learnt circulated.

Policy, Process and Responsibility

- 6.3 The TLB is responsible for funding and implementing the appropriate management response including remediation, on their establishments. Remediation work for hazardous military contamination such as chemical weapon residues, must be undertaken by service specialists and appropriate contacts are provided at Annex A. Independent contractors, managed by competent MOD specialists may be used for industrial type contamination such as hydrocarbons, metals and even radionuclides, such as Radium-226.
- 6.4 The TLB must ensure that the appropriate regulatory and waste management bodies are consulted and the necessary permissions, consents and authorisations sought. Equally, the TLB must ensure all other interested parties, including, where necessary, the local community are informed and consulted through adequate stakeholder dialogue. Hence, specialist advice is essential.
- 6.5 The LQA and LQS for the establishment must be updated upon the completion of remediation.
- 6.6 The Phase 4 Management Response Process Map, providing guidance on the management process, is presented as Figure 4.

Verification and Monitoring

- 6.7 Once the detailed remediation design is complete, a Verification Plan should be prepared detailing the data gathering requirements necessary to demonstrate that the remediation meets the site remediation criteria.
- 6.8 A Monitoring and Maintenance Plan will also be required if the remediation is to include permanent structures that require maintenance or if there will be a need for monitoring to demonstrate the continuing effectiveness of the site remediation following substantial completion of the site works.
- 6.9 Once the site remediation is complete, a Verification Report will be required to demonstrate that the agreed site remediation criteria has been achieved. This report should provide a full record of all remediation activities carried out at the site and data collected in accordance with the requirements of the Verification Plan.
- 6.10 Long-term monitoring and/or maintenance will only be necessary if a Monitoring and Maintenance Plan was prepared for the site. Maintenance reports will not be of direct interest unless they can be related to exceptional results in the long-term monitoring programme. However Monitoring Reports may need to be reviewed until the end point for the long-term monitoring programme has been achieved.

PHASE 4: MANAGEMENT FLOW CHART

Responsibilities

- Decisions made by TLB with advice from MOD specialists (see Annex A).
- Work to be undertaken either as TLB Project using the Regional Prime Contract or through DE.
- Liaise with Regulatory Authority.

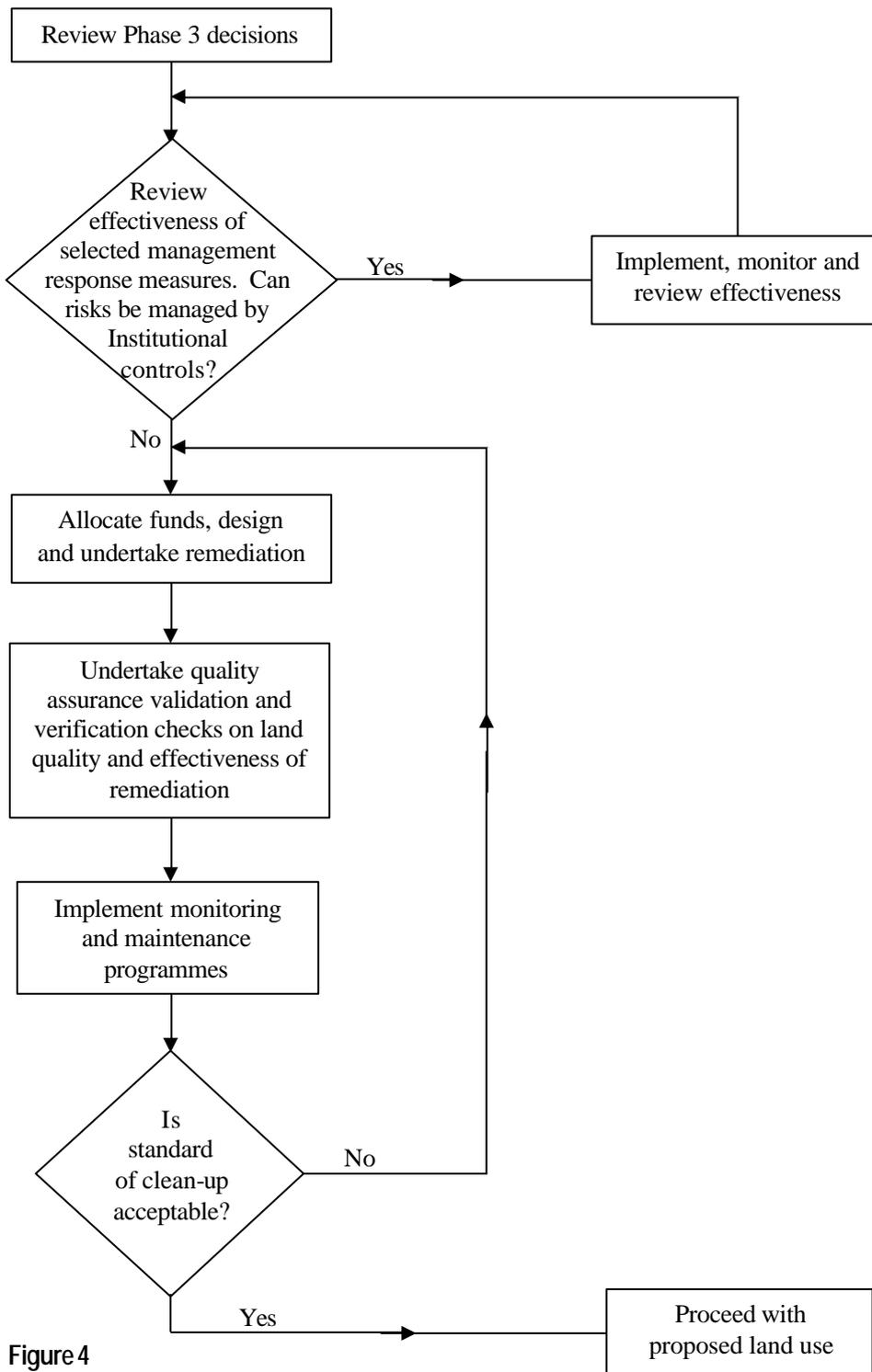


Figure 4

CONCEPTUAL SITE MODEL

Textual Explanation/Representation

7.1 The conceptual model is typically derived during a Phase 1 LQA and refined in subsequent Phases. It must comprise of graphical and tabular representations supported by a full textual justification. The conceptual model is not complete unless all three elements (contaminant, pathway and receptor) are provided. The text accompanying the summary table and plans must include the following information:

- Discussion of the receptors present
- Discussion of all the likely contaminants, their properties and location.
- Discussion of the pathways potentially occurring
- Identification of all the pollutant linkages
- Identification of any pollutant linkages initially considered but now excluded
- Justification for inclusion or omission of pollutant linkages by reference to the available evidence.

Assessing viable pathways requires the application of common sense and general scientific knowledge about the nature of a particular contaminant, including how it may move or be transported, the circumstances of the land in question (e.g. geology, hydrogeology etc) and the behaviour of certain receptor types on the site (primarily applicable to humans and other living organisms).

It is essential to ensure that all the relevant justifications for including or omitting a pathway or a receptor are included. The importance of the justification is that it allows those not involved in the construction of the conceptual model to follow the thought process employed in its construction. Upon deciding on the inclusion or omission of a receptor, account must be taken that the receptor must be 'likely' to be present given the current use of the land. NOTE: 'Likely' is defined as 'more likely than not'.

Providing it is suitable to do so, potential contaminants and pathways can be grouped together rather than treated individually for the development of the conceptual model. When identifying and documenting the individual components of the pollutant linkage the following considerations should be addressed where appropriate:

Considerations:

7.1.1 Contaminant Information

Considerations:

- Contaminant Types: Identification of contaminants of concern based upon site history
- Contaminant Properties: Physical properties of contaminants such as solubility, density, viscosity, Henrys Law
- Contaminant Form: Solid phase (particles), sorbed phase (bound to soil), free phase (NAPL's), vapour phase (in soil & air) and dissolved phase (in groundwater & pore water)
- Contaminant Distribution: Point sources (pipes and tanks), diffuse sources (stack emissions and landspreading), possible lateral extent, concentration and depth profiles.
Complicating Effects: De-commissioning, redevelopment and partial remediation.

7.1.2 Receptor Information

Considerations:

- Land-Use: Identification of current land uses
- Humans: Critical receptor identification (children or adults), Exposure Averaging Areas (based upon receptor behaviour) – Guidance available in CLR 7, CLR 10 and CLR14

- Ecosystems: Habitat and ecosystem descriptions, species composition, temporal trends & animal and plant distributions
- Property: Flora & Fauna: Identification of crops, domestic produce, livestock, owned or domesticated animals, wild animals subject to shooting or fishing rights
- Property: Buildings: Buildings (including constituent material types) and ancient monuments
- Controlled Waters: Identification of coastal waters, inland freshwaters, ponds, lakes, rivers, watercourses and groundwaters.

7.1.3 Pathway Information

Considerations:

- Direct Exposure: Direct with the contaminant (dermal, plant roots, building materials etc.), direct ingestion, and inhalation of vapours or dust in air.
- Indirect Exposure: Ingestion of contaminated foods, migration into controlled waters.

7.2 Schematic Representation

In order to put the conceptual model into context and to link the identified pollutant linkages to the area of land being assessed it is necessary to produce a site plan illustrating the location of potential contaminants and receptors and schematic representation of the conceptual model in cross section.

The site plans identify the potential or known location of contaminant sources on the site.

A schematic cross-section representation will be required where the distribution and possible migration of contaminants in the sub-surface needs to be illustrated. Examples of schematic cross sections can be found in the Environment Agency R&D report relating to Conceptual Model Development.

RISK ASSESSMENT

Introduction

- 8.1 As mentioned previously, the key objective of the risk assessment is to determine whether land is posing or could potentially pose risks to the environment, health, buildings and structures and quantify the significance and associated liabilities.
- 8.2 Part 2A of the Environmental Protection Act 1990, as supported by the Contaminated Land (England) Regulations (2000) and the Statutory Guidance (Defra Circular 01/2006), provides the new regime for the identification and management across Britain. The regime enshrines the principle of 'suitable for use' which requires a risk based approach to risk management founded on the contaminant source-pathway-receptor model. Under this model, there must be a linkage between a contaminant source capable of causing harm via a viable pathway to a receptor that is sensitive to the contaminant for a risk to exist. This is referred to as 'pollutant linkage'.
- 8.3 The following paragraphs are not intended to provide a definitive guide to risk assessment but outline best practice and identify current guidance. Risk assessments should not be undertaken in isolation and specialist support and advice should be sought. Appropriate contacts are listed in Annex A.

Main Stages of Risk Assessment

- 8.4 There are four main stages:
- Hazard Identification
 - Hazard Assessment
 - Risk Estimation
 - Risk Evaluation

Phase 1 Preliminary Qualitative Risk Assessment

- 8.5 This is undertaken during Phase 1 LQA's and involves establishing a conceptual contaminant source-pathway-receptor model, where all potential pollution linkages are identified and qualitatively assessed, with the objective of establishing the potential health, environmental, infrastructure and liability risks, likelihood of pollutant linkage, potential consequence of the pollutant linkage and likely significance.
- 8.6 This assessment should be presented as a summary table with the assumptions and limitations clearly documented in the text. A suitable table is enclosed at Annex D together with explanatory notes.

Phase 2 Quantitative Risk Assessment

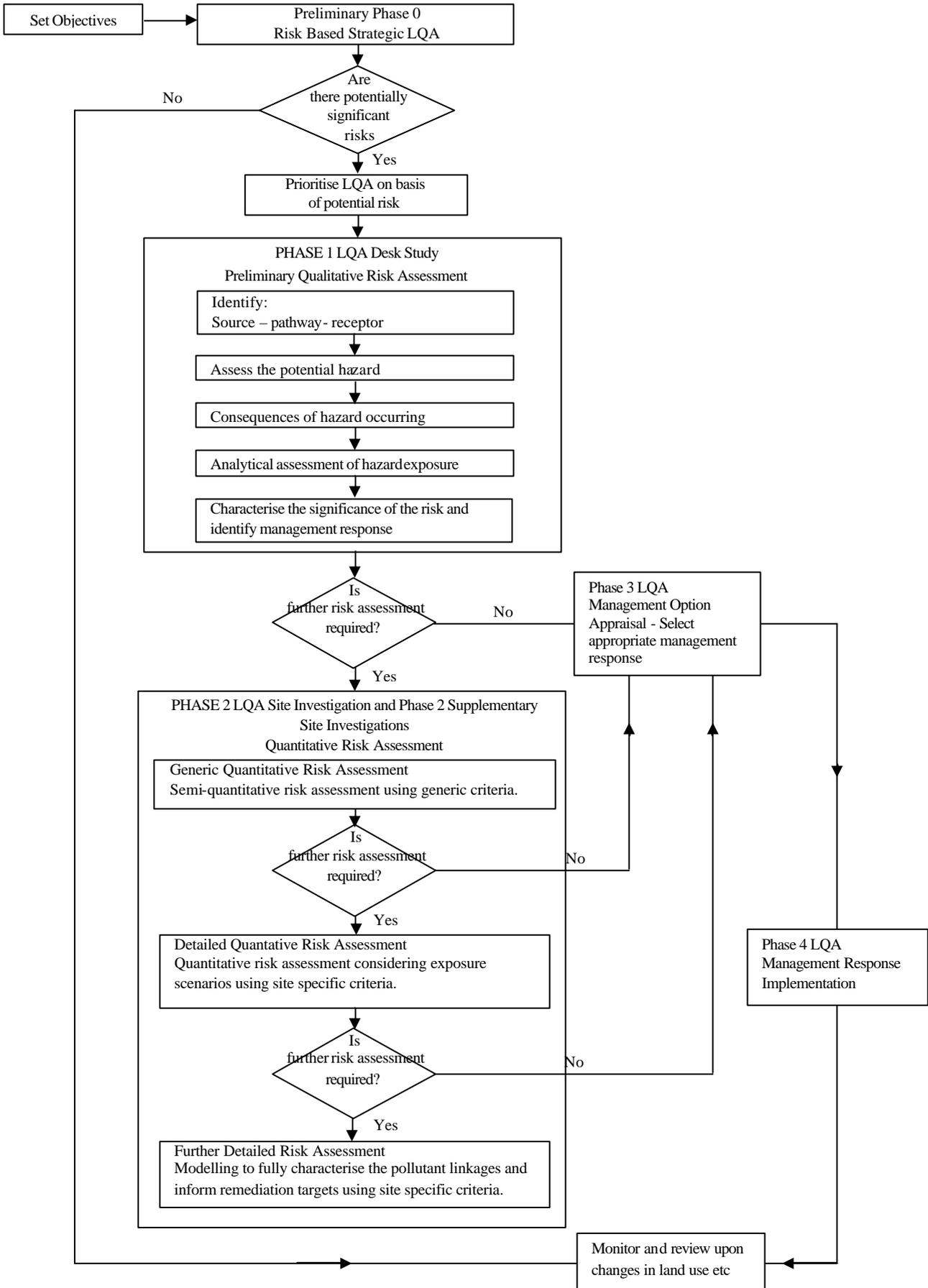
- 8.7 A Phase 2 Generic Quantitative Risk Assessment involves the comparison of site-specific analytical data to appropriate generic assessment criteria, such as the UK CLEA Soil Guideline Values (SGVs), UK Drinking Water Standards (DWS's) and Environmental Quality Standards (EQS's) to provide a quantitative risk assessment. Generic guidelines take into account a degree of uncertainty and are therefore conservative. Consequently, where measured concentrations of contaminants fall below them it can be concluded that there is no risk providing the guidelines have been applied correctly. It is essential to understand the limitations of the application of the various generic guidelines in particular the exposure scenarios to which they relate. In the case of the generic CLEA SGVs they are not suitable in situations where the conceptual model does not match the CLEA exposure scenarios.
- 8.9 Where the determined concentrations of contaminants exceed the generic assessment criteria, proceed to a detailed quantitative risk assessment and produce site-specific assessment criteria. This involves the comparison of measured concentrations of contaminants with site-specific assessment criteria to provide a quantitative risk assessment. This may require further site investigation and the decision to proceed is both economic and technical. It can be more cost effective to undertake the remediation than go to the expense of conducting a detailed quantitative risk assessment.
- 8.10 Additional risk assessments may be required to further reduce any uncertainty and hopefully result in the derivation of more cost-effective remediation criteria or demonstrate that no remediation is in fact required.

8.11 Guidance on undertaking qualitative and quantitative risk assessment is available from the specialist contacts and documents listed in Annex A and Appendix 1, respectively.

8.12 Specific guidance on the assessment of risks associated with explosive ordnance and chemical munitions and how to integrate this into the LQA process has been prepared by the MOD Contaminated Land Policy Group. This guidance is documented in Appendix 1.

8.13 The summary process map is presented as Figure 5.

RISK ASSESSMENT PROCESS MAP



Note: Further risk assessment is required where unacceptable risks are identified.

Figure 5

LQA AND LQS REPORTING FORMATS

Introduction

- 9.1 It is essential that LQAs are not only reported in a consistent fashion but that the format is user-friendly, meets the Department's needs and represents best practice. Under the Environmental Information Regulations (EIR) 2004 both the public and non-government organisations have the right of wide access to environmental information concerning the MOD estate. Consequently, information of a confidential nature, which could be legitimately withheld on commercial and security grounds, should be presented separately from the main LQA findings. This is particularly important if the LQA is eventually to be used to assist in the marketing and disposal of an establishment.
- 9.2 The following format should therefore be adopted:
- Land Quality Assessment Report with Land Quality Statement - (UNRESTRICTED)
 - Technical Note - (RESTRICTED- COMMERCIAL or RESTRICTED - MANAGEMENT)

Land Quality Assessment Report

- 9.3 The Land Quality Assessment Report is a combined factual and interpretative report that should comprise the factual information and other evidence gathered relating to the environmental quality of the site. This should include general background namely; objectives, methodology and constraints, together with an assessment of the site sensitivity, a conceptual contamination model that places the contamination in context, environmental risk assessment (undertaken in accordance with current best practice guidance as set out in Chapter 6) and an assessment of the overall land quality and suitability for use. Where aspects are more clearly shown in the drawn form, then appropriate figures should be included. Historical maps, colour photographs and trial pit logs etc should be provided as annexes to the report and where appropriate colour figures should be used. In particular, the site location plan and plans highlighting areas of concern, or the likely extent of contamination and potential receptors should be presented in colour.
- 9.4 Site sensitivity is defined by factors relating to location, geology, hydrology and hydrogeology. The sensitivity takes account of both onsite and adjacent land uses, the proximity of potential contamination sources to receptors such as watercourses and the concept of groundwater vulnerability. The sensitivity recognises the risk posed by contamination i.e. the susceptibility varies according to the nature of the superficial and solid geology, the nature and composition of the soil, aquifer properties such as porosity and the thickness of the unsaturated zone. Ecological issues should also be taken into account.

Land Quality Statement

- 9.5 The Land Quality Assessment Report should also include a short summary, no more than 3 sides of A4, of the environmental condition of the site entitled 'Land Quality Statement for xxxxx'. This replaces the executive summary and is a non-technical summary of the environmental condition of the site that presents any identified or suspected contamination in context, identifies its suitability for re-use and any constraints on the use or development of the site. The Land Quality Statement must not include reference to recommendations for further work or the Technical Notes and must be capable of being used as a free standing document. Hence it should reference appropriate figures from the LQA report such that they can be included without the need to reference the LQA Report.

Technical Note

- 9.6 The Technical Note should include, but not necessarily be limited to the environmental risk assessment, including the liability classifications, an appraisal of MOD's liability within the current regulatory context, an appraisal of the management response options and associated cost estimates and a justified recommendation. Justification should include the operational, economic and environmental advantages. In the case of Phase 2 LQAs, the costs must be presented as order of cost estimates (OCE).
- 9.7 The appraisal of MOD's liability must include a separate risk assessment that is sufficient to determine whether the site meets the definition of contaminated land according to the satisfactory guidance. This must include a summary evaluation of the potential pollution linkages and an assessment of significant possibility of significant harm. Additional guidance is presented at Annex E.

Guidance

- 9.8 Guidance on the production of OCEs is provided by DE Technical Bulletins 99/19 and 99/21 (<http://deintranet.de.r.mil.uk:147/publications/de/tb/1999.htm>). Further guidance on reporting formats is provided at Annex C and the format should be adapted to suit the circumstances under which the LQA is being undertaken.

Annex A – Contact Points for Specialist MOD LQA Advice

<u>ORGANISATION</u>	<u>CONTACT POINT</u>	<u>SPECIALISM</u>
Directorate of Safety & Claims (DS&C)	Chief Environmental Safety Officer	Environmental Policy
DE Estates Strategy & Policy Directorate	DE ES&P Env Pol	MOD Environmental Policy and Land Disposal Policy
MOD CLPG	DE CST Environmental	
DE Construction Support Team Environmental	Head of CST Environmental DE Ops North CST 1	MOD Contaminated Land Policy, Land Quality Assessment and Environmental Management
DE Disposals	Head of Disposals	MOD Land Disposal Policy
DE&E D Facilities	Head of Environmental Science Group	DE&S & RN LQAs, EOC, EO risk assessment
DE&S EPPol	Environmental Protection Policy Group	Environmental Protection
ARMY	CESO Army AIO C1 Hard FM/Estate	Environmental Policy
Royal Navy	CESO (RN)	RN Environmental & Safety Policy
RAF	CESO RAF	Environment Protection Policy
RAFIO RAF Innsworth	HQSTC Infra4 Head of LQA	RAF Land Quality Assessment
Dstl CBDE	Hd of Safety	Chemical Weapons Safety
D Def Log	Def Log Saf/	Safety Policy
DP(FIN)	DP Fin 4	
D News (PO)	D News CPO	Environmental Press Policy
DRPS	Principal Radiation Protection Adviser	Radiological Issues
DPRS	Health Physics Support	Radiological Records

HQRE Th Tps	As JSP 364 - EOD Manual	Explosive Ordnance Disposal
HQSTC ROII Office (RAF Wittering)	SO2 A4 EOD Ops and Plans	Explosive Ordnance Disposal
Historic Branch (Army) (Navy) (RAF)	HB(A)1 NHBL(AL) AHB (RAF)	Historical Research
D Met O	Met O SO	Safety Policy

Annex B – Checklists for reviewing conceptual model and proposed detailed inspection

TABLE B1 – REVIEW OF CONCEPTUAL MODEL	
Background Information	
1	Is there sufficient documentary information regarding the site setting and history to construct an adequate conceptual model?
If not, consider commissioning further desk study work. Use the work instruction on procuring design services to identify the data sets to be obtained by documentary research	
Adequacy of the Conceptual Model	
2	Is the list of pollutants complete, based upon the history of the site?
If not, amend the CM accordingly having regard to DoE industry profiles & special sites guidance.	
3	Have all viable pathways been identified given the form of the pollutant, its likely location and the use of the site by the receptors in question?
If not, amend the CM accordingly and consider whether any of these pathways need confirming via visual or intrusive inspection or whether they are obvious.	
4	Have the possible presence of all Part 2A receptor types (as per Table A & B of the statutory guidance) been evaluated?
If not, amend the CM accordingly and consider the need to confirm the presence of these receptors by further desk study, visual or intrusive inspection work	
Risk Assessment Information	
5	Is there existing evidence of actual pollution or harm at the site?
If so, consider whether you need to gather any further information at all via detailed inspection. It may well be all that's required is to pull together the existing data in a summary report	
6	Is there existing evidence of unacceptable risks at the site?
If so, (e.g. existing risk assessment reports) consider whether you need to gather any further information at all via detailed inspection or just summarise what has already been done.	
7	Given the types of pollutant linkages present have you identified the methodology of assessing risks to each receptor?
If not, consider which risk assessment tools you will use and the data that's required to use them. You may need to gather parameters such as basic soil properties, or develop health criteria values in addition to gathering contaminant information.	
8	Is there evidence of the presence of pollutants on the site?
If so, consider whether you need to gather any further information at all. If evidence is needed to confirm each contaminant is present, can the presence of the contamination be confirmed simply by visual means or will sampling and analysis be required? If so what samples will be required and from where given what you know of the CM?	
9	Do you have enough information on the receptors to be able to carry out a risk assessment given the methodologies identified in 7 above?
If not, then information on the presence distribution type and behaviour of receptors may be needed via visual or intrusive investigation.	
10	Do you have enough information to confirm that the pathways are present?
You may need to confirm the existence of preferential pathways, geology etc. as part of the inspection work (but only if there is a real doubt as to their existence)	

TABLE B2 - ASSESSING INSPECTION PROPOSALS

Conceptual Model	
1	Will the proposal deal with all pollutant linkages identified by the CM?
	It must include provisions to gather information needed to confirm the presence of contaminants, pathways and receptors and whether they form a viable pollutant linkage AND information to decide whether the linkage is significant.
Background Information	
2	Does the proposal adequately summarise the existing documentary information?
	There must be enough information to give confidence that the existing documentary information has been well reviewed. A good summary of existing information will allow you to assess whether the proposals for gathering further information are actually needed.
Sampling Strategy	
3	Will samples be taken from the right media and at relevant locations and depths given the contaminant distribution and exposure scenarios detailed in the CM?
	If samples are needed to prove the existence of contamination, it should be clear where they are being taken from and why. Sufficient samples (or other evidence) are needed to confirm the existence of pollutant linkages and allow an assessment of significance. Comprehensive site characterisation should generally be avoided.
4	Will enough samples be taken to allow valid interpretation?
	The site should be properly zoned and appropriate averaging areas defined in order to allow an adequate assessment of risk in line with established good practice. In general more samples will be required in order to adequately assess risks to human health than controlled waters (see CLR7)
5	Are the Methods Proposed appropriate for the site?
	The site investigation methods being proposed should be the most suitable and cost effective way of gathering the necessary data given the site specific setting and constraints. The "Guidance on Site Investigation Techniques". Can be used to help assess the general suitability of methods.
Analytical Strategy	
6	Will all contaminants of concern be detected to a level sufficient for risk assessment?
	The analytical methods being proposed must be capable of detecting the contaminants of concern at a sufficiently low level to allow comparison with either generic or site specific assessment criteria. It's important to know how you will assess the risks for each contaminant before you gather the data, to make sure data is suitable. Will the analyses be MCERTS compliant?
7	Has a phased analytical strategy been considered?
	Sampling strategies are usually designed to gather sufficient samples to allow statistical analysis should the samples prove to be contaminated. However it may be possible to save a significant sum of money by adopting a phased analytical strategy e.g. testing only a portion of samples from a wider sampling grid/pattern first and only if a potential problem is indicated via a screening analysis going on to test the rest of the samples.
Risk Assessment	
8	Have appropriate risk assessment methods and tools been specified?
	Risk assessment should be carried out in line with established "UK" compliant good practice.
9	Will the proposal collect all the information needed to use the risk assessment tools?
	Quantitative risk assessment tools in particular may require information on geological, soil or receptor characteristics in addition to contaminant concentrations in order to be used correctly. Wherever possible site specific data should be collected rather than reliance upon generic assumptions.
Quality Control & Quality Assurance	
10	Have appropriate QC/QA measures been identified?
	The proposal should include sufficient detail to give confidence that samples are being taken, stored, transported and tested in an appropriate fashion.

Annex C – Generic Format of Phase 1 & Phase 2 Land Quality Assessment Reports

1. Face Sheet

This should contain:

- a. Title "INSERT TLB SPONSOR DETAILS" centred at the top of the sheet.
- b. Title in the centre of the sheet, with the Project No. immediately below.
- c. The legend "Prepared by (the Author's name) for the Ministry of Defence, TLB Details, under commission (number)" in the bottom right hand corner of the sheet along with the month and year in which the Study was produced.
- d. Marked areas for signing as accepted by the Project Sponsor.

2. Size

- e. This should always be A4 vertical format, but may contain folded A3 or larger sized sheets in clear A4 pocket inserts.

3. Maps, Logs and Plans

Maps should illustrate:

- Site Location;
- Site Boundary;
- Potential contaminant sources;
- Potential contaminant sources;
- Potential Receptors;
- Scale Bar; and
- North Arrow.

Phase 1 LQA

The following presents sections that need to be covered within a Phase 1 LQA.

Land Quality Statement		Land Quality Report	
(Should be a summary of the following information and no more than 3 sides of A4 and include references to appropriate figures)			
1.	Introduction	1.	Introduction
1.1	Terms of Reference	1.1	Terms of Reference
1.2	Site Location	1.2	Site Location
1.3	Site Description	1.3	Site Description
1.4	Site History	1.4	Site History
1.5	Environmental Setting	1.5	Environmental Setting
1.6	Site Sensitivity	1.6	Site Sensitivity
2.	Sources of Information	2.	Sources of Information

3.	Conceptual Model	3.	Conceptual Model
4.	Preliminary Qualitative Risk Assessment	4.	Preliminary Qualitative Risk Assessment (to include summary table)
5.	Overall Land Quality and Suitability for Redevelopment	5.	Overall Land Quality and Suitability for Redevelopment
		6.	References
		7.	Annexes
		8.	Figures

Phase 2 LQA

The following presents sections that need to be covered within a Phase 2 LQA.

Land Quality Statement
(Should be a summary of the following information and include references to appropriate figures)

1.	Introduction
1.1	Terms of Reference
1.2	Site Location
1.3	Site Description
1.4	Site History
1.5	Environmental Setting
1.6	Site Sensitivity
1.7	Sources of Information
2.	Phase 1 LQA Findings
3.	Site Investigation
4.	Ground Conditions
5.	Conceptual Model
6.	Generic Quantitative Risk Assessment

Land Quality Report

1.	Introduction
1.1	Terms of Reference
1.2	Site Location
1.3	Site Description
1.4	Site History
1.5	Environmental Setting
1.6	Site Sensitivity
1.7	Sources of Information
2.	Phase 1 LQA Findings and Preliminary Risk Assessment
3.	Site Investigation
4.	Ground Conditions
5.	Assessment Approach
5.1	Definition of Contaminated Land
5.2	Assessment Framework
5.3	Assessment Guidelines
6.	Conceptual Model
7.	Generic Quantitative Risk Assessment
6.1	Introduction

Land Quality Statement

(Should be a summary of the following information and include references to appropriate figures)

Land Quality Report

- | | | | |
|-----|--|-----|--|
| 7. | Detailed Human Health Quantitative Risk Assessment* | 8. | Detailed Human Health Quantitative Risk Assessment* |
| | | 6.2 | Generic Assessment Criteria |
| | | 6.3 | Generic Quantitative Risk Assessment (to include summary table) |
| | | 7.1 | Introduction |
| | | 7.2 | Detailed Assessment Methodology |
| | | 7.3 | Detailed Quantitative Risk Assessment (to include summary table) |
| 8. | Detailed Groundwater Quantitative Risk Assessment* | 9. | Detailed Groundwater Quantitative Risk Assessment* |
| | | 8.1 | Introduction |
| | | 8.2 | Detailed Assessment Methodology |
| | | 8.3 | Detailed Quantitative Risk Assessment (to include summary table) |
| 9.. | Overall Land Quality and Suitability for Redevelopment | 10. | Overall Land Quality and Suitability for Redevelopment |
| | | 11. | References |
| | | 12. | Annexes |
| | | 13. | Figures |

* Where required.

Phase 1 and 2 LQA

Technical Note

1. Introduction
2. Summary of Environmental Risk Assessment
3. Liability Appraisal in Regulatory Context
- must include an assessment of the significance of pollutant linkages consistent with the requirements of making a determination under Part 2A.
4. Assessment of Management Options (to include reliable order of cost estimates)
5. Conclusions and Recommendations
6. Figures
7. Annexes

Annex D

LAND QUALITY ASSESSMENT: ENVIRONMENTAL RISK ASSESSMENT SUMMARY TABLE

Area/Building	Potential Pollutant (Hazard)	Potential Receptor	Potential Pathway to Receptor	Associated Hazard	Potential Consequence of Hazard-Receptor Link	Likelihood of Hazard-Receptor Linkage	Potential Significance
		(specific to pollutant)	(specific to pollutant)	(specific to pollutant)	e.g. Severe Moderate Mild Negligible	e.g. Certain Almost Certain Likely Possible Unlikely Nil Chance	e.g. Risk Very High Risk High Risk Moderate Risk Low Risk Negligible Risk Liability: A } B } To be C } presented in D } Technical E } Note only F }

Classifications are defined on the accompanying Table

CLASSIFICATIONS TO BE USED IN ENVIRONMENTAL RISK ASSESSMENT SUMMARY TABLE

Potential Consequence of Hazard-Receptor Linkage	
Severe	Irreparable damage to buildings, structures or the environment. A significant change to the number of one or more species or particular ecosystem(s). Damage to human health. Substantial pollution of sensitive water resources.
Moderate	Damage to sensitive buildings, structures or the environment. A change to population densities of non-sensitive species. Non-permanent health effects to humans. Pollution of non-sensitive water resources or small-scale pollution of sensitive water.
Mild	Easily repairable effects of damage to buildings or structures. Some change to population densities but with no negative effects on the function of the ecosystem. Slight short-term health effects to humans. Slight pollution to non-sensitive water resources.
Negligible	Very slight non-structural damage or cosmetic harm to buildings or structures. No significant changes to population densities in the environment or in any ecosystem. No measurable effect on humans. Insubstantial pollution to non-sensitive water resources.

Potential Significance: Risk Classification	
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remedial action.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard at the site without remedial action.
Moderate Risk	It is possible that without appropriate remedial action, harm could arise to a designated receptor but it is relatively unlikely that any such harm would be severe and if any harm were to occur it is more likely that such harm would be relatively mild.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that at worst, that this harm, if realised, would normally be mild.
Negligible Risk	The presence of an identified hazard does not give rise to the potential to cause significant harm.

Likelihood of Hazard-Receptor Linkage	
Certain	100%
Almost Certain	95-99%
Likely or probable	55-94%
Possible or as likely as not	45-54%
Unlikely or improbable	5-44%
Nil Chance	0-4%

Potential Significance: Liability Classification	
A	Immediate significant risk of health hazard occurring
B	Immediate significant risk of unacceptable damage to the environment
C	Large remediation liability
D	Minor remediation liability
E	Minor significance, no remediation required
F	No effect on re-use options or site value

These tables do not indicate direct correlation between the classification systems shown. More than one liability classification letter may be used if appropriate, e.g. A, D.

Annex E – Part 2A Risk Assessment Guidance

ASSESSING THE SIGNIFICANCE OF POLLUTANT LINKAGES

Within the Technical Note the assessment of potential liability within the regulatory context must include an assessment of whether the identified pollutant linkages are:

- Resulting in significant harm being caused to the receptor in the pollutant linkage;
- Present a significant possibility of significant harm being caused to that receptor;
- Are resulting in the pollution of the controlled waters which constitute the receptor, or
- Are likely to result in such pollution.

Assessing Significant harm

The statutory Guidance on significant harm is set out within paragraphs A22 to A26 and Table A of Chapter A, Annex 3 of Defra Circular for England 01/2006 for England (Appendix 1) or paragraphs 1.22 to 1.26, 2.44 and Table A of Chapter 1 the NAW Guidance for Wales (Appendix 1) or paragraphs A23 to A27 and Table A, Annex 3 of Scottish Executive Circular 1/2000 for Scotland (Appendix 1). When considering whether “significant harm is being caused” the statutory Guidance requires an appropriate scientific and technical assessment of all the available evidence, before a judgement is to be made on “the balance of probabilities”.

Assessing the Significant Possibility of Significant Harm

The statutory Guidance on significant possibility of significant harm is set out within paragraphs A27 to A34 and Table B of Chapter A, Annex 3 of Defra Circular 01/2006 for England (Appendix 1) or paragraphs 1.27 to 1.34 and 2.45 to 2.49 and Table B of Chapter 1 of the NAW Guidance for Wales (Appendix 1) or paragraphs A28 to A37 and Table B, Annex 3 of Scottish Executive Circular 1/2000 for Scotland (Appendix 1). When considering whether “there is a significant possibility of significant harm being caused” the Statutory Guidance requires that a scientific and technical assessment of the risks arising from the pollutant linkage be made using relevant, appropriate, authoritative and scientifically based guidance. A significant risk of harm is considered to exist if the assessment indicates that the pollution linkage in question meets the conditions set out in Table B, and that there are no suitable and sufficient risk management arrangements already in place to prevent the harm in question.

In considering whether there is a significant risk of significant harm, the Statutory Guidance advises that only the current use of land should be considered and furthermore, that account should be taken of any evidence that the current use will cease in the near future.

Assessing Pollution or Likely Pollution of Controlled Waters

The Statutory Guidance on the interpretation of the occurrence or likelihood of pollution of controlled waters is set out within paragraphs A35 to A39 of Chapter A and paragraphs B50 & B51 of Chapter B, Annex 3 of Defra Circular 01/2006 in England (Appendix 1) or paragraphs 1.35 to 1.39 of Chapter 1 and paragraphs 2.50 & 2.51 of Chapter 2 of the NAW Guidance for Wales (Appendix 1), or paragraphs A38 to A42 of Chapter A, and B50 and 51 of Chapter B, Annex 3 of Scottish Executive Circular 01/2000 for Scotland (Appendix 1).

Pollutant Linkage Summary Table

For LQA purposes contaminants may be grouped as MOD will be treated as a single entity under Part 2A.

An example of a completed summary table is shown overleaf (Table E1).

TABLE E1 SUMMARY OF POLLUTANT LINKAGE EVALUATION TEMPLATE

Pollutant Linkage	Contaminant	Pathway(s)	Receptor	Potential for Significant Pollutant Linkage	Area(s) Affected
1	List contamination present or likely to be present	List viable pathways	List potential receptors	Proven Likely Unlikely	
2					
3					
4					
5					
6					

Appendix 1

UK Legislative Regime and Government Policy

- The Contaminated Land (England) Regulations 2006
Statutory Instrument (SI)2006 No. 1380
- The Contaminated Land (Scotland) Regulations 2005
Scottish Statutory Instrument (SSI) 2005/658
Scottish Statutory Instrument (SSI) 2000/178
- The Contaminated Land (Wales) Regulations 2006
Welsh Statutory Instrument (SI) 2006 No. 2989 (W.278)
- Northern Ireland Waste and Contaminated Land Order 1997
- Defra (2006) Circular 01/2006 Environmental Protection Act 1990:
Part 2A Contaminated Land
HMSO London
- Scottish Executive EPA 1990:Part 2A Contaminated Land – Statutory Guidance Edition 2
- Welsh Assembly Government EPA 1990: Part 2A Statutory Guidance on Contaminated Land (2006)
- Remediation of Contaminated Land
National Assembly for Wales guidance to enforcing authorities under Part 2A of the Environmental Protection Act 1990
- Department for Local Communities and Local Government (2006)
Planning Policy Statement PPS10: Planning for Sustainable Waste Management
- Department for Local Communities and Local Government (2004)
Planning Policy Statement PPS23: Planning and Pollution Control

MOD Policy

- JSP 418 MOD Sustainable Development & Environmental Manual
- DE Designated Maintenance Guide 12 Site Closure Guide
- Duty Holders Contaminated Land Guide

DE Technical Bulletins

- 99/19 Order of Cost Estimates, Defence Estates
Specialist Services
- 99/21 Estimating using Risk Analysis, Defence Estates
Specialist Services

British Standards Institution

- BS 10175: 2001 *Investigation of Potentially Contaminated Sites - Code of Practice*
- BS 5930: 1981 (updated in 1999) *Code of practice for site investigations*
- BS 1377:1990 *Methods of test for soils for civil engineering purposes* BS 6068: *Water Quality: Part 2: Chemical and biochemical methods*
- BS 6068: *Water Quality: Part 4: Microbiological methods*
- BS 6068: *Water Quality: Part 5: Biological methods*
- BS 6068: Part 6: Section 6.1:1981 (confirmed 1990) (ISO 5667/1-1980) *Water Quality: Part 6.1 Sampling: Section 6.1 Guidance on the design of sampling programmes*
- BS 6068: Part 6: Section 6.2:1991 (ISO 5667/1-1991) *Water Quality: Part 6 Sampling: Section 6.2 Guidance on sampling techniques*
- BS 6068: Part 6: Section 6.3:1986 (ISO 5667/3 - 1985) *Water Quality: Part 6 Sampling: Section 6.3 Guidance on the preservation and handling of samples*
- BS 6068: Part 6: Section 6.4:1987 (ISO 5667-4:1987) *Water Quality: Part 6 Sampling: Section 6.4 Guidance on sampling from lakes, natural and man made*
- BS 6068: Part 6: Section 6.6:1991 (ISO 5667-6:1991) *Water Quality: Part 6 Sampling: Section 6.3 Guidance on sampling of rivers and streams*
- BS 6068: Part 6: Section 6.11:1993 (ISO 5667-11) *Water Quality: Part 6 Sampling: Section 6.11 Guidance on the sampling of groundwaters*
- BS 6068: Part 6: Section 6.12:1993 (ISO CD 5667-12) *Water Quality: Part 6 Sampling: Section 6.12 Guidance on sampling of sediments*
- BS 6068-6.18: (BS ISO 5667-18) *Water Quality - Sampling: Part 18 Guidance on sampling of groundwater at contaminated sites 2000*
- BS 7755 *Soil Quality (2000): Part 1 Vocabulary*
Part 2 Sampling
Part 3 Chemical Methods
Part 4 Biological Methods
Part 5 Physical Methods

Building Research Establishment (BRE)

- Digest 1 *Concrete in aggressive ground*
- Digest 255 *Performance of building materials in contaminated land*
- Digest 275 *Fill: Part 2: Site investigation, ground improvement and foundation design*
- Digest 318 *Site investigation for low-rise building: desk studies*
- Digest 322 *Site investigation for low-rise building: procurement*
- Digest 348 *Site investigation for low-rise building: the walk over survey*
- Digest 363 *Sulphate and acid resistance of concrete in the ground*

- Digest 381 *Site investigation for low-rise building: trial pits*
- Digest 383 *Site investigation for low-rise building: soil description*
- Digest 414 *Protective measures for housing on gas contaminated land*
- Digest 447 *Brownfield development sites: ground-related risks for buildings*
- IP2/87 *Fire and explosion hazards associated with the redevelopment of contaminated land*
- IP3/89 *Subterranean fires in the UK – the problem*
- D Crowhurst *Measurement of gas emissions from contaminated land*

Canadian Council of Environment Ministers (CCME)

- *Guidance manual on sampling, analysis and data management for contaminated sites, Volume 2: analytical method summaries*
CCME (Winnipeg) (1993)
Report CCME EPC-NCS 66E

Chemical Industries Association

- *Contaminated land and land remediation – guidance on the issues and techniques* CIA (London) (1993)

Confederation of British Industry

- *Guidelines for business to deal with contaminated land* CBI (London) (1994)

Construction Industry Research and Information Association (CIRIA)

- SP 25, 1989 A J Weltman & J M Head *Site investigation manual*
- SP 45, 1986 *Recommendations for the procurement of ground investigation*
- SP 73, 1991 *Role and responsibility in site investigation*
- SP 78, 1991 *Building on derelict land*
- SP 79, 1992 *Methane and Associated Hazards to Construction: a bibliography*
- Report 130, 1993 *Methane: Its occurrence and hazards in construction*
- Report 131, 1993 *The measurement of methane and other gases from the ground*
- Report 132 *A guide to safe working practices for contaminated sites*
- Report 133, 1986 *Control of groundwater for temporary works*
- Report 149, 1996 *Protecting development from methane*
- Report 150, 1995 *Methane investigation strategies*
- Report 151, 1995 *Interpreting measurements of gases in the ground*
- Report 152, 1995 *Risk assessment for methane and other gases in the ground*
- Report 186, 1999 *Hydraulic measures for the control and treatment of groundwater pollution*

- C540, 2000 *Remedial treatment for contaminated land – training pack*
- C553, 2001 *Risk assessment for contaminated land – training pack*
- C549, 2001 *Remedial processes for contaminated land – principles and practice*
- C545, 2000 *Contaminated land – management of financial risks*
- C552, 2001 *Contaminated land risk assessment – A good management guide*
- C557, 2001 *Remedial engineering of closed landfill sites*
- C578, 2002 *Brownfield sites – a client's guide*
- C612, 2004 *Implementation of remedial options for contaminated land – training pack*
- C622, 2004 *Selection of remedial treatment for contaminated land – a guide to good practice*
- C659, 2006 *Assessing risks posed by hazardous ground gases to buildings*
- FR/CP/14, 1993 *Methane investigation strategies*
- FR/CP/22 *Interpreting measurements of gas in the ground*
- FR/CP/23 *Risk assessment for methane and other gases in the ground*
- FR/CP/25 *Remedial treatment of contaminated land using in-ground barriers, liners and cover systems*

DoE/DETR/DEFRA/EA

- Waste Management Paper 26A, *Landfill completion*, HMSO (London) 1993
- Waste Management Paper No 27, *Landfill gas*, HMSO (London) 1991
- CLR 1 *A framework for assessing the impact of contaminated land on groundwater and surface water* (2 vols.) DoE (London) 1994
- CLR2 *Guidance on Preliminary Site Inspection of Contaminated Land*. Applied Env. Research Centre Ltd. Vol 1 DoE 1994.
- CLR3 *"Documentary Research on Industrial Sites"* RPS Group plc. DoE 1994.
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- *Code of safe drilling practice Part 1: surface drilling* BDA (Brentwood), 1981
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Interdepartmental Committee on the Redevelopment of Contaminated Land (ICRCL)

- ICRCL 17/78 *Notes on the development and after-use of landfill sites*
- ICRCL 18/79 *Notes on the redevelopment of gasworks sites*
- ICRCL 23/79 *Notes on the redevelopment of sewage works and farms*

- ICRCL 42/80 *Notes on the redevelopment of scrapyards and similar sites*
- ICRCL 61/84 *Notes on the fire hazards of contaminated land*
- ICRCL 64/85 *Asbestos on contaminated sites*
- ICRCL 70/90 *Notes on the restoration and aftercare of metalliferous mining sites for pasture and grazing*

International Organisation for Standardisation (ISO)

ISO = full ISO standard - usually adopted by BSI as British Standard
 DIS = draft international standard
 CD = committee draft
 WD = working draft
 WI = work item

- CD 11259 *Description of soils and sites*
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- CD 11074-2 *Soil quality - Vocabulary - Part 2: Terms and definitions relating to sampling*
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- CD 10381-3 *Soil quality - Sampling - Part 3: Guidance on safety*
- CD 10381-4 *Soil quality - Sampling - Part 4: Guidance on the procedure for the investigation of natural, near-natural and cultivated soils*
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 - 3 - *Specification for ground investigation*
 - 4 - *Guidelines for the safe drilling of landfills and contaminated ground*

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US Environmental Protection Agency

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Welsh Development Agency

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