

Strategic national guidance

The decontamination of the open environment exposed to chemical, biological, radiological or nuclear (CBRN) substances or material

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Foreword

By Elliot Morley, Minister of State, Environment and Agri-Environment

The Government has published this guidance to help local authorities, and others with responsibilities for protection of the public, to develop practical strategies for cleaning-up the open environment in the event of releases of chemical, biological, radiological or nuclear (CBRN) substances, whatever their cause. It complements similar contingency planning guidance published by the Home Office.

The persistence of CBRN substances in the environment can vary from just a few hours to perhaps many months or even many years in the case of some radioactive materials. However a well-managed recovery strategy can significantly reduce the overall impact of an incident. The local authority's recovery strategy will reflect a pattern of decisions that sets the long term direction of the environmental recovery process and ultimately determines its overall success.

This guidance provides an agreed set of basic recovery principles and a shared understanding of the key issues that may need to be addressed. In order to provide further advice and assistance to those involved the government is actively considering the establishment of a national decontamination and recovery service. The guidance will be subject to continuing review and will be kept up to date. As such we would welcome feedback on the document. Any comments should be sent to cbrnenquiries@homeoffice.gsi.gov.uk.

I am grateful to all of the individuals and organisations that have contributed to this document. It has been particularly helpful to receive the input of colleagues in the Local Government Association, the Home Office, the Environment Agency, the Emergency Planning Society and the Government Office for London.

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1. Introduction

- 1.1. This guidance has been written to help local authorities and others in England and Wales develop common strategies for decontaminating urban and rural environments following the release of chemical, biological, radiological or nuclear (CBRN) substances and return any affected areas, as far as practicable, to normal use.
- 1.2. Accidental releases, outbreaks of serious communicable diseases, contamination from overseas incidents, even domestic spillages or leakages can produce consequences equally as severe as a deliberate release of chemical biological or radiological substances. The measures required to deal with the consequences of any crisis featuring the accidental release of toxic substances or a major infectious disease outbreak would be similar to those required for a deliberate release. It is therefore appropriate to have generic guidance that can be adapted to any credible scenario.
- 1.3. This guidance builds on that previously issued by the Home Office directly to local authorities on the emergency response to the release of CBRN substances¹ and also on the published guidance on the decontamination of people.² It does not introduce any new burdens on local authorities.
- 1.4. A recovery strategy reflects a pattern of decisions that set the long-term direction of the environmental recovery process and determines its success. This guidance is intended to support and improve strategic decision-making at local level and underpin the generic major incident plans of local authorities.
- 1.5. Section 2 deals with the roles and responsibilities of organisations that will decide and implement the recovery strategy. Section 3 explains the strategic principles and priorities of recovery, how local factors may affect the recovery strategy, and the key outcomes that need to be achieved.
- 1.6. Section 4 discusses different recovery options for dealing with CBRN incidents using five simplified profiles of different types of incident that could affect the open environment. It provides local authority managers with a basic technical understanding of CBRN recovery approaches.

¹ *The Release of Chemical ,Biological ,Radiological or Nuclear (CBRN) Substances or Material: Guidance for Local Authorities* (Home Office, August 2003)

<http://www.ukresilience.info/cbrn/lacbrnintro.htm>

² For information on the roles and responsibilities of local emergency organisations when responding to a CBRN incident see *The decontamination of People Exposed to CBRN Substances: Strategic National Guidance*, published February 2003 on the Cabinet Office's UK Resilience website

http://www.ukresilience.info/cbrn/cbrn_guidance.htm

2. Roles and Responsibilities

- 2.1. Local authorities will play a lead role recovering from the effects of a chemical, biological or radiological terrorist incident³. This will include organising and managing the decontamination of the affected area and restoring the environment as far as practicable to normal use. The timescales for environmental clean-up will depend upon the incident locations, the types of substance used, their persistence in the environment and the severity of contamination.
- 2.2. For some CBRN incidents, the affected area could be relatively localised. In other scenarios the affected area may be more widespread, e.g. in a populated urban city centre or in rural farmland. In either case Central Government would assist the local authority, in various ways, to develop and implement its recovery strategy.
- 2.3. Government has an important supporting role to play by:
 - (a) Providing technical advice on chemical and biological substances from centres of excellence such as the Defence Science and Technology Laboratory (Dstl)⁴, and the Health Protection Agency (HPA).
 - (b) Providing technical advice on radiological substances from other centres of excellence including the National Radiological Protection Board (NRPB) and the Atomic Weapons Establishment (AWE).
 - (c) Providing assistance to local authority emergency response teams under Military Aid to the Civil Community (MACC) arrangements⁵.

³ The local authority would normally lead rehabilitation of the community following a major incident. See *Recovery: An Emergency Management Guide* published on the Cabinet Office's UK Resilience website <http://www.ukresilience.info/contingencies/business/recovery.pdf>

⁴ The Ministry of Defence's (MOD) approach to managing CBRN risks is explained in *Defending Against the Threat from Biological and Chemical Weapons*, published July 1999, on the MOD web site at <http://www.mod.uk/issues/cbw>. MOD will not take the lead in responding to civil CBRN emergencies but can provide expert advice and support, which would be funded by local authorities. See http://www.publications.parliament.uk/pa/cm200203/cmhansrd/vo030430/text/30430w06.htm#30430w06.html_sbhd1

⁵ Arrangements for Military Aid to the Civil Community (MACC) are described in the Cabinet Office Publication, *Dealing with Disaster*, Revised 3rd Edition, published June 2003 on the Cabinet Office's UK Resilience website <http://www.ukresilience.info/contingencies/dwd/index.htm>.

- (d) Co-ordinating the activities of individual Government Departments responding to the incident and providing a framework within which individual departments can discharge their specific responsibilities.⁶
- (e) Co-ordinating the collection of information on the incident and its effects for the purposes of:
 - (i) providing information to the public and media at the national level;
 - (ii) briefing Ministers; and
 - (iii) informing Parliament.
- (f) Acting as the focal point for communications with the local authority's Strategic Co-ordinating Group. In some cases the Regional Resilience Forums could be a conduit.

2.4. In the event of a CBRN terrorist incident in Great Britain, the Home Office would initially assume lead government department responsibility for dealing with the effects of the emergency. The Home Office would be supported by other departments including the Department for Environment, Food and Rural Affairs (Defra), which also has the responsibility in England for co-ordinating the government's contribution to the decontamination and recovery phase of such incidents or emergencies in the open environment irrespective of the cause of the incident⁷. At some point, to be determined on a case-by-case basis and once the crisis management phase is concluded, the lead department responsibility would be transferred to Defra although depending on the nature and location of the incident(s), for example where releases of CBRN materials occur primarily within buildings and infrastructure, other departments might take the lead. Consequence management for devolved functions following terrorism within Wales would fall to the Welsh Assembly Government (WAG) and its own lead department arrangements.

2.5. In respect of CBRN incidents arising from non-terrorist causes, the civil contingencies Secretariat of the Cabinet Office (in consultation with the Home Office) would ensure that, dependent on the cause of the incident, a lead department was identified for both the crisis and consequence management phase. The Personnel, Management and

⁶ For further information on lead Government Department responsibilities during CBRN incidents see The role of Lead Government Departments in Planning for and Managing Crises, published July 2002 on the Cabinet Office's UK Resilience website <http://www.ukresilience.info/handling.htm>.

⁷ Defra's role would be taken in the Devolved Administrations by the relevant responsible departments.

Business Services Group of the WAG will take the immediate lead for any matters which are devolved and in which the lead role needs to be confirmed.

- 2.6. Other Government Departments also have important roles when responding to CBRN incidents. For example, the Department of Health (DoH) is responsible for managing any implications for the impact on public health that may arise from the release of CBRN substances; the Department for Transport (DfT) has strategic responsibility for transport security, including airports; and the Office of the Deputy Prime Minister (ODPM) is responsible for buildings and infrastructure. The proposed national decontamination and recovery service would, on request from the body co-ordinating the incident response, provide advice and support, including management of the decontamination process. The Government is examining possible arrangements with contractors for ensuring that suitable commercial decontamination services are available.

Box 1: Recovery from Crisis

The major long-term impact of a CBRN incident is principally the disruption it causes to normal life by denying access to the area affected by the release^{8,9}. A well-managed recovery strategy can significantly reduce the overall impact of the incident, especially where the critical national infrastructure is affected¹⁰. A great deal of information will have already been acquired during the crisis response to the incident. Centres of excellence such as Dstl, HPA, NRPB and AWE will have identified the type of CBRN substance dispersed and its hazards. Members of the public may have been relocated away from the hazard zone to a place of safety. The incident scene will have been stabilised by the emergency services and a cordon established to prevent any further spread of contamination. A mixture of publicly owned land, commercial land and private land may be affected by CBRN contamination. In most cases the key organisations leading the recovery process will be the local authority and its clean-up contractors, with continued advice and support from the Environment Agencies, the Food Standards Agency, the Police and the local water supplier and sewerage undertaker.

- 2.7. Government Departments will begin to scale down their involvement in the response to a CBRN incident only when Ministers are satisfied that it is prudent to do so, e.g. when the consequences of the incident have been contained, the conditions at the affected area properly dealt with

⁸ A useful article on demystifying CBRN threats is published on the *World Magazine* web site http://www.worldmag.com/world/issue/03-15-03/cover_1.asp and also in the *Washington Post* <http://www.washingtonpost.com/ac2/wp-dyn/A34577-2001Dec12?language=printer>

⁹ See also Chapter 2 - *Grounding the threat in reality* - of Stimson Center Report No 35 *Ataxia: The Chemical and Biological Terrorism Threat and the US Response* published on the Stimson web site <http://www.stimson.org/cbw/pubs.cfm?id=12>

¹⁰ The Critical National Infrastructure (CNI) are those parts of the United Kingdom's infrastructure for which continuity is so important to national life that loss, significant interruption, or degradation of service would have life-threatening serious economic or other grave consequences for the community. <http://www.homeoffice.gov.uk/terrorism/govprotect/infrastructure/>

and central assistance is no longer required. The following decision-making criteria would be likely to be applied by Ministers:

- (a) is there no longer a widespread threat to public health¹¹ or the environment;
- (b) have the consequences of the incident been successfully reduced to the extent that local authorities consider themselves to have adequate resources to maintain public confidence and deal with the situation; and
- (c) has a recovery strategy been prepared by the local authority and relevant organisations (see Box 1).

2.8. Different organisations and organisational arrangements may be involved in the recovery process in comparison with the crisis phase, as the balance of risk may shift away from members of the general public towards a much smaller group of professional local authority staff and civilian contractors implementing the clean-up process.

2.9. The role of the local authority will be to:

- (a) Develop a phased recovery strategy (see Box 2) in conjunction with advice from Defra, regulatory authorities such as the Environment Agency, and technical centres of excellence;
- (b) Organise and manage the decontamination of the affected area and restore the environment to normal use, invoking mutual aid arrangements with neighbouring authorities and contractors as appropriate¹²;
- (c) Manage risks to the health and safety of workers undertaking decontamination of the environment and processing hazardous wastes; and
- (d) Where waste disposal routes are not immediately available, develop interim strategies for safely storing hazardous waste packages in an environmentally acceptable and responsible way.

2.10. Local Authority Environmental Health Departments will have a major input during the recovery process as they have most of the responsibility in legislation and operational experience. The local authorities will also have a vital role in local, public and media

¹¹ For information on managing the risks to health from CB substances see the *Deliberate Release of Biological and Chemical Agents: Guidance to Help Plan the Health Service Response*, published August 2002 on the Department of Health's web site <http://www.dh.gov.uk/PolicyAndGuidance/EmergencyPlanning/DeliberateRelease/fs/en>

¹² Local authority arrangements for mutual aid are described in the Cabinet Office Publication, *Dealing with Disaster*, published June 2003 on the Cabinet Office's UK Resilience website <http://www.ukresilience.info/contingencies/dwd/index.htm>.

communication. Contingency planning is addressed in the Civil Contingencies Bill, which had its second reading on the 19th of January 2004 and is now in the committee phase. The purpose of the Civil Contingencies Bill, and the accompanying non-legislative measures, is to deliver a single framework for civil protection in the United Kingdom. The Bill includes a duty for local authorities to promote business continuity management.

2.11. The role of central government in the regions will be to:

- (a) Help co-ordinate response recovery efforts through the Regional Resilience Forums¹³ and the Regional Civil Contingency Committees (RCCCs), especially in the event of multiple incidents; and
- (b) Liaise with other regions and with central government when sharing of resources is needed across regional boundaries.

2.12. The role of clean-up contractors will be to:

- (a) Safely implement the phased recovery strategy under the direction of the local authority;
- (b) Provide and operate decontamination technology and train and equip their workforce with suitable personal protective equipment;
- (c) Liaise with the local sewerage undertaker and the Environment Agency to protect watercourses by intercepting water used in decontamination and directing it to containment areas for appropriate treatment; and
- (d) Manage solid hazardous waste streams in an environmentally acceptable and responsible way, minimising risks to the health and safety of workers, the public and the environment.

2.13. The role of the Environment Agency will be to:

- (a) Advise the local authority on the appropriate storage, transport and disposal of hazardous wastes and the treatment of liquid effluents;
- (b) Continue to identify risks to the environment and people during each separate phase of the decontamination process and adjust

¹³ These forums have no formal role in response but the RCCCs when convened can be utilised to co-ordinate resources and will have a similar membership to the forums.

the recovery strategy to protect vulnerable environmental pathways and sensitive receptors; and

(c) Ensure that its regulatory role continues to function appropriately.

2.14. The role of the Police will be to:

(a) Control access and continue to protect the security of the cordon surrounding the area affected by CBRN contamination¹⁴.

2.15. The role of the Food Standards Agency will be to:

(a) Ensure that food contaminated to unacceptable levels does not enter the foodchain;

(b) Provide advice and information on food safety issues; and

(c) Ensure, in conjunction with the Environment Agency, safe disposal of contaminated food.

Box 2: Phased Remediation

The recovery phase¹⁵ of a major incident is the process of restoring and rebuilding the community in the aftermath of an emergency. Recovery involves decontamination of the environment. This will involve applying the same basic principles that apply more generally to the environmental remediation¹⁶ of contaminated land; making inspections and keeping under review the condition of the land; preventing, minimising and mitigating the effects of contamination; and restoring the land to its former state where practicable. However it is important to ensure that a remediation strategy will result in an overall net environmental improvement because remedial activities may have the potential to damage the environment, e.g. when excavating large amounts of contaminated material or disposing of toxic waste streams¹⁷. It is essential that these adverse impacts are properly managed and controlled by the local authority, drawing on advice from central government and others as appropriate. The overall process of remediation may require a phased approach with different remedial actions being carried out in sequence. The phasing of remediation

¹⁴ Local authorities have responsibility for managing the recovery process including securing the scene of the incident and controlling access to the recovery site, with advice and support from the Police Service. The generic roles and responsibilities of the Police are explained in *The Decontamination of People Exposed to CBRN Substances: Strategic National Guidance*, published February 2003 on the Cabinet Office's UK Resilience website http://www.ukresilience.info/cbrn/cbrn_guidance.htm.

¹⁵ The meaning of recovery is explained in *Recovery: An Emergency Management Guide* published on the Cabinet Office's UK Resilience website <http://www.ukresilience.info/contingencies/business/recovery.pdf>

¹⁶ Basic legal requirements for remediation are explained in Part IIA of the Environmental Protection Act 1990. Statutory guidance to local authorities on the remediation of contaminated land is published on the Scottish Executive web site <http://www.scotland.gov.uk/library3/environment/clc-13.asp>

¹⁷ See also Annex 16.3 *Interim Guidance from the Environment Agencies on the Disposal of Radioactive Waste Arising from a Nuclear Accident*, which forms part of Chapter 16 of the Department of Trade and Industry's Nuclear Emergency Planning Liaison Group (NEPLG) Guidance at <http://www.dti.gov.uk/energy/nuclear/safety/neplg16.pdf>

is likely to follow a progression from impact assessment actions through to successive remedial treatment actions and then finally monitoring actions to confirm successful clean up.

3. Recovery Principles and Priorities

3.1. During the early response to the incident the local authority should establish a Remediation Working Group to prepare advice and recovery proposals for the local authority's management team to consider¹⁸. The aim of the recovery strategy should normally be to return the environment to unrestricted use.

3.2. It is very difficult to make general statements about CBRN substances because of the wide range and variety of effects, toxicity and concentrations that could be deployed. However in general terms, the principal challenges of chemical, biological and radiological decontamination of the environment are that:

- chemicals are easy to find and isolate but difficult to destroy and can generate toxic waste by-products;
- biological substances are easy to destroy but difficult to find and isolate and it is hard to be certain they are fully removed;
- radiation is easy to find and isolate but impossible to destroy, it can only be removed and containerised.

3.3. In practice local constraints, such as intervention actions already undertaken during the emergency phase, may strongly influence the practical choice of recovery techniques especially, where the permitted timescales for recovery are short because critical national infrastructure is affected. Also, when making decisions on recovery options there is a balance to be struck between maximising protection of people and protection of the environment, because these constraints may drive accepted levels of clean-up, and their associated environmental impacts, in opposing ways.

3.4. Factors influencing the recovery strategy

3.4.1 **Detection and intervention timelines.** Chemical, biological or radiological substances could be dispersed in a number of ways, not necessarily by the use of static containers or explosive devices. The immediate effects of a release, whatever its cause, of a chemical substance are likely to be noticeable more quickly than a biological or radiological substance. Biological substances may require an

¹⁸ Two technical handbooks dealing with recovery from CBRN incidents are being developed mainly for local authority use. The handbooks will give practical advice on the management processes and methods of recovery from CBRN incidents, supported by relevant technical and logistics information and decision-aiding flowcharts.

incubation period of several days before people become sick. The delayed onset of symptoms in a biological incident means that the area affected may be greater due to the migration of affected individuals. Exposure to radiological substances also may not produce any immediately noticeable health effects, resulting in contamination spread before it is detected by monitoring instruments.

3.4.2 Size of the affected area. The area of land that has been contaminated to a significant degree by a chemical substance will normally only stretch a few hundred metres from the original release point. However the hazard zone will be larger than the contamination area because of evaporation or resuspension into the air of the substance. This is especially true for chemical releases that produce a vapour hazard downwind of the contaminated area.

3.4.3 Stability and persistence of the substance. The recovery strategy will depend upon the persistence of the substance in the environment (see Box 3). Although chemical and biological substances vary considerably in their properties and in their effects on humans, substances are not always persistent for long periods of time and may safely break down over a few days when exposed to rain or sunlight or can be destroyed by using simple treatment processes such as spraying with dilute bleaching solutions. However most radiological substances, and some chemical or biological substances, are highly persistent. Additionally CBRN substances may penetrate into cracks and crevices or be absorbed into materials such as rubber and paint. If this occurs they will be protected from the decontamination process and so could later be released, giving rise to a persistent contact or vapour hazard to members of the public.

3.4.4 Nature of the location. Decontamination techniques for urban clean up in towns and cities will be different to rural clean up in the countryside. The clean up of substances released in the open environment will be different to clean up inside a structure. Natural weathering and wet decontamination techniques will be most effective for chemical and biological incidents which take place outdoors either in urban or rural environments.

3.4.5 Effectiveness of recovery options. Recovery decisions should take account both of the expected benefits of different decontamination options and also their likely contribution to an early return to normal living within the affected population. NRPB has developed a simple categorisation scheme for comparing different recovery options for radiological incidents, based upon the likely scale, duration and resource requirement necessary to implement each option¹⁹. Potential recovery options may be broadly divided into three categories; those that are moderately dose-reducing, incur relatively little disruption or require few resources, and which can be completed soon after the

¹⁹ See *Intervention for Recovery After Accidents*. Documents of the NRPB. Volume 8. No 1. 1997. Available from the NRPB web site http://www.nrpb.org/publications/documents_of_nrp/index.htm

incident (Category A); those that are more strongly dose-reducing but which incur significant disruption or require significant resources, or can only be carried out over protracted periods (Category B); and those that are either poorly dose-reducing or only moderately dose-reducing and incur significant disruption or require significant resources (Category C). The CBRN recovery strategy should focus initially on Category A and Category B options, although the local authority may still wish to implement Category C options for reasons other than health protection, for example public reassurance. There may also be a role for cost-benefit analysis in decision-making, for example when it may be more cost-effective to resurface a public highway rather than remove very low levels of persistent contamination.

- 3.4.6 Health and safety management.** Risks to the health and safety of people will need to be managed as an integral part of the recovery strategy. This will include local authority staff, clean-up contractors, sewerage company workers, the Police and Fire Services, external advisors, possibly voluntary organisation workers and members of the civic community, who may potentially be exposed to residual levels of CBRN substances during different phases of the clean-up operation. The general approach to controlling exposure to hazardous substances is explained on the Health and Safety Executive's (HSE) *COSHH Essentials* web site.^{20,21} HSE's principles of hazard control involve the following steps; assess the risks to health arising from potential exposure to a CBRN substance (Step 1); decide what precautions are needed (Step 2); prevent or adequately control exposure (Step 3); ensure that control measures are used and maintained (Step 4); monitor the exposure of people (Step 5); carry out appropriate health surveillance (Step 6); and ensure that people are properly informed, trained and supervised (Step 7). Each of these steps will need to be considered within the local authority's recovery strategy.

Box 3: Persistence of CBRN Substances

The persistence of a CBRN substance is its ability to remain hazardous in the environment over time. The choice of recovery strategy will be strongly influenced by the persistence of the substance being cleared up. Substances with low persistence such as sarin or cyanide disappear within hours. A

²⁰ Legal requirements are set out in the Control of Substances Hazardous to Health (COSHH) Regulations 2002.

²¹ *COSHH Essentials* is a free on-line risk assessment service for hazardous substances, provided by HSE at <http://www.coshh-essentials.org.uk>. The key principles of hazard control are explained at <http://www.coshh-essentials.org.uk/assets/indg136.pdf>

persistent chemical substance might last several months or even a few years under the right conditions. For chemical and biological substances the actual rate of deterioration will partly depend on local weather conditions. For example chemical substances evaporate faster on hot days than cold days and biological substances break down faster in direct sunlight than in the shade. A persistent radiological substance may take many decades to completely breakdown and the rate of decay is not affected by external factors such as the weather.

3.5 Priority actions for recovery

3.5.1 Stabilise any further migration of contamination. A physical cordon should be established around the suspected perimeter of contamination to restrict entry and exit. However because most types of CBRN release result in 'splatter' - small areas of contamination in a largely uncontaminated environment – it may not be possible to establish a precise boundary between uncontaminated and contaminated areas. Local authorities should use their judgement after seeking advice from specialist agencies to decide an appropriate hazard management zone (which will be larger than the suspected contaminated perimeter). The hazard management zone should be physically sealed off as far as possible, e.g. with plywood board similar to that used on construction sites. Where possible contaminated water should be intercepted in storage tanks for treatment and safe disposal. In the open environment, CBRN contamination in watercourses may need to be temporarily blocked and the path of the watercourse diverted. Containment of any affected livestock, cats and dogs, and feral animals may also need to be considered to prevent the spread of infectious substances.

3.5.2 Survey the affected area. Environmental monitoring to map affected areas after a CBRN incident would provide the main basis for decision-making on the decontamination and restoration of the environment to as near as normal use as practicable. The sampling strategy should focus initially on confirming the safety of the cordon perimeter. However it may not be necessary to carry out detailed surveys of the hazard zone, until after initial decontamination has been carried out. This is partly because in cases where the release of CBRN substances comes from improvised terrorist devices their relatively inefficient or incomplete nature may minimise the area contaminated. If terrorists used a greater quantity of material, the most likely effect would be higher levels of contamination close to the release site rather than a proportionate increase in the area affected. Depending on the specific CBRN substance involved, a survey of the hazard area may be practicable.

3.5.3 Decide target clearance levels. The recovery strategy will be influenced by knowledge of the risks to public health from the

substance, what level of residual contamination may safely be permitted to remain ('safe clearance levels') and the availability of suitable detection technologies capable of monitoring and distinguishing between levels of residual contamination above and below the agreed safe level. These technologies and standards are well understood for radiological substances. However there remain a number of technical uncertainties when applying military decontamination data to civilian clean-up scenarios. There is a wide range of potential chemical or biological weapon substances for which no safe clearance levels have been firmly established for civilian application. In the absence of clearance level data, experts from Dstl Porton Down will provide advice to local authorities. In addition two handbooks dealing with recovery from CBRN incidents are being developed by Defra for local authority use. The handbooks compile the best available safety data, principally from experience of past accidents and from defence sources, and give practical advice on the management processes and methods of recovery from CBRN incidents, supported by relevant technical and logistical information and decision-aiding flowcharts.

3.5.4 Develop phased recovery options. The process of remediation may require a phased approach with different remedial actions being carried out in sequence (see Box 2). Remediation is likely to follow a progression from impact assessment, through to successive treatment actions and then monitoring to confirm successful clean up. When deciding between different options the questions, which local authority managers must address, are similar to those which would apply to any pollution prevention and control strategy.²²

- (a) How effective will the recovery option be?
- (b) Is the recovery option environmentally acceptable?
- (c) What clearance level will adequately protect public health?
- (d) What levels of residual contamination will be acceptable?
- (e) How will the authority establish public confidence in its clean-up strategy?
- (f) How quickly can the option be implemented?
- (g) What resources will be required?
- (h) What wastes will be generated?
- (i) How will they be managed and disposed of?
- (j) What are the environmental impacts of the disposal options?

3.5.5 Transport and disposal of wastes. Waste management planning is an integral component of the recovery strategy. CBRN recovery techniques may involve demolishing highly contaminated structures, pressure washing lightly contaminated surfaces, sandblasting harder

²² For example, the European system of Integrated Pollution Prevention and Control (IPPC) includes formal licensing requirements to plan ahead for eventual decommissioning of Installations and to restore sites to their former condition. For further information see the site report requirements under IPPC, discussed in *Integrated Pollution Prevention and Control: A Practical Guide* published August 2000 by DETR. <http://www.defra.gov.uk/environment/ppc/ippcguide/index.htm>.

surfaces, replacing road surfaces and sweeping and vacuuming streets. This will produce large volumes of contaminated aqueous slurries and solid rubble. Early intervention actions by the emergency services will also generate wastes, mainly large volumes of contaminated water and bags of contaminated clothing from mass decontamination of the public. Introduction of statutory restrictions on foods from an affected area may also result in large volumes of waste crops and farm produce, including milk. The success of the recovery option may depend upon the availability of disposal routes for these wastes and also the receiving capacity of the disposal locations. The Water UK *Protocol for the Disposal of Contaminated Water*²³ provides useful guidance on dealing with incidents involving CBRN contamination of water and the disposal of waste water resulting from decontamination work etc. For solid wastes the local authority may need to consider an interim management strategy - such as temporary storage of hazardous wastes in ISO containers at a military site or a sports stadium - to allow the operators of disposal facilities sufficient time to safely receive, store, treat and dispose of the wastes. The local authority may also need to consult the local community, regarding the temporary storage, transport routes and intended disposal locations of CBRN wastes to maintain public confidence.

4 Management Approaches to Environmental Decontamination

4.1 Although the hazardous properties of different CBRN substances vary considerably, methods for decontaminating and restoring the environment to normal use share some common factors. Figure 1 and Figure 2 illustrate typical decontamination and waste management strategies needed to deal with persistent or non-persistent types of chemical, biological or radiological substances, released outside into either urban or rural environments. The strategies are based on simplified incident profiles explained in Annexes 1 to 5 of this document. In addition, for CBRN incidents involving animals Defra has separately developed a contingency plan to address disposability issues²⁴.

4.2 Important local resources

4.2.1 Irrespective of the precise circumstances of the incident, successful recovery will partly depend upon the ready availability of the following local resources that may already be in place to deal with, for example, major chemical incidents.

4.2.2 **Decontamination solutions.** Chlorine-based bleaching or sterilising solutions are highly effective at removing both chemical and biological

²³ *Protocol for the Disposal of Contaminated Water*. Water UK. Second Edition. April 2003 obtainable via local water undertaking.

²⁴ *Foot and Mouth Disease Contingency Plan*. Version 3. March 2003. A disposal strategy for contaminated animal carcasses is set out on Pages 40 - 42 of the contingency plan, which offers a hierarchy of preferred disposal options based upon incineration, rendering and landfill.
<http://www.defra.gov.uk/footandmouth/contingency/index.htm>

contamination. The most widely available sterilising solutions are calcium hypochlorite, sodium hypochlorite and sodium dichloroisocyanurate (FiClor), which are all commonly used to sterilise bacteria in swimming pools. A decontamination solution of 0.5% hypochlorite in water would be effective against many substances.

4.2.3 Water supply. An available water supply is needed both to prepare decontamination solutions and to rinse decontaminated surfaces. In rural or coastal environments freshwater from watercourses or saltwater from the sea provide a readily available water supply. In urban environments water is usually supplied via fire hydrants, which should be properly maintained and periodically tested, especially near buildings that may be a target for terrorists. Fire hydrants are owned by water companies and tested by the Fire Service.

4.2.4 Drainage management equipment. Run-off water and rinse water from decontamination will contain high concentrations of chlorine. The waste water must be intercepted and treated to neutralise its chlorine content which is hazardous to the environment. In urban areas the road drainage system is particularly vulnerable. Storm water drains may need to be blocked or their effluents diverted to holding tanks before decontamination is carried out, in accordance with the Water UK Protocol for Disposal of Contaminated Water.

4.2.5 ISO containers. Decontamination methods for dealing with persistent CBRN substances will tend to generate large amounts of solid waste. These will normally require temporary storage in ISO containers, especially in the case of radioactive wastes.

4.3 Partner organisations

4.3.1 Recovery from a CBRN incident will involve a partnership between the public local authority and private sector organisations. Commercial contractors will be likely to undertake decontamination and clean-up operations on behalf of the local authority. In addition the wastes, which are generated, are also likely to be managed by commercial organisations, e.g. private sector companies operate many hazardous waste landfill sites and incineration facilities.

4.3.2 Water supply and sewerage services. Water supplies and sewerage services to a particular area are provided by the local water companies, although it should be noted that in some areas two separate companies may be involved in the provision of services. Their expertise in local drainage systems and effluent interception will be very important when planning wet decontamination operations, especially to predict and avoid impacts on watercourses and drinking water supplies.

4.3.3 Landfill site operators. Contaminated soils or solid residues from liquid waste slurries are likely to be disposed to a hazardous waste

landfill. Disposal arrangements will need to be discussed and agreed with the landfill operator.

4.3.4 Clinical waste incineration companies. Bags of contaminated clothing and protective equipment that are lightly contaminated with CBRN substances are combustible and may be destroyed by incineration processes. In principle these wastes are similar to other hazardous chemical, biological or radioactive substances which are commonly disposed from hospitals and research establishments as 'clinical waste' to incineration plants in the UK.

4.3.5 Insurers. It is the responsibility of land owners and occupiers to ensure adequate insurance cover to meet the cost of dealing with the consequences of a CBRN terrorist incident, as it would be for any other potentially serious incident such as fire or flood. However in many cases as the CBRN risk is so open-ended insurers are increasingly less willing to cover the risk to private property. Commercial property, however, can be covered by the Pool Re scheme set up by the insurance industry and underwritten by HM Treasury. In the public sector, central and local government bears its own risk. Powers exist under the Local Government and Housing Act 1989 for the Government to make financial assistance available to local authorities following an emergency or disaster involving destruction of, or danger to, life and property. The Bellwin Scheme exists for this purpose, although it is discretionary and has not to date paid out for the costs of dealing with past terrorist incidents. The Local Government Act 2003 allows for alternative grant making powers including the provision for ministers to make special grants to local authorities. The local authority has a legal duty of care towards its contractors and may be vicariously liable for the actions of recovery contractors operating under the authority's instructions and directions. Military assistance may be required for the transportation of waste to disposal locations because commercial waste transport contractors also face similar insurance difficulties.