

SD:SPUR Information Paper

GOOD PRACTICE TOOLS FOR USE IN THE DEVELOPMENT OF STRATEGIES, PLANS AND PROCEDURES FOR THE MANAGEMENT OF DECOMMISSIONING WASTES AND REDUNDANT BUILDINGS, PLANT AND EQUIPMENT ON NUCLEAR SITES

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SUMMARY

This paper is about six good practice tools that are particularly relevant to the management of decommissioning wastes and redundant buildings, plant and equipment on nuclear sites. These tools are:

- the SD:SPUR guidance on applying sustainable practice to the management of nuclear decommissioning wastes
- the NDA guidance on integrated waste strategies
- the ICE demolition protocol
- the DTI code of practice on site waste management plans
- the nuclear industry code of practice on clearance and exemption
- the WRAP quality protocol for aggregates from inert wastes.

The paper begins with a brief description of the framework in which nuclear sites develop their strategies for managing decommissioning wastes and items. The various stages in the management process are identified, together with the key considerations at each stage. Information about the six good practice tools is then given. This includes identification of the management stages for which the tools are most useful and the key considerations that they particularly address. The final section of the paper deals with likely extensions to the existing tools and development of new tools.

The paper is intended mainly for those who develop strategies and manage decommissioning wastes at nuclear sites. It is hoped that it will also be useful to others who have an interest in nuclear decommissioning.

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1 INTRODUCTION

This paper provides information about the main good practice tools that are available in the UK to assist in the development of strategies, plans and procedures for managing decommissioning wastes and redundant buildings, plant and equipment on nuclear sites. The tools include guidance, codes of practice and protocols issued by government departments and agencies and other organisations. The decommissioning wastes covered in the paper are those of interest to SD:SPUR, namely radiologically clean, excluded, exempt and low activity solid wastes. Throughout the paper the term 'items' is used to mean buildings, including their fixtures and fittings, plant and equipment.

The paper begins with a description of the framework in which site-specific management strategies are developed, the principal stages in their development and implementation, and the key considerations at each of these stages. It then summarises the main good practice tools and the ways in which they can be used, in the context of national policies and regulatory requirements. The final section of the paper indicates possible future work on extensions to existing tools and development of new tools.

2 DEVELOPMENT AND IMPLEMENTATION OF SITE STRATEGIES FOR MANAGING DECOMMISSIONING WASTES AND ITEMS

2.1 Framework in which Site Strategies are Developed

The framework within which each nuclear site develops its strategy for managing decommissioning wastes and items includes:

- national policies for nuclear decommissioning, for the management of all radioactive and non-radioactive wastes, and for the management of contaminated land
- all the relevant regulatory frameworks
- multi-site strategies for nuclear decommissioning, for the management of all radioactive and non-radioactive wastes, and for the management of contaminated land
- the site's own strategies for nuclear decommissioning, for the management of all radioactive and non-radioactive wastes, and for the management of contaminated land.

The ways in which these policies, frameworks and strategies interact is shown in Figure 1. The responsibilities for developing policies, regulations, strategies, plans and procedures for decommissioning and waste management are shown in Table 1.

Multi-site strategies are the overall strategies of the organisations that own and/or operate several nuclear sites, for example, the Nuclear Decommissioning Authority (NDA), some of the site licence companies that operate NDA sites, British Energy and the Ministry of Defence (MoD). Site strategies for decommissioning, for the management of all radioactive and non-radioactive wastes, and for the management of contaminated land, are more detailed than the multi-site strategies and are consistent with them. At each site, the strategies for decommissioning, waste management and the management of contaminated land have to be consistent with each other [HSE, 2006; EA, 2005].

Site strategies must comply with national policies, including those for nuclear decommissioning and for the long-term management of solid low level radioactive waste (LLW) [DTI, 2004a; Defra et al, 2007]. They must also comply with regulatory requirements (for example, the standard conditions in nuclear site licences, the Radioactive Substances Act 1993 and its Exemption Orders). They should be consistent with regulatory guidance

such as the Health and Safety Executive's (HSE's) safety assessment principles (SAPs) for nuclear facilities, and the Environment Agency's radioactive substances regulation environmental principles (REPs) [HSE, 2006; EA, 2005].

It is an NDA requirement that the nuclear sites for which it is responsible have an 'integrated waste strategy' (IWS) that covers all radioactive and non-radioactive solid, liquid and gaseous wastes [NDA, 2006a and 2006b]. A site's strategy for the management of its clean, excluded, exempt and low activity solid wastes and items from decommissioning is part of its IWS. It is government policy that all nuclear-licensed sites should have a plan for managing their LLW; this plan should be part of a wider integrated waste management strategy, and compatible with the proposed end-state for site decommissioning [Defra et al, 2007].

The development of the various types of strategy is not a sequential, top-down process. The usual approach is to establish them in parallel, with feedback from one to another so as to achieve consistency and integration. For example, at each site the strategies for decommissioning, for waste management and for the management of contaminated land are developed together so that there will be management routes available for decommissioning and land remediation wastes when they arise.

2.2 Stages in the Management of Decommissioning Wastes and Items

The various stages in the management of decommissioning wastes and items at a nuclear site are shown in Figure 2, in the form of a flow diagram. The first stage (see box 1 in Figure 2) is to characterise wastes, materials that may become wastes and items so as to obtain initial estimates of quantities and characteristics such as radioactive and hazardous content. These estimates are required to provide input to the development of a management strategy and need not be very detailed.

Strategy development (see box 2 in Figure 2) typically involves several steps; it is good practice to involve a range of stakeholders in all of them [Miller and Tooley, 2005; NDA, 2006a and 2006b]. The first step is to identify, in broad terms, management options for each major type of waste and item. Examples of broad options could be decontaminate and dispose to landfill, decontaminate and re-use on site, or dispose to an LLW facility. The options are then combined to obtain candidate strategies for managing all wastes and items that will arise during site decommissioning. Usually several candidate strategies are defined that differ in key respects, such as the quantities of wastes disposed or re-used on site and off site. The next step is to assess and compare the candidate strategies on a wide range of factors, including their health impacts on the public and workers, environmental impacts, social and economic impacts, technical difficulties and financial costs. The outcome of the comparison is taken into account by the site operator when taking the decision on the preferred strategy.

The next major stage is to decide in more detail how each type of waste and item will be managed within the preferred strategy. This may be preceded by further characterisation if it is evident that more needs to be known about wastes and items in order to assess and compare management options for them (see boxes 3 and 4 in Figure 2). It is good practice to involve a range of stakeholders in the assessment and comparison, starting with the identification of envisageable management options for each type of waste or item and the screening out of those that are not feasible or are obviously unacceptable to one or more key groups of stakeholders [Miller and Tooley, 2005; NDA, 2006a and 2006b]. Options that are grossly inconsistent with the preferred strategy should also be eliminated. Those that are slightly inconsistent can be carried forward and, if such options are selected, the strategy can be modified accordingly. Assessments and comparisons of options are usually on the basis of a range of factors similar to those considered when assessing and comparing strategies (see above).

Implementation of the selected management options for each type of waste and item starts with the development of plans, procedures and work instructions (see box 5 in Figure 2). It involves monitoring (of the workplace and the environment) and verification that procedures and instructions have been followed (for example, measurements to show remaining levels of contamination are within appropriate standards).

The final stage is to manage residual decommissioning wastes, that is any wastes that were stored to allow radioactive decay or while a disposal facility was being constructed, and wastes generated during previous management stages. These wastes have to be characterised and management options selected for them, in the same way as for the other decommissioning wastes.

2.3 Key Considerations at Management Stages

The key considerations at each stage in the management of decommissioning wastes and items are summarised in Table 2 and discussed below. The considerations are based on the review of the various good practice tools (see Section 3).

2.3.1 Key Considerations in Characterising Wastes and Items

The key considerations at the initial characterisation stage (see box 1 in Figure 2) are:

- the quantities of radioactive and non-radioactive wastes, and of materials that may become wastes
- the numbers of items (contaminated and uncontaminated)
- the physical and chemical nature of wastes and items
- their radioactive content (concentrations and total activities of important radionuclides)
- the hazardous content (concentrations and total quantities of non-radioactive hazardous substances)
- confidence levels in measurements and estimates of quantities and activities
- level of detail.

The last of these considerations is relevant to all aspects of characterisation. At the initial stage it is only necessary to know enough about wastes, potential wastes and items to be able to formulate, assess and compare candidate strategies for their management (see box 2 in Figure 2). If further information is needed to decide in more detail how to manage a particular type of waste or item, this can be acquired after the preferred strategy for managing all the wastes and items has been selected (see box 3 in Figure 2).

It is not always straightforward to decide on the right level of detail for initial characterisation. For example, when there are many different types of waste on a site it may not be appropriate to only characterise those that arise in the highest quantities. It could also be important to include types of waste that arise in small quantities if these are likely to require special treatment, and if provision needs to be made for this in an overall strategy.

Although not a key issue, consulting some stakeholders about initial characterisation can save time and money at a later stage. Those who could be consulted include: other nuclear industry organisations, who may have experience with similar types of wastes; regulators, who may have particular views on what should be done by way of characterisation; and NGOs, who may have different perspectives on which radionuclides and other substances are most hazardous to health.

2.3.2 Key Considerations in Developing Strategies and Selecting Options

The key considerations when developing a strategy for the management of a site's decommissioning wastes and items, and when selecting the preferred management option for each type of waste and item (see boxes 2 and 4 in Figure 2), are:

- stakeholder involvement (planning it and doing it)
- establishing guiding principles
- setting objectives and targets
- devising a methodology or methodologies for assessing and comparing strategies and options
- ensuring consistency between the various site strategies
- financial costs.

Planning how to involve stakeholders in strategy development and option selection is best carried out in consultation with those stakeholders who may wish to be involved. This helps to avoid unrealistic expectations on the part of the stakeholders and misunderstandings about the scope of their involvement. It is also more efficient for site operators, who can save time and money by not pursuing involvement methods that are unlikely to succeed. If a wide range of stakeholders are involved throughout strategy development it may not be necessary to involve them to the same extent when selecting options for particular wastes and items. It could be sufficient for them to check that the selection methodology is acceptable and that the options selected are consistent with the site's strategy.

It is helpful to have guiding principles that are to be used in identifying candidate strategies and options and in assessing and comparing them. Examples of such principles are:

- sustainability
- protecting human health and the environment
- taking precautionary action when there are uncertainties
- avoiding actions with irreversible effects
- using the best scientific data
- the proximity principle for waste management.

Such principles can be employed when devising screening criteria for strategies and options, and when establishing the attributes to be considered in assessments and comparisons. It is important that the principles are agreed with stakeholders.

General objectives can be useful in strategy development. For example, an overall objective to minimise waste arisings, so far as is practicable, can help in identifying candidate strategies. Using numerical targets can constrain strategy development unduly and is best left until the option selection stage, when targets can be set that are based on the preferred strategy. The ability to meet the targets can then be used as a screening criterion to shortlist options or as an attribute on which to compare shortlisted options.

The methodologies used for assessing and comparing waste management strategies and options at most nuclear sites are of the 'best practicable environmental option' (BPEO) type. The steps in such a methodology are [Environment Agency and SEPA, 2004]:

- identification of candidate strategies or options
- screening to obtain a shortlist of strategies or options
- selection of attributes
- evaluation of shortlisted strategies or options on attributes
- application of weighting factors for attributes
- identification of the BPEO

- integration into decision making.

The exact methodology will depend on the problem being addressed and on the preferences of the stakeholders who are being involved. In some cases numerical scoring on attributes and application of various sets of weighting factors will be appropriate but in others more qualitative methods will suffice.

Consistency between the site's strategy for clean, excluded, exempt and low activity wastes and items and the rest of its IWS needs to be considered throughout strategy development, as does consistency with the site's decommissioning and contaminated land strategies. This is not a matter of fixing one strategy and making the others consistent with it, but of parallel development and adjustment of the various strategies so that they fit together.

Financial costs are an important consideration in strategy development and option selection. In both cases the objective is value for money rather than cost reduction for its own sake. It can be helpful to separate costs out when comparing strategies and options on their various attributes. In this way it is made clear which strategy or option is best on all the attributes other than cost, and which one is preferred when costs are included.

2.3.3 Key Considerations in Implementing Options

The key considerations when implementing the preferred management options for each type of waste and item (see box 5 in Figure 2) are verification and providing information to stakeholders. Plans, procedures and work instructions for managing wastes and items should ideally include means of verifying that they have been followed. This is particularly important when segregating and sentencing wastes as clean, excluded, exempt or LLW.

The information provided to stakeholders could be about progress in implementing options and progress in carryout the overall strategy. It is also desirable to tell stakeholders about any changes to the strategy or options that are being made during implementation (for example, because technological developments have occurred). Arrangements for providing information need to be reviewed at intervals, particularly over decommissioning projects that will span many decades.

3 GOOD PRACTICE TOOLS

The good practice tools considered in this paper are:

- the SD:SPUR guidance on applying sustainable practice to the management of nuclear decommissioning wastes
- the NDA guidance on IWS
- the Institution of Civil Engineers (ICE) demolition protocol
- the Department of Trade and Industry (DTI) code of practice on site waste management plans (SWMPs)
- the nuclear industry code of practice on clearance and exemption
- the Waste and Resources Action Programme (WRAP) quality protocol for aggregates from inert wastes.

Information about these tools is given in Sections 3.1 to 3.6. The information provided for each tool is:

- its scope, ie the types wastes and items it deals with
- its status, eg guidance on formal requirements, voluntary code of practice
- its origin
- references to the documents that describe the tool
- website(s) where the tool and its documentation can be obtained
- the purpose of the tool
- its main features
- the management stages that the tool is most useful for (see Figure 2)
- the key considerations that it particularly addresses (see Table 2).

Table 3 summarises the major uses of the six good practice tools. It will be seen from the table, and from the information in Sections 3.1 to 3.6, that the tools are complementary. They are best used together throughout the various stages in the management of decommissioning wastes and items.

3.1 SD:SPUR Guidance

Scope – radiologically clean, excluded, exempt and slightly radioactive solid wastes from decommissioning on nuclear-licensed sites; redundant buildings on nuclear-licensed sites.

Status – good practice guidance.

Origin – CIRIA's SD:SPUR learning network, with input from a wide range of stakeholders.

Reference – Miller, W and Tooley, J, 2005. SD:SPUR, Site decommissioning: sustainable practices in the use of construction resources. *Guidance on the application of sustainable practices to the management of decommissioning wastes from nuclear licensed sites*. CIRIA W009.

Available at – www.sdspur.com/guidance.htm

Purpose – to give generalised guidance for dealing sustainably with the assets and large volumes of radiologically clean and slightly radioactive solid wastes that arise from the decommissioning of nuclear sites, especially for waste managers and strategy developers.

Main features –

- intended to assist in the preparation of IWSs and to be compatible with the carrying out of BPEO studies
- contains advice on establishing, assessing and comparing candidate strategies for the management of all a nuclear site's decommissioning wastes and items
- also contains advice on establishing, assessing and comparing candidate options for the management of particular decommissioning wastes and items
- has information on various options for re-using and recycling wastes, and for refurbishing, deconstructing and demolishing buildings
- provides 'sustainability indicators' for use in BPEO studies; indicators relate to:
 - impacts on human health and safety
 - impacts on natural, physical and built environment
 - social and economic impacts / quality of life
 - financial costs
- contains advice on involving stakeholders throughout the development of waste management strategies and assessments of waste management options
- describes the regulatory background
- gives information on waste inventories
- contains a case study (for Dounreay).

Most useful for management stages – 2 (development of management strategies for wastes and items), 4 (selection of management options for wastes and items), 6 (management of residual wastes).

Key considerations particularly addressed – stakeholder involvement, guiding principles, methodology.

3.2 NDA Guidance on IWS

Scope – radioactive and non-radioactive solid, liquid and gaseous wastes from operations and decommissioning on nuclear sites.

Status – NDA guidance on its requirements.

Origin – NDA, with input from regulators and operators of nuclear sites.

References –

NDA, 2006a. *Specification for the Content and Format of a Site Integrated Waste Strategy Document*. NDA Doc No ENG01.

NDA, 2006b. *Companion Document to Integrated Waste Strategy Specification*. NDA Doc No ENG02.

Available at – www.nda.gov.uk/documents

Purpose – to assist the nuclear-licensed sites for which the NDA is responsible to develop their IWSs; may also help other nuclear sites.

Main features –

- the specification (ENG01) sets out what is to be included in an IWS document, section by section; the companion document (ENG02) provides background and further guidance
- describes the scope of an IWS and explains why it is required, namely to:
 - protect people and the environment and respond to stakeholder concerns
 - make the most effective use of existing waste management facilities
 - provide value for money to UK taxpayers
- gives guidance on stakeholder engagement during the development of an IWS and for waste issues in general
- contains advice on formulation of an IWS, including strategic optioneering, dealing with constraints and dependencies, describing assumptions
- through the concept of IWS, emphasises the need for consistency between decommissioning, waste and contaminated land strategies, and shows how to achieve this
- contains information on the regulatory and policy framework relevant to:
 - strategic planning
 - sustainable development
 - waste hierarchy
 - other principles and considerations
- identifies need to outline areas where further work is required and make plans to address them.

Most useful for management stages – 2 (development of management strategies for wastes and items), 4 (selection of management options for wastes and items), 6 (management of residual wastes).

Key considerations particularly addressed – stakeholder involvement, guiding principles, consistency.

3.3 ICE Demolition Protocol

Scope – non-radioactive demolition wastes on any site.

Status – planning and management tool.

Origin – ICE and London Remade, with input from construction industry, local authorities, regulators and government departments in the UK and other EU countries.

References –

EnviroCentre Ltd, 2005a. *Demolition Protocol Executive Summary*.

EnviroCentre Ltd, 2005b. *A Report on the Demolition Protocol*.

EnviroCentre Ltd, 2005c. *Demolition Protocol Implementation Document*.

WRAP, 2005a. *The Demolition Protocol: Aggregates Resource Efficiency in Demolition and Construction. Volume 1. For Policy-Makers and Planners*.

WRAP, 2005b. *The Demolition Protocol: Aggregates Resource Efficiency in Demolition and Construction. Volume 2. For Developers and Designers*.

WRAP, 2005c. *The Demolition Protocol: Aggregates Resource Efficiency in Demolition and Construction. Volume 3. For Contractors*.

WRAP, 2005d. *The Demolition Protocol: Aggregates Resource Efficiency in Demolition and Construction. Volume 4. For Suppliers*.

Available at – www.ice.org.uk/knowledge/specialist_waste.asp
www.aggregain.org.uk/demolition/the_ice_demolition_protocol/index.htm

Purpose – to show how to achieve resource efficiency by linking the production of demolition material to its specification as high value material in new builds, thus minimising waste and maximising the displacement of primary construction materials.

Main features –

- aimed at policy developers, local authorities, managers of demolition projects, those responsible for procurement and specification of construction materials
- documentation includes a report describing its development, an implementation document with a step-by-step guide to using the protocol, and brochures for particular audiences
- at the demolition stage, requires the carrying out of a 'demolition audit' for each building to:
 - determine the quantities of various materials that it contains
 - determine the quantities of materials that could, in principle, be recovered
 - set recovery targets, based on the capacity of local companies to purchase or reprocess demolition materials
- at the new build stage, requires:
 - determination of the quantities of recovered materials that could, in principle, be specified
 - setting of targets for use of recovered materials, based on standards for the quality of the materials, local availability and costs
- methodologies can be implemented in contractual conditions, via the planning system, or less formally.

Most useful for management stages – 2 (development of management strategies for wastes and items), 4 (selection of management options for wastes and items), 5 (implementing options), 6 (management of residual wastes).

Key considerations particularly addressed – guiding principles, objectives and targets.

3.4 DTI Code of Practice on Site Waste Management Plans

Scope – non-radioactive demolition wastes on any site.

Status – voluntary code of practice¹.

Origin – DTI, Defra, Environment Agency, WRAP, construction industry.

References –

DTI, 2004b. *Site Waste Management Plans, Guidance for Construction and Clients, Voluntary Code of Practice.*

Available at – www.dti.gov.uk/construction/sustain
www.constructingexcellence.org.uk/resources/publications

Purpose – to help construction companies and their clients to improve their environmental performance, meet regulatory requirements and reduce their waste disposal costs.

Main features –

- sets out the main steps in formulating a SWMP, including:
 - identifying who is responsible for producing and implementing it
 - characterising wastes that will be produced during demolition and construction
 - selecting the management options to be used for these wastes
 - training staff
 - planning waste and materials handling
 - monitoring performance
 - reviewing how the SWMP worked and identifying learning points for the next time
- contains a checklist of questions to address when formulating a SWMP, including topics such as:
 - avoiding over-ordering of materials
 - making maximum use of secondary and recycled materials
 - setting targets for minimising waste arisings
 - having measures in place to deal with hazardous wastes
 - maximising re-use and recycle on and off site
 - waste segregation
 - identifying actions for future projects
- gives general guidance on waste legislation and more specific guidance on the 'duty of care'
- provides advice on introducing waste minimisation initiatives
- contains references to best practice examples of the preparation of SWMPs
- provides advice on reporting quantities of waste re-used, recycled and disposed, and checking against targets.

Most useful for management stages – 2 (development of management strategies for wastes and items), 4 (selection of management options for wastes and items), 5 (implementing options), 6 (management of residual wastes).

Key considerations particularly addressed – guiding principles, objectives and targets, verification.

¹ SWMPs will become compulsory for developments above a certain value when regulations are introduced in 2007 or 2008.

3.5 Nuclear Industry Code of Practice on Clearance and Exemption

Scope – radiologically clean, excluded, exempt and slightly radioactive wastes and items arising on nuclear sites.

Status – code of practice by and for the nuclear industry.

Origin – Clearance and Exemption Working Group, which reports to the Nuclear Industry Safety Directors Forum.

Reference – CEWG, 2006. *Clearance and Exemption Principles, Processes and Practices for Use by the Nuclear Industry. A Nuclear Industry Code of Practice.* Issue 1.01.

Available at – www.ukaea.org.uk/news/clearance_and_exemption.htm

Purpose – to set out the principles, processes and practices to be used by the nuclear industry when determining whether a material or article can be released from controls related to its potential radiological impact.

Main features –

- aimed at people within nuclear industry organisations who are responsible for formulating strategies, plans and working procedures
- contains summaries of the relevant parts of the Radioactive Substances Act and its Exemption Orders, and associated regulatory guidance
- provides guidance on interpretation of regulatory limits for clearance and exemption, with flowcharts to show how to determine whether materials and articles are exempt
- sets out approaches to be used for topics on which regulatory guidance is unclear or insufficient for practical purposes, including approaches for:
 - defining 'clean' articles and materials
 - separating and segregating clean, exempt and low activity wastes
 - dealing with inhomogeneous distributions of radioactivity in a material or article
 - clearance levels for surface contamination
- recommends management principles and arrangements
- sets out clearance and sentencing processes for various types of materials and articles, including:
 - clean, activated and tritiated solids
 - surface contaminated items
 - high surface area to volume materials and items
 - loose, porous and impervious solids
 - liquids
 - gases and vapours
- provides guidance on statistical approaches, sampling strategies and measurement practices.

Most useful for management stages – 1 and 3 (initial and further characterisation), 2 (development of management strategies for wastes and items), 4 (selection of management options for wastes and items), 5 (implementing options), 6 (management of residual wastes).

Key considerations particularly addressed – all those related to characterisation of radioactive wastes and items, guiding principles, objectives and targets, verification.

3.6 WRAP Quality Protocol for Aggregates from Inert Waste

Scope – inert, non-radioactive wastes on any site.

Status – guidance for producers, purchasers and regulators.

Origin – WRAP, with input from stakeholders from the construction supply chain and the environment agencies.

References –

WRAP, 2005e. *The Quality Protocol for the Production of Aggregates from Inert Waste*. Revised Edition.

WRAP, 2005f. *The Quality Protocol for the Production of Aggregates from Inert Waste in Northern Ireland*.

WRAP, 2004. *The Quality Protocol for the Production of Aggregates from Inert Waste in Scotland*.

Available at – www.aggregain.org.uk/quality/quality_protocols/index.html

Purpose – to provide:

- a uniform control process for producers of aggregates from inert waste, from which they can demonstrate that their product is full recovered and no longer a waste
- a means of assuring purchasers that the recovered product meets the appropriate standards
- a way to create an audit trail for those who ensure compliance with waste management legislation.

Main features –

- requires producers of aggregates from inert waste to:
 - set up a suitable system for control of factory production
 - describe each product, including the aggregates specification to which it conforms
 - establish acceptance criteria for inert waste from which aggregates are to be produced
 - prepare a method statement for the waste recovery process
 - establish and implement an inspection and testing system
 - keep records
- contains a flowchart for acceptance and processing of inert waste
- provides guidance on the definitions of 'waste' and 'inert waste'
- contains information on methods for testing aggregates to determine their suitability for various uses.

Most useful for management stages – 1 and 3 (initial and further characterisation), 4 (selection of management options for wastes and items), 5 (implementing options), 6 (management of residual wastes).

Key considerations particularly addressed – quantities and nature of wastes, guiding principles, verification.

4 POSSIBLE FUTURE DEVELOPMENTS

4.1 Updates and Extensions to Existing Tools

Most of the existing good practice tools are updated and revised at intervals to take into account policy, regulatory and technical developments, and experience in using the tools. For example, the current edition of the NDA guidance on IWSs is the second and the WRAP quality protocol has been revised once [NDA, 2006a and 2006b; WRAP, 2005e]. There are plans to revise the SD:SPUR guidance in two or three years' time, when further work has been carried out to assess and compare generic management options for clean and low activity decommissioning wastes and items.

The nuclear industry code of practice on clearance and exemption will be reviewed and revised as appropriate, for example to include any changes to Exemption Orders [Defra, 2006]. Work is also beginning to extend the code of practice to include more guidance on practical implementation. At present this tool is aimed at those who write working procedures and work instructions [CEWG, 2006]. The intention is to extend it to include outline contents and templates for clearance and exemption procedures and records.

4.2 Development of New Tools

4.2.1 New Tools being Developed

The Environment Agency and WRAP are working together to develop quality protocols for recovery of other materials from other types of wastes, including some non-hazardous wastes and wastes from remediation of contaminated land. These ten new 'end-of-waste' protocols could lead to significant cost savings for organisations that manage wastes and/or use recovered materials [Defra, 2006].

4.2.2 New Tools Required

It can be seen from Section 3 that none of the existing good practice tools deal explicitly with the potential re-use of plant and equipment. The nuclear industry code of practice on clearance and exemption points out that there is a lack of regulatory guidance for the general topic of clearance of clean and lightly contaminated items, and provides advice on suitable approaches [CEWG, 2006]. It could be useful to produce more detailed, quantitative guidance for the three situations for potential re-use of plant and equipment: on the nuclear sites where the plant and equipment originates, on other nuclear sites, and on non-nuclear sites (including nuclear sites that have been delicensed and released to be used for other purposes).

There is also relatively little guidance on re-use of redundant buildings. The SD:SPUR guidance covers this topic in a qualitative way [Miller and Tooley, 2005]. It could be helpful to have more quantitative advice, especially for the situation in which the area in which the redundant building is located is to be delicensed and the building could be re-used for non-nuclear purposes.

5 REFERENCES

Notes:

- i) All references are available on the website of the authoring organisation, unless otherwise stated.
- ii) See Section 3 for further details of availability of good practice tools.
- iii) See Table 4 for a key to acronyms.

<i>Short ref.</i>	<i>Full reference</i>
CEWG, 2006	Clearance and Exemption Working Group, 2006. <i>Clearance and Exemption, Principles, Processes and Practices for Use by the Nuclear Industry. A Nuclear Industry Code of Practice.</i> Issue 1.01. (Available on the UKAEA website.)
Defra, 2006	Department for Environment, Food and Rural Affairs, 2006. <i>The Defra Simplification Plan: Maximising Outcomes, Minimising Burdens.</i>
Defra et al, 2007	Department for Environment, Food and Rural Affairs, Department of Trade and Industry, Scottish Executive, Welsh Assembly Government, Department of the Environment for Northern Ireland, 2007. <i>Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom.</i>
Defra et al, 2006	Department for Environment, Food and Rural Affairs, Scottish Executive, Welsh Assembly Government, Department of the Environment for Northern Ireland, 2006. <i>Response to the Report and Recommendations from the Committee on Radioactive Waste Management by the UK Government and the Devolved Administrations.</i>
DETR, 2000	Department of Environment, Transport and the Regions, 2000. <i>Waste Strategy 2000 for England and Wales.</i> Cm 4693. (Available on the Defra website.)
DoE(NI), 2006	Department of Environment for Northern Ireland, 2006. <i>Towards Resource Management, the Northern Ireland Waste Management Strategy 2006-2020.</i>
DTI, 2004a	Department of Trade and Industry, 2004. <i>The Decommissioning of the UK Nuclear Industry's Facilities.</i>
DTI, 2004b	Department of Trade and Industry, 2004. <i>Site Waste Management Plans, Guidance for Construction Contractors and Clients. Voluntary Code of Practice.</i>
EnviroCentre Ltd, 2005a	EnviroCentre Ltd, 2005. <i>Demolition Protocol Executive Summary.</i> (Available on ICE and AggRegain websites.)
EnviroCentre Ltd, 2005b	EnviroCentre Ltd, 2005. <i>A Report on the Demolition Protocol.</i> (Available on ICE and AggRegain websites.)
EnviroCentre, 2005c	EnviroCentre Ltd, 2005c. <i>Demolition Protocol Implementation Document.</i> (Available on ICE and AggRegain websites.)

<i>Short ref.</i>	<i>Full reference</i>
EA, 2005	Environment Agency, 2005. <i>Radioactive Substances Regulation Environmental Principles (Interim). A framework for technical decisions and technical guidance on radioactive substances regulation.</i> Version 1.
EA and SEPA, 2004	Environment Agency and Scottish Environment Protection Agency, 2004. <i>Guidance for the environment agencies' assessment of best practicable environmental option studies at nuclear sites.</i>
HSE, 2006	Health and Safety Executive, 2006. <i>Safety Assessment Principles for Nuclear Facilities.</i> 2006 Edition.
Miller and Tooley, 2005	Miller, W and Tooley, J, 2005. SD:SPUR, Site decommissioning: sustainable practices in the use of construction resources. <i>Guidance on the application of sustainable practices to the management of decommissioning wastes from nuclear licensed sites.</i> CIRIA W009.
NDA, 2006a	Nuclear Decommissioning Authority, 2006. <i>Specification for the Content and Format of a Site Integrated Waste Strategy Document.</i> Doc. No. ENG01, Rev 2.
NDA, 2006b	Nuclear Decommissioning Authority, 2006. <i>Companion Document to Integrated Waste Strategy Specification.</i> Doc. No. ENG02, Rev 2.
SE and SEPA, 2003	Scottish Executive and Scottish Environment Protection Agency, 2003. <i>National Waste Strategy Scotland, the National Waste Plan 2003.</i>
WAG, 2002	Welsh Assembly Government, 2002. <i>Wise about Waste: the National Waste Strategy for Wales.</i>
WRAP, 2005a	WRAP, 2005. <i>The Demolition Protocol: Aggregates Resource Efficiency in Demolition and Construction. Volume 1. For Policy-Makers and Planners.</i>
WRAP, 2005b	WRAP, 2005. <i>The Demolition Protocol: Aggregates Resource Efficiency in Demolition and Construction. Volume 2. For Developers and Designers.</i>
WRAP, 2005c	WRAP, 2005. <i>The Demolition Protocol: Aggregates Resource Efficiency in Demolition and Construction. Volume 3. For Contractors.</i>
WRAP, 2005d	WRAP, 2005. <i>The Demolition Protocol: Aggregates Resource Efficiency in Demolition and Construction. Volume 4. For Suppliers.</i>
WRAP, 2005e	WRAP, 2005. <i>The Quality Protocol for the Production of Aggregates from Inert Waste.</i> Revised Edition.
WRAP, 2005f	WRAP, 2005. <i>The Quality Protocol for the Production of Aggregates from Inert Waste in Northern Ireland.</i>
WRAP, 2004	WRAP, 2004. <i>The Quality Protocol for the Production of Aggregates from Inert Waste in Scotland.</i>

Table 1 Responsibilities for Development of Strategies, Plans and Procedures

<i>Level</i>	<i>Development Activity</i>	<i>Responsible Organisation</i>
1	National policies (UK-wide or separately for England, Wales, Scotland and Northern Ireland) ¹	Central government, devolved administrations
2	Regulatory frameworks (UK-wide or separately for England, Wales, Scotland and Northern Ireland) ²	Central government, devolved administrations, regulators
3	Multi-site strategies for decommissioning, waste management, management of contaminated land	Site owners and operators
4	Site strategies for decommissioning, waste management, management of contaminated land	Operators
5	Site waste management strategies (all categories of radioactive and non-radioactive waste)	Operators
6	Site management plans for various types of waste	Operators
7	Site waste management procedures	Operators
8	Site/plant work instructions	Operators

Notes

1. The main policy documents relevant to this paper are:

decommissioning of nuclear facilities – DTI, 2004a
management of solid radioactive wastes – Defra et al, 2007; Defra et al, 2006
management of non-radioactive solid wastes – DETR, 2000; SE and SEPA, 2003; WAG, 2002; DoE(NI), 2006.

2. The regulatory frameworks for nuclear decommissioning and the on-site management of nuclear decommissioning wastes are developed by the Health and Safety Commission (HSC), the HSE and the DTI. The regulatory frameworks for the off-site management of decommissioning wastes are established by Defra and their counterparts in Scotland, Wales and Northern Ireland, with advice from the environment agencies (the Environment Agency in England and Wales, the Scottish Environment Protection Agency (SEPA), and the Environment and Heritage Service (EHS) of Northern Ireland).

Table 2 Key Considerations at Stages in the Management of Decommissioning Wastes and Items

<i>Stage</i>	<i>Key Consideration</i>	<i>Details</i>
1. Initial characterisation	Waste quantities	Quantities of each major type of radioactive and non-radioactive waste.
	Numbers of items	Numbers of each major type of contaminated and uncontaminated item.
	Nature	Physical and chemical nature of wastes and items.
	Radioactivity content	Concentrations and total activities of important radionuclides in wastes and items; judgements on importance should take into account stakeholder views and have in mind candidate management options.
	Hazardous content	Concentrations and total quantities of non-radioactive hazardous substances in wastes and items.
	Confidence levels	Confidence levels on measurements and estimates, taking into account detection limits and sampling limitations.
	Level of detail	Characterise in enough detail to formulate and compare possible strategies.
	Further work	Estimate costs and doses/risks to workers of further characterisation (for use in strategy development).
2. Developing management strategy	Stakeholder involvement	In consultation with stakeholders, plan how they are to be involved in strategy development, then implement the plan.
	Guiding principles	Establish guiding principles to be used in identifying candidate strategies and assessing and comparing them (eg sustainability, protecting human health and the environment, precautionary action, avoiding irreversible effects, use of best scientific data, proximity principle).
	Objectives & targets	General objectives can be useful in strategy development (eg from waste hierarchy) but numerical targets should only be set once strategy has been decided.
	Methodology	Use BPEO-type methodology to provide input to decision on preferred strategy, with special attention to various aspects of sustainability.
	Consistency	Ensure that strategy for managing clean, excluded, exempt and low activity wastes and items is consistent with site's decommissioning strategy, IWS and strategy for managing contaminated land.
	Financial costs	Best given separate consideration when comparing candidate strategies.

<i>Stage</i>	<i>Key Consideration</i>	<i>Details</i>
3. Further Characterisation	Level of detail	Key considerations are as for initial characterisation but now enough detail is needed to select and implement management options for each type of waste and item.
4. Selecting management options for wastes and items	Stakeholder involvement	In consultation with stakeholders, plan how they are to be involved in selecting management options for all or some types of wastes and items, then implement the plan.
	Guiding principles	Establish guiding principles to be used in identifying candidate options and assessing and comparing them (eg sustainability, protecting human health and the environment, precautionary action, avoiding irreversible effects, use of best scientific data, proximity principle).
	Methodology	Use BPEO-type methodology to provide input to decisions on preferred options for each waste type, with special attention to various aspects of sustainability.
	Consistency	Ensure that options are consistent with site management strategy for decommissioning wastes and items.
	Financial costs	Best given separate consideration when comparing candidate options.
5. Implementing management options	Verification	Plans, procedures and work instructions should include means of verifying that they have been followed. Particularly important when sentencing wastes and items as clean, excluded or exempt.
	Information	Stakeholders should be kept informed of progress and any changes to plans.
6. Managing residual wastes	As stages 1, 3, 4, 5	See stages 1, 3, 4, 5

Table 3 Summary of Good Practice Tools

<i>Good Practice Tool</i>	<i>Scope</i>	<i>Major Uses (management stage)</i>	<i>Key Considerations Addressed*</i>
SD:SPUR Guidance	clean, excluded, exempt and slightly radioactive solid decommissioning wastes, and redundant buildings, on nuclear-licensed sites	developing site strategies and selecting management options for types of waste and item (2, 4, 6)	stakeholder involvement guiding principles methodology
NDA IWS Guidance	radioactive and non-radioactive solid, liquid and gaseous wastes on nuclear sites	developing site strategies and selecting management options for types of waste and item (2, 4, 6)	stakeholder involvement guiding principles consistency
ICE Demolition Protocol	non-radioactive demolition wastes on any site	developing site strategies, selecting and implementing management options for types of waste and item (2, 4, 5, 6)	guiding principles objectives and targets
DTI Code of Practice on Site Waste Management Plans	non-radioactive demolition wastes on any site	developing site strategies, selecting and implementing management options for types of waste and item (2, 4, 5, 6)	guiding principles objectives and targets verification
Nuclear Industry Code of Practice on Clearance and Exemption	clean, excluded, exempt and slightly radioactive wastes and items on nuclear sites	all management stages(1-6)	all for characterisation of radioactive wastes guiding principles objectives and targets verification
WRAP Quality Protocol for Aggregates from Inert Waste	inert non-radioactive wastes on any site	characterisation, selecting and implementing management options for types of waste (1, 3, 4, 5, 6)	quantities and nature of wastes guiding principles verification

*See Table 2 for details of considerations.

Table 4 Key to Acronyms

Acronym	Meaning
CEWG	Clearance and Exemption Working Group
CIRIA	Construction Industry Research and Information Organisation
Defra	Department for Environment, Food and Rural Affairs
DETR	Department of Environment, Transport, and the Regions (a predecessor of Defra)
DoE(NI)	Department of Environment for Northern Ireland
DTI	Department of Trade and Industry
EA	Environment Agency (for England and Wales)
EHS	Environment and Heritage Service (for Northern Ireland)
EU	European Union
HSC	Health and Safety Commission
HSE	Health and Safety Executive
ICE	Institution of Civil Engineers
IWS	integrated waste strategy
LLW	low level radioactive wastes
MoD	Ministry of Defence
NDA	Nuclear Decommissioning Authority
REPs	radioactive substance regulation environmental principles (Environment Agency)
SAPs	safety assessment principles (HSE)
SD:SPUR	site decommissioning: sustainable practices in the use of resources
SE	Scottish Executive
SEPA	Scottish Environment Protection Agency
SWMP	site waste management plan
WAG	Welsh Assembly Government
WRAP	Waste and Resources Action Programme

Figure 1 Framework in which Site Strategies are Developed

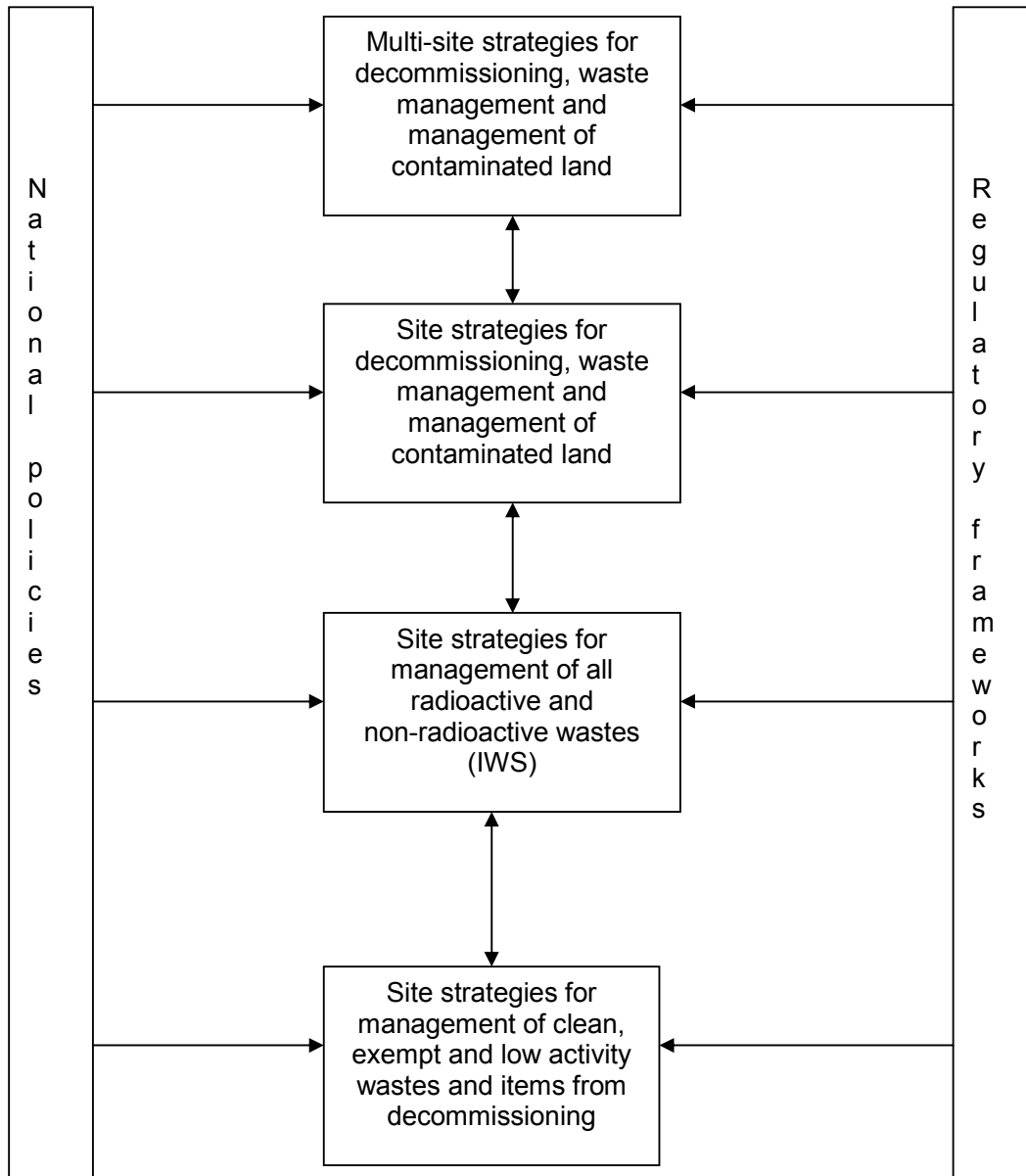


Figure 2 Flow Diagram for Management of Decommissioning Wastes and Items

