SD:SPUR Scoping Document
Waste Management Framework Guidance Note No.3

Selection of Management Options for Waste and Items

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James Penfold and Alan Paulley

PREFACE

This is the third in a series of four scoping reports that have been developed on behalf of the SD:SPUR Learning Network by Quintessa and Golder Associates. The scoping reports are intended to support the development of detailed guides relating to the management of decommissioning wastes and items from nuclear licensed sites. The need for such guides, covering activities and decision processes implemented by waste management practitioners, has been identified by members of the SD:SPUR Project Steering Group.

It is important to stress that the scoping documents are not themselves intended to serve as formative guidance. They are deliberately short in length, being aimed at identifying key issues that will need to be addressed, rather than developing such ideas to the level at which they can be considered to represent practical guides. A common format is followed in each case; following a brief introduction to the document, the text is then structured to provide a discussion of:

- Context: identification of the main considerations associated with this particular stage in the management process, including any relevant policies and regulations.
- Need: discussion of any existing guidance that may be relevant, and the scope of the guidance that ought therefore be provided by SD:SPUR.
- Relevance: consideration of the target audience and how the guidance might be used, wider concerns and developments, and the potential for referencing existing good practice guidance.
- Format: anticipated length and other features relating to presentation of the guidance document.

At the time of preparing this draft, there remains uncertainty as to whether the proposed guidance is best presented as a single document, or in four separate guides. A single document would have advantages in terms of emphasising the degree of feedback and iteration that is inherent in developing and implementing a management strategy; however, it could prove to be of considerable bulk. For present purposes, the scoping documents have been developed assuming that separate guides will be produced. If this path continues to be followed, a companion general 'handbook' for the process as a whole (e.g. drawing on the existing outline description in earlier SD:SPUR material) could help to present a more integrated picture and avoid duplication in the individual guides.

1 INTRODUCTION

This scoping report considers the selection of management options for wastes and items arising from the decommissioning of nuclear licensed sites.

Option selection is the process of identifying, assessing and comparing techniques for treating materials in order to guide decisions regarding how specific wastes and items should be managed. The background SD:SPUR guidance document (Miller and Tooley, 2005) and the SD:SPUR Good Practice Tools document (Hill, 2007), both highlight that option selection for the management of specific assets and decommissioning wastes should be carried out within the context of a broader site strategy. Key considerations in the development of such a strategy are discussed in the scoping document for Guidance Note 2 (Egan and Walker, 2009) and its relationship to more detailed option selection is discussed below.

In addition, the existing SD:SPUR guides (Miller and Tooley, 2005; Hill, 2007) both note that the assessment of management options may required more detailed characterisation of wastes and items than would normally be carried out in support of general strategic planning. In any overall management approach, there should inevitably therefore also be a close relationship between the process of option selection – and the information required to support that process – and the approach taken in characterisation (Needham and Penfold, 2009).

Finally, questions of quality control, verification and communication can be an important element of how management options for wastes and items are identified and assessed, as well as how those options are monitored and reviewed once implemented. In practice, as part of an iterative overall management approach, option selection may not be a once-for-all decision, but will be kept under review to enable learning from experience as the decommissioning programme progresses. Feedback from implementation (Bjerregard and Towler, 2009), to guide review and future options selection is therefore a relevant consideration within an integrated overall approach.

2 CONTEXT

The context for this element of the guidance is shaped by the SD:SPUR process, the content and coverage of other guidance documents, and the regulatory and other requirements that need to be fulfilled. These aspects are considered in this section.

2.1 Relationship to the Management Strategy

Decisions on the most appropriate management option for a given material are inevitably strongly linked to the overarching strategy – a preceding stage of the good practice process. The scope of guidance on the formulation of the management strategy is discussed in an accompanying paper (Egan and Walker, 2009). This defines the characteristics of a ‘strategy’ and its relationship to decisions on specific management options. It also summarises the policy, regulatory and other drivers for establishing an overall strategy – aspects such as the interpretation and application of the waste management hierarchy and the need for a Site Waste Management Plan (SWMP) and/or Integrated Waste Strategy (IWS).

Management options for specific materials and items will be influenced by similar requirements in so far as the processes implemented need to be consistent with the overall strategy. Inevitably, however, the development of strategy will be informed by knowledge of feasible management options, so there will inevitably be a measure of iteration between the two, as strategy becomes clarified and options refined.

It cannot therefore be simply assumed that the establishment of management strategy will determine a clear context within which management options are defined, assessed, and selected. For the purposes of this document, it is nevertheless assumed here that it is at the management strategy level where primary responsibility is given to addressing requirements of the IWS in particular. The selection of management options, by contrast, will need to take account of specific practical requirements in relation to the management of decommissioning materials – for example, those defined in NII's guidance (HSE 2002a; b).

In discussion of the wider development of strategy (Egan and Walker, 2009), it was noted that providing opportunity for broad stakeholder involvement is an important element in the process, to ensure that the factors taken into account reflect the relevant perspectives of different groups. Engagement with stakeholders is also relevant in the selection of management options for individual materials and items, but the appetite of non-statutory stakeholders for close involvement may well be less strong than that for determining broad strategy, especially if the focus is likely to be more technical in nature. Nevertheless it remains important that opportunities are provided for review as the options assessment process is implemented, and that the logical basis for selecting a preferred option is made transparent.

2.2 Regulatory and Other Requirements

Although the scope of the overall guidance is expected to encompass all materials and items from decommissioning, the focus of guidance for decision making on management options is expected to be on the potential treatment and re-use of materials with very low concentrations of radioactivity or other potential hazards, rather than non-active inert wastes. A particularly important consideration is the distinction between material to which the Radioactive Substances Act (RSA93) applies, and that which is exempted. Exempted wastes from nuclear licensed sites remain classified as radioactive substances, but the provisions of RSA93 are removed. Different regulations will therefore apply and different options are likely to be relevant. It is likely that the guidance will have to deal with different types of waste separately at a detailed level owing to the different regimes that apply. It is also relevant to note that the RSA93 exemption regime is currently under review and developments will need to be monitored (Defra, 2008). The outcome of the Defra review may influence the definition of strategy, for example in relation to segregation of lower activity wastes, and the types of management option that can be considered for particular types of exempted wastes.

Requirements for radioactive materials

NII provides guidance on options evaluation in Technical Assessment Guides (HSE 2002a; b). NII refers to the end product of decommissioning as 'wastes' but in practice it can be read to encompass materials that could be reused. In both documents, the selection of an appropriate method for managing the waste (or material) is required to be undertaken in a structured and systematic manner, as part of the development of the decommissioning plan.

NII requires that "*Licensees should examine a full range of options, taking account of all relevant factors... The process by which the preferred option has been selected and justified should be described and licensees should maintain appropriate records of the decision process*" (HSE 2002b). The guidance notes that Cost-Benefit Analysis (CBA) can be a useful tool, but there are limitations in its capability to represent all of the influencing factors. NII does not give more detailed guidance on assessment and selection of options, but in practice multi-attribute methods are commonly used.

The environment agencies have responsibility for disposals and discharges of radioactivity. Recent draft assessment guidance from the Environment Agency (2008), supporting the wider development of Environmental Principles for Radioactive Substances Regulation, now refers to the demonstration of Best Available Techniques (BAT), rather than Best Practicable Environmental Option (BPEO) or Best Practicable Means (BPM). Despite differences in terminology and detailed scope, the processes for minimising waste arisings and optimising the approach to radioactive waste management have common themes, whether applied at a 'site-wide' or waste-specific level. Procedures set up to undertake BPEO and BPM assessments (including related regulatory guidance (Environment Agency and SEPA, 2004; SNIFFER, 2005)) are therefore expected to remain essentially valid.

It is worth noting that other factors may shape the options that are assessed. For example, NII expects that licensees manage radioactive material in a manner that does not foreclose management options (HSE, 2002a). It notes the value of segregation of material according to similar physical, chemical and radiological properties. Also, Government policy on low-level radioactive waste (Defra et al., 2007), notes that there is a 'presumption towards early solutions', which could potentially be taken as a discouragement to store very low-activity wastes on site until such time as they can be put to re-use.

Requirements for non-radioactive materials

Various regulations and regimes apply under EPA90 to the management and disposal of wastes that are demonstrated to be non-radioactive, excluded or exempt under RSA93. Which set of regulations apply depends, in part, on the physical and chemical properties of the waste, its potential for causing harm to the environment and the manner in which the waste is planned to be disposed. The provisions of the Waste Framework Directive (75/442/EEC), the recent Directive on Wastes (2008/98/EC) and the Landfill Directive (1999/31/EC) are notable.

Guidance on the selection of management options is limited, compared with that developed for radioactive materials. In practice the selection of a management option is typically dependent on the categorisation of the material in terms of its disposability (e.g. inert, hazardous etc), and economic factors that might be expressed in CBA.

However, there is very considerable experience of sustainable use of materials within the construction industry; the majority (c. 90%) is typically reused. There is well established guidance on the issue in relation to typical construction wastes (e.g. CIRIA's Construction Waste and Resources project). With the exception of the SD:SPUR guidance, there is very little in relation to decommissioning materials in the nuclear industry, which have until recently been regarded as wastes.

2.3 Other Issues

Hill (2007) provides a useful description of the existing good practice tools that are relevant.

It is relevant to recognise that, even though policy and regulatory guidance tends to emphasise the importance and role of the Waste Management Hierarchy in taking sustainability principles into consideration, there may be limits to the public acceptability of re-use and recycling strategies, particularly where these might involve exempted or other low activity materials being re-used off-site. In particular, there may be controversy over the nature of risk-informed judgments, as required by Government policy (Defra et al., 2007), when used to support such decision making. This applies particularly to the definition of management strategy, but also potentially to choices between specific management options.

It is also relevant to note that scope of any options comparison is not just the process or technology that is deployed, but decisions about how it should be implemented. For example, it may be judged necessary, as part of a site integrated waste strategy, to combine or align options for different wastes. Implementation issues may also introduce practical constraints on the scope of options that are considered. In some instances, such as where the volumes involved are small and the economic case for implementing a management option locally may be weak, multi-site solutions may be considered.

Furthermore, in addition to regulatory requirements and practical constraints, the need to demonstrate value for money (and the system of priorities used in determining investment) will inevitably be a factor when considering management options for decommissioning materials. In practice, this means that decision making involves not only consideration of life-time costs (and potential cost savings) but also the shorter-term affordability of capital investment in different options. Effective and appropriate accounting for costs in waste management, and clear guidance on business case development in relation to the management of lower-priority hazards on nuclear licensed sites, is necessary to ensure that options are not inappropriately constrained.

Finally, it will be important that processes used to select management options and the case that is ultimately made for a particular course of action take account of, and are robust to, uncertainties in the underlying evidence. In this respect, there is an important interface to waste characterisation guidance (Needham and Penfold, 2009), as well as to uncertainties in (for example) technical performance and investment cost. Confidence in decision making depends on having a clear understanding of the quality and reliability of evidence supporting the comparison of options. Approaches to assessing information quality include the NUSAP methodology (Funtowicz and Ravetz, 1990) [1].

3 NEED

As indicated in Section 2, there are a number of requirements arising from regulations and other factors that require to be addressed with a structured approach to the choice of systems and technologies for the management of decommissioning materials and items. However, there is also established guidance already available. This section examines the need for further guidance by examining existing guidance, and considering some key themes.

[1] Issues surrounding the evaluation of uncertainty and quality in quantitative information, and implications for its use to guide policy development are discussed at http://www.nusap.net/.

3.1 Existing Guidance

The existing SD:SPUR guidance provides a fairly clear and comprehensive description of options assessment methodologies. For example, it considers how sustainability considerations interact with the BPEO concept, presents the main stages of a BPEO/BPM approach to comparing options, describes the types of management options for broad categories of wastes, and the criteria by which they can be assessed. However, the PSG has expressed the view that a more practical and specific guide is needed. It also predates important developments in relation to IWS (NDA, 2006a; b) and the regulatory application of BAT (Environment Agency, 2008).

Hill (2007) presents other guidance that is relevant, and summarises its applicability. In relation to the selection of management options, EA and SEPA's guidance on BPEO (Environment Agency and SEPA, 2004) and Sniffer guidance on BPM (2005), is also relevant (as noted by Miller and Tooley (2005)). This provides a good foundation in terms of the general approach to be adopted, but is not specific to decommissioning materials, and generally does not put any emphasis on sustainability considerations. It is also unspecific in terms of options comparison methods (beyond advocating multi-attribute approaches generally). However, it is clear regarding regulatory expectations. The relevance and application of this guidance to decommissioning materials and items has been discussed by Miller and Tooley (2005).

SAFEGROUNDS guidance provides a useful and up-to-date resource in relation to options comparison methods. In particular, a new SAFEGROUNDS guide on options comparison methods is shortly to be published. As a "sister" project to SD:SPUR, consistency and compatibility would be beneficial, and it covers ground not discussed elsewhere. Furthermore, there is the opportunity to learn from SAFEGROUNDS experience. However, the scope considered in the SAFEGROUNDS guidance is different, and the range of methods considered is probably wider than required for the SD:SPUR guidance.

An important consideration in any consideration of the use of decision-support techniques is the fact that, since such tools only inform and do not 'make' decisions, there needs to be a guidance for how the outputs from options studies are integrated into decision making. This is recognised in regulatory guides (e.g. Environment Agency and SEPA (2004)), but it is appropriate to emphasise that the principle role of such techniques in the context of environmental risk decisions is to identify key issues and concerns that affect choices between options, and to reveal corresponding diversity in perspectives, rather than to deliver outcomes and solutions. Several of the issues alluded to earlier, regarding factors others than technology choice (e.g. where processing is carried out, the importance of clear guidance on investment priorities and the management of uncertainties) are fundamental to the a comprehensive options evaluation.

Finally, whatever approach is taken to involvement of external stakeholders, there are two important principles relevant to any options assessment. First, it is important to ensure that those involved in undertaking the analysis have an appropriate technical background to challenge assumptions and to ensure that the comparison is not simply a 'box-ticking' exercise. Second, in so far as commercial confidentiality considerations allow, overall openness and transparency is supported by ensuring that the outcome of any options comparison, and the decision logic that underpins identification of the preferred way forward, is properly recorded and published.

3.2 Need for a Consistent Approach

The brief summary in Section 2 indicates that there remains a considerable difference in the approach to determining management options for decommissioning materials that are subject to the provisions of RSA93 and those that are not (i.e. both exempted and non-radioactive materials). On the one hand, radioactive materials have traditionally been regarded as being potentially hazardous and inappropriate for re-use. For this reason regulation and guidance has evolved that requires reasonably sophisticated consideration of potential management options in terms of a range of factors that go beyond simply safety and economics. In contrast, conventional (non-radioactive) demolition materials have increasingly been viewed as a useful resource, or, if not, a waste without unique characteristics. For these materials, options are (for the most part) readily established, in the main there are no significant hazards to consider, and so options can be selected on economic grounds with reference to sustainability principles.

Whilst there remains a distinction between the two categories when considering decommissioning materials on nuclear sites, this needs to be viewed in the light of the potential for radioactivity to be present in all of the wastes. A consistent approach that can encompass both those wastes and materials that are subject to control under RSA93 and others (either non-radioactive or exempt) originating from nuclear decommissioning would offer benefits in terms of identifying a comprehensive overall strategy for waste management. It is nevertheless recognised that detailed guidance on options for specific wastes are likely to need to deal with different types of waste separately, in order to reflect the particular set of management options available. The existing guidance (Miller and Tooley, 2005) tends to preserve the distinction.

3.3 More Detailed Description of the Process

As noted in Section 3.1, a key shortcoming that has been identified in the existing guidance is that it does not provide a very specific description of the methods(s) that can be applied in the selection of management options. The broad themes of options comparison are discussed (mainly related to the BPEO concept), and their implications are considered. However, the next level of detail is not explored.

The SAFEGROUNDS options comparison guidance provides a helpful input, but as noted it was developed for application to different types of problem. The guidance needs to be supplemented by giving specific consideration to the nature of decommissioning materials and processes for their treatment, such as how to deal with secondary wastes, multi-site solutions, etc. This additional information would not necessarily alter the basic steps of the process described in Miller and Tooley (2005), but would provide a clearer description of their practical application.

3.4 Management Options

The existing guidance provides descriptions of the types of management options that can be applied, which provides a useful indication of those that should be considered in practice. However, this information would be of greater value if it were gathered together and presented with more consistency. For example, different levels of information are provided by Miller and Tooley (2005) in relation to segregated wastes compared with lightly contaminated radioactive wastes. In general terms, it would seem that there is scope to describe potential management options for key categories of

material more systematically and consistently, and probably to supplement the existing descriptions with additional information that can help to support evaluation in a site-specific context. However, any such 'data sheets' should be structured so as to avoid making the guidance unwieldy.

As well as simply presenting treatment options in isolation, more thought needs to be given to how combinations of options, as well as implementation strategies for specific technological choices, can be developed and assessed. For example, it will often be the case that segregation and treatment stages will precede specific re-use/recycle or disposal option. Alternatives at each stage can lead to a large range of combinations that should be considered in determining what is finally implemented.

3.5 Factors in Selection of Management Options

The factors that are used to assess options fundamentally influence the outcome. The existing guidance largely drew on BPEO guidance and supplemented it with sustainability indicators. This provides a good point of reference that is generally applicable to the determination of strategy. However, when a strategy has been established, and the question concerns identification of a management option for a particular category of material at a given site, more specific (and quantifiable) factors are relevant. If the strategy has established the basic principles for how the materials should be managed, this stage of the decision process can focus on issues concerned with technical capability, practicality and cost. The existing guidance (both regulatory and SD:SPUR) generally does not explore in great detail this concept of a two-tier approach (strategy and management option) in great detail, and the gap needs to be addressed to fulfil expectations of "practical guidance".

3.6 Accessibility

Finally, it is noted that existing guidance (regulatory and from SD:SPUR) is presented in the style of a technical discussion. Taking account of the perceived need for more practical and usable guidance, it is concluded that updated guidance needs to be much more accessible. This could involve the use of flowcharts, pro-forma tables and checklists that together would provide the practitioner with a template that could be used in a typical situation. In addition, identification of potential options for specific categories of decommissioning materials and items should be presented systematically, possibly in the form of a technical appendix.

4 RELEVANCE

Guidance on the selection of management options for decommissioning materials is particularly relevant at present due to the programme of work to decommission NDA sites. SD:SPUR guidance will be relevant to the majority of material to arise (by volume) on these sites. Whilst the practices for managing these materials are generally sound, there remain opportunities to adopt more sustainable practices and learn from experience in the non-nuclear construction industry. There are also opportunities to make the process more efficient and foster a greater consistency in approach.

Whilst there is clearly an awareness of SD:SPUR and its guidance, it is unclear how routinely it is used. This may be because the guidance is not in the form of an accessible and practical guide. This could be addressed by focusing on describing its application in the specific case of decommissioning materials. The document should therefore take a fresh approach, explaining the whole process in a

practical way, but linking and signposting existing guidance. The real test of the success of the guidance will be the extent to which it is routinely used, and seen as enabling better decisions to be made at the project level, rather than just fulfilling regulatory requirements.

The existing regulatory guidance on BPEO (and draft guidance on BAT), as well as the NII's technical assessment guides, provides a clear requirement for systematic options assessment, but is unspecific in relation to very low level decommissioning wastes; hence, the guide would have a clear relevance in regulatory terms. As well as meeting regulatory requirements, there is an opportunity to better (or at least more consistently) fulfil NDA's requirements – both in relation to IWS, integration of approaches within and across sites, and by demonstrating value for money.

Other guidance (e.g. Hill (2007)) and existing practical experience will be highly relevant and useful in developing the guide, though it may prove difficult to obtain genuine case studies for the document. Nevertheless, capturing and using such experience needs to be considered . This would be best done by interacting directly with nuclear site operators, regulators, and planners, amongst others.

Whilst some shortcomings are evident in the existing SD:SPUR guidance, it nevertheless provides a lot of valuable information and is a foundation for the more practical set of guides that is proposed. Similarly, with due consideration for the difference in the area of application, the SAFEGROUNDS guidance suite provides a lot of relevant information, as discussed in preceding sections.

5 FORMAT

The format of the document is mainly defined by the audience and the extent and detail of information to be presented. In relation to the audience, it is assumed that the document is primarily aimed at those responsible for the management of decommissioning materials with very low levels of radioactivity. It should therefore essentially be a technical document, with non-technical summaries to communicate the key points.

In relation to the amount of information needed, it is assumed that the document should provide a complete description of the process of selecting the option for managing the material. It would be helpful for Appendices to be produced, providing summary descriptions of management options (and key factors relevant to their evaluation) for the most significant types of bulk materials expected to arise from nuclear site decommissioning.

The format of the guide will go a long way towards addressing the issues raised concerning practicality and accessibility of the guidance. The existing SD:SPUR guidance (Miller and Tooley, 2005) was essentially in the form of a discussion paper, and this has been recognised as limiting its routine application by practitioners. The good practice tools report (Hill, 2007) provides an example of a more accessible format.

Whilst it is likely that further consultation with potential users will be needed, simple features like flowcharts, textboxes, checklists and a register of technical options would also help to ensure a more accessible document.

In addition to a "handbook" style document, there may be scope for case studies to illustrate the application. However, these will require careful consideration as to the benefit the provide. It may be that they are most useful in instances where it is difficult to provide standardised guidance for specific situations.

The document should not repeat guidance elsewhere (other SD:SPUR guidance and that written by regulators and other organisations) at length. However, if a complete process description is to be produced it will be necessary to identify and document the key points. References to these other documents should be detailed (e.g. referring to the specific section or paragraph of the document).

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