

“A Good Decision Is Based On Information, Not On Numbers” – A Process For National Strategic Decision Making – 17203

Helen Cassidy*, Alan Paulley**, David Collier*** and Hannah Kozich*

*LLW Repository Ltd, Pelham House, Pelham Drive, Calderbridge, Cumbria, CA22 2TN, United Kingdom

** Quintessa Ltd, Birchwood Blvd, Warrington, WA3 7QZ, United Kingdom

*** White Ox Ltd, 113 York Road, Montpelier, Bristol, BS6 5QG, United Kingdom

ABSTRACT

Waste management decision making is the process used by waste owners to determine and justify choices in across the lifecycle of a waste (from the manner of generation or retrieval to final disposition). In the UK, waste owners in the nuclear industry are obligated, by their environmental permits and authorisations, to demonstrate the application of robust and well-underpinned decision making processes for waste management. This is captured through the requirement for waste owners to demonstrate the identification and implementation of Best Available Technique (BAT)¹.

The National Waste Programme (NWP), led by LLW Repository Ltd, is a UK wide programme which leads the implementation of the *UK National Strategy for the management of solid LLW from the nuclear industry* [1] and which aims to deliver a self-sustaining culture for optimised management of Low Level Waste (LLW) in the UK. Recognising the requirement on waste owners, the NWP has – in conjunction with appointed contractors – led the development and publication of national strategic optioneering studies (so-called national strategic BAT studies) to support waste owners.

Recognising the benefits that this approach to optioneering and strategic decision making could have for other waste producers, this paper provides an overview of the process used for the development of the suite of national strategic BAT assessments for the NWP. It details: the main phases of the process, the key features of each process phase, the benefits of the approach and key learning from its deployment in practice.

¹ The legislative regime in England and Wales requires the identification and application of BAT. There is an equivalent regime in Scotland known as Best Practicable Environmental Option (BPEO) and Best Practicable Means (BPM). The requirements are comparable across the two legislative regimes and, for the purposes of simplicity, the term BAT will be utilised in this paper. The approach and outcomes of the national strategic optioneering process described are applicable across the UK.

INTRODUCTION

The National Waste Programme (NWP), led by LLW Repository Ltd, is a UK wide programme which leads the implementation of the *UK National Strategy for the management of solid LLW from the nuclear industry* [1] and which aims to deliver a self-sustaining culture for optimised management of Low Level Waste (LLW) in the UK. The strategic intent of the programme is to ensure that the strategy is implemented across the UK nuclear industry so as to ensure that the national Low Level Waste Repository is available for waste disposals until 2130, overall waste management costs are reduced, hazard reduction and decommissioning are enabled, the Waste Hierarchy is applied and that stakeholders are engaged in the delivery of the programme [2].

It is widely recognised that effective waste management is an integral component of the successful operation or decommissioning of nuclear facilities. Decisions for waste management can have significant implications in terms of cost, time, flexibility and reputation for the operator; and can impact the efficacy and success of the principal operation and decommissioning process.

In the UK, there is a legal requirement on waste producers to undertake robust and well-underpinned decision making for management of their wastes at both a strategic and project level through the application of Best Available Techniques (BAT). The term BAT is used to represent difference concepts across industries and internationally, but in terms of its UK application to radioactive management, BAT concerns the demonstration of optimisation in practical decisions. It requires a systematic options assessment to ensure that the best approach is identified for the management of wastes whilst taking due account of a wide range of factors such as safety, cost, technical feasibility, environmental impacts, amongst other aspects [3]. To support waste producers in their BAT processes, the NWP undertakes delivery and maintenance of a suite of "National Strategic" BAT assessments for significant waste populations (namely metallic waste [4], soft-solid organic waste [5], soils / concrete / rubble / granular materials [6] and asbestos [7]). These address the overall features of relevant waste populations at the national level, recognising key waste streams and characteristics within them. The national strategic studies are published in the public domain in order to provide overarching strategic 'framework' assessments either for direct use by waste producers in their own assessments, provided that their wastes fall within the scope of the assessment; or as an information source to inform the waste specific assessments. The outcomes also inform development of UK national strategy directly and contribute to ensuring that the supply chain is in place to meet current and future demand.

The NWP has worked closely with contractors over the past five years on the revision and redevelopment of the strategic BAT assessments for the UK. This has involved

the development of a successful and effective process for the delivery of strategic decision making involving a four step process – scoping, screening, assessment and integration. The scoping phase enables the boundaries of the study to be collectively discussed and agreed within the wider stakeholder group. Screening and assessment is undertaken by a focussed project team, involving challenge and contribution from independent experts, and the outcomes of the assessment are reviewed by the wider stakeholder community to improve and validate the assessment. 'Integration' refers to the subsequent steps where waste managers take the outcomes and use them to support the development of site-specific strategies. Stakeholders range from waste producers to treatment, disposal and regulatory organisations.

THE PROCESS FOR NATIONAL STRATEGIC OPTIONEERING

The process for development and execution of waste management optioneering, and the identification of BAT, is a mature process in the United Kingdom as a consequence of the regulatory expectations on individual waste owners as previous discussed. Collaborative industry experience has been collated and published in the form of the *Nuclear Industry Code of Practice on Best Available Technique* (BAT NiCoP) [3]. The process utilised for the execution of national strategic optioneering is based on that detailed in the BAT NiCoP but has been amended to work on a much higher, national strategic environment. This section provides an overview of the process developed and employed by the NWP Office and its contractors for the delivery of national strategic optioneering.

Principles

The development and publication of national strategic optioneering is undertaken in line with the following principles:

- The process and its execution are fully inclusive of and responsive to stakeholders and their views. This means that stakeholders are suitably engaged during process delivery and that their views are used to inform the direction of the study.
- The process is evidence based; opinion may be noted but it does not drive the direction of the process unless it is backed up by suitably robust and underpinned evidence.
- The options 'scoring' process is qualitative to ensure a focus on the key logic given the high-level nature of the assessments and the ranges of issues and uncertainties involved, and to ensure the agility and clarity of the process and its outcomes.
- The process is facilitated by experts who are procured by but otherwise 'independent' of the NWP Office. This means that delivery of the process is undertaken in conjunction with independent contractors, to demonstrate

transparency to stakeholders and minimise the risk of the outcomes being overly impacted by existing bias or opinion from the NWP Office.

- The process is transparent. Information is collated on decision making throughout the process and is provided in the final documentary outputs to ensure that the logic and thread for decision making is visible to all relevant stakeholder groups.

Process Overview

The national strategic optioneering process is a four stage process as detailed in Figure 1 incorporating scoping, screening, assessment and integration.

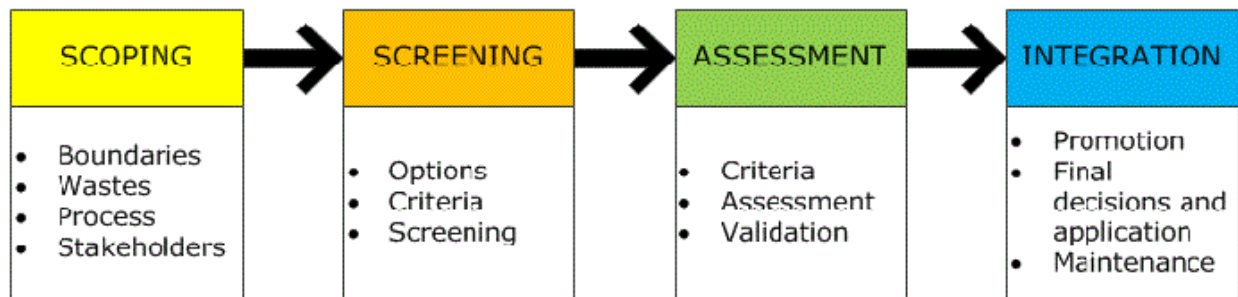


Figure 1 - National Strategic Optioneering Process Overview

Scoping

The initial phase of the national strategic optioneering process utilised by the NWP Office and its contractors to develop national strategic BAT assessments is scoping. This phase is where the assessment is defined and shaped, and where a plan is developed to determine how the phase will be executed, ensuring its execution if focused on the correct options and assessment approaches. Figure 2 provides an overview of the main stages within the scoping phase.

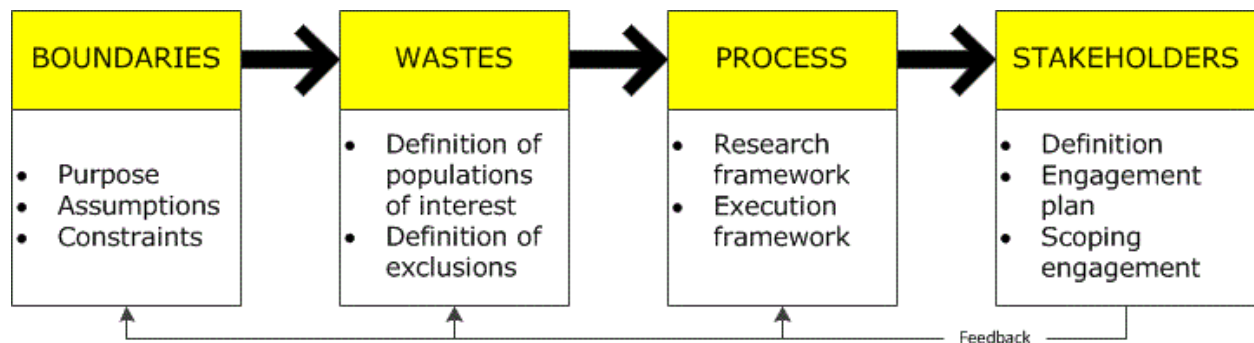


Figure 2 - Process Overview of the Scoping phase

This phase is executed by the project team (a partnership team comprised of personnel from the NWP Office and the contracting organisation). The boundaries for the study are set by mutual agreement of the purpose of the study (for example, whether it is a new study, a periodic review of an existing study or a review of an existing study predicated by a change in the strategic, regulatory or technological environment); and identification of any pertinent assumptions and constraints. The waste populations within the scope of the study are then established by defining the radiological, chemical, physical and volumetric properties of the wastes within the scope of the study. This is typically informed by the NWP Office, through collaborative discussion with waste owners, but is refined through discussion by the project team.

This stage identifies the populations of waste of interest and, by inference, the populations excluded from the study. For example, the scope of the national strategic metallic BAT included different populations of ferrous metals (with different degrees of complexity, dimensions and mixing with other wastes) typical of operations and decommissioning activities but excluded precious metals and problematic metals such as mercury.

The generic framework for the process to be employed is then established by determining how information will be gathered to inform the study (defining whether information can be gained from literature review, existing studies and / or engagement with waste owners) and, at a high level, how the study will be executed.

This phase includes definition of the stakeholder engagement approach and identification of relevant stakeholders (which can include, but is not limited to, waste owners, the supply chain, the regulatory community, local government and planning authorities, strategic authorities such as the Nuclear Decommissioning Authority (NDA) and government) and establishing a stakeholder engagement plan. The scoping phase concludes with a stakeholder scoping workshop where the boundaries, waste populations, process and plans for ongoing stakeholder engagement are explored, discussed and agreed with the relevant stakeholder group for the study. Feedback from the stakeholder scoping workshop is actively used by the project team to refine, clarify and, where needed, reshape the boundaries, populations, process and stakeholder engagement plans before the process progresses to the next phase. This has proven an essential and beneficial process. Ensuring stakeholder buy-in and feedback to the process maximises the value they can provide to the programme, helps the project team optimise the approach to execution of the study, and helps ensure the end product will be utilised. In doing so it helps avoid the risk of re-work at a later stage (e.g. avoiding scenarios where stakeholders do not consider the end product to be sufficiently useful).

Screening

Screening, alongside assessment, forms the main execution steps of the optioneering process itself. Screening is undertaken with the aim to identify the credible options which require further and more detailed examination during the subsequent options assessment phase. A process summary of the screening phase and its component activities is provided in Figure 3.

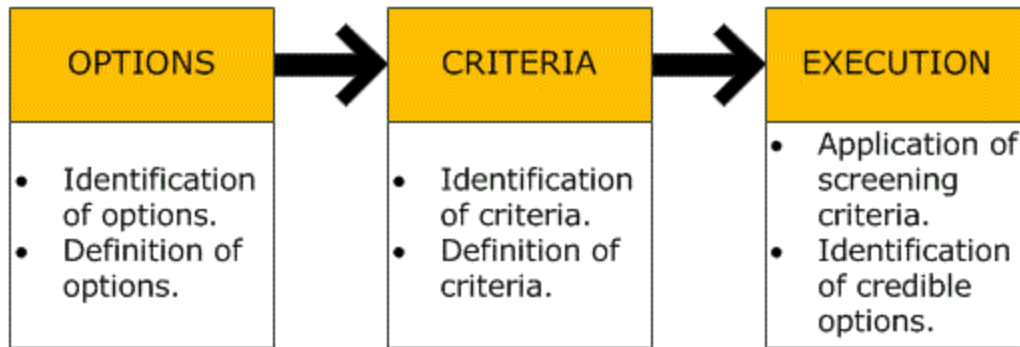


Figure 3 - Process Overview of Screening Phase

The objective of the screening phase, as highlighted by Figure 3, is to identify a “short-list” of credible options for further detailed assessment; enabling the efforts of the assessment phase to be simplified and focussed. An initial “long-list” of options is developed by the project team through literature review, consideration of any existing or historical options assessments, the input of expert views from subject matter experts in waste management and discussion with relevant stakeholders. Typically, this long-list aims to identify all management options (including for example decommissioning, treatment, storage and disposal approaches, and options that ‘enable’ the main management option steps) that could, on their own or in combination with others, plausibly offer some benefit to management of the waste populations in scope.

At this stage, it is important that the widest range of options are identified and that undue constraints (in terms of technological maturity or prior application of a technology in a nuclearized environment) are not applied, so as to reduce the prospect of bias, to ensure that a suitably wide range of options are considered in the study and to not unduly disregard innovative options.

The identified long-list of options is further developed and defined through the production of option descriptions, so enough information is provided to inform subsequent phases of the study. The screening criteria for use in the execution phase are identified and defined next. These are a set of criteria which challenge the legal, technical, financial and social credibility of the options; and need to be pitched carefully so the option set can be streamlined without biasing the assessment or unduly exclude more innovative options. Essentially, the screening criteria consider

whether there is a potential benefit to the option, and whether there are strong reasons to directly exclude it due to feasibility, disproportion between benefits and costs or other detriments, or other practicability concerns.

This phase completes with execution of option screening where the options are assessed against the screening criteria and qualitatively “scored”. For the national strategic optioneering, this tends to be a binary pass or fail assessment; however, the rationale for the scoring is collected and recorded at this stage to enable transparency of the process at subsequent phases when it is available for the wider stakeholder group to access.

This allows opportunities and other details of logic to be recorded, e.g. where options may be screened ‘out’ for current use but it is recognised that there is potential for further research and development. Screening execution is undertaken by the project team with independent technical experts and, where appropriate, representatives from the wider stakeholder community. The output of this phase is a short-list of options for assessment in the next process phase.

Assessment

The assessment phase involves the consideration and review of the list of short-listed options against a set of assessment criteria to identify both a list of preferred options for the given waste populations and the hierarchy of preference for these options. To facilitate the assessment process, short-listed options may be further refined, grouped, or combined into a smaller number of credible life-cycle options for assessment. Elements of these credible options typically consider:

- ‘Enabling’ options, recognising site / waste-stream specific steps that are essential precursors to the main management and treatment steps; such options are typically discussed in detail in the assessments, to recognise their importance in realising life-cycle options linked to end-points of interest, but represent detailed issues that are common to strategies at the national level and so do not differentiate between strategic options;
- ‘Main treatment’ options, and combinations of them (e.g. metal treatment strategies could use one of a range of surface decontamination approaches, with or without subsequent metal melting steps);
- Waste ‘end-point’ options, including release of materials to the open market where plausible, and disposal / discharge of solid, liquid and gaseous primary and secondary wastes as appropriate. These end-points are typically organised into hierarchies reflecting those that are, in principle, preferred e.g. from regulatory guidance, all other aspects remaining equal.

Figure 4 provides an illustrative overview of the main stages and activities within the assessment phase.

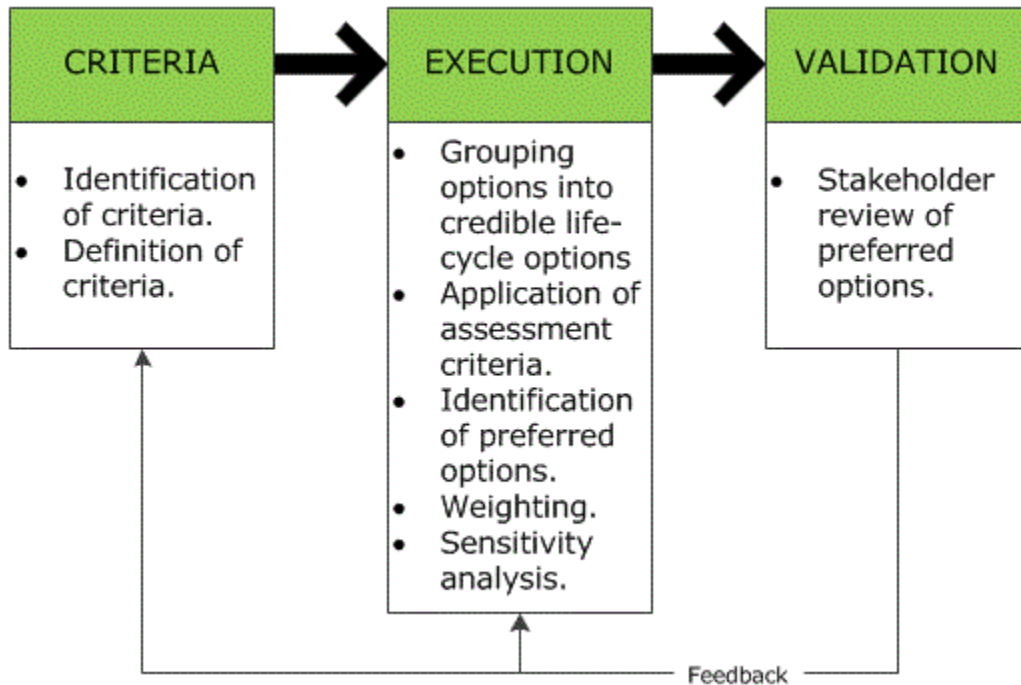


Figure 4 - Process Overview for Assessment Phase

As in the screening phase, there is an activity undertaken by the project team to define assessment criteria for the study. Existing information sources – notably the BAT NiCoP [3], BAT decision making guidance [8] and the NDA Value Framework [9] – define lists of suitable assessment criteria which can be used to assess waste management options. These information sources are reviewed against the scope of the study (including key assumptions and constraints) to identify the criteria which are relevant to the populations under consideration and which will be discriminatory in assessment of the different options (i.e. for which the options behave differently). The criteria should be diverse and, for national strategic optioneering in particular, suitably holistic across the waste management process to enable assessment of the legal, social, environmental, safety, cost and implement ability aspects of given options. The assessment criteria are then “unpacked” further to identify relevant sub-criteria and the key questions which should be considered when assessing an option against a specific criterion. Typically, in the assessments however, rather than requiring exhaustive analysis of all sub-criteria for each option, the detailed sub-criteria are used as an ‘aide memoir’ list and audit tool to ensure all of the key issues are captured.

Alongside this, a protocol for application of the criteria (a “scoring” system) is developed. In the national strategic optioneering studies, this system has involved

the identification of strengths, weaknesses and neutral aspects for particular options rather than a numerical scoring system. This qualitative assessment approach enables the options assessment process to focus on the evidence, reasoning and rationale for performance of an option against a criterion rather than on arbitrary scoring scales; this is helpful in dealing with uncertainties and complexities that occur at the generic national level, as well as being less subjective and enabling greater clarity for end-users of the studies.

The execution of the options assessment phase involves the assessment of each credible option against each of the criteria using the protocol established at the preceding stage typically by the project team with additional input from subject matter experts and, where relevant, stakeholders. The reasoning and rationale for scoring is recorded throughout the process.

This process identifies the preferred options from the list of credible options produced from the screening phase. The preferred options are typically then ranked in order of preference to produce a hierarchy of options. The hierarchy is generally based on how the option performs against the Waste Hierarchy (i.e. environmental performance) to ensure alignment with the strategic themes of the UK national strategy for LLW management in the nuclear industry [1].

Ranking however will be adjusted according to practicability challenges reflecting the ability of options to deliver the various end-points. Where appropriate, the options may be subject to further sensitivity analysis by re-assessing the hierarchy of options, for example to explore sensitivity if different qualitative 'weightings' of criteria are used, or to test whether the ranking of options changes under different future waste inventory scenarios.

The options assessment phase is concluded with stakeholder engagement, review and validation. This typically includes a stakeholder validation workshop involving all the stakeholders represented at the scoping workshop and any other additional stakeholders identified in the engagement plan. The wider stakeholder community is informed about the purpose, shape and outputs of the process and (more importantly) has an opportunity to provide feedback on them and challenge information or logic. The workshop format typically includes presentations from the project team followed by detailed participant group-work to assess and comment on the outcomes of the assessment. This is supported by plenary discussion and question-and-answer sessions with the project team.

The workshop conclusions are used by the project team to further refine and clarify the outputs of the options assessment phase, resulting in an outcome which has appropriate 'buy-in' from all parties. Although it has not been the case so far in any of the current series of strategic BATs, screening or assessment would be revisited if the collective stakeholder view was that the process to date had significant flaws.

The project team then issue a report describing the context, process, criteria and outcomes of the different phases of the process and the rationale for the decision making undertaken across the study. It is reviewed in draft form by stakeholders and includes a record of the full stakeholder engagement process and conclusions.

Integration

The integration phase is often overlooked but is the most important phase of the national strategic optioneering process. This phase is where the outcomes of the optioneering is made available to end users and where it is put into use to inform and support decision making by waste owners. Figure 5 provides an overview of the main process activities for the integration phase.

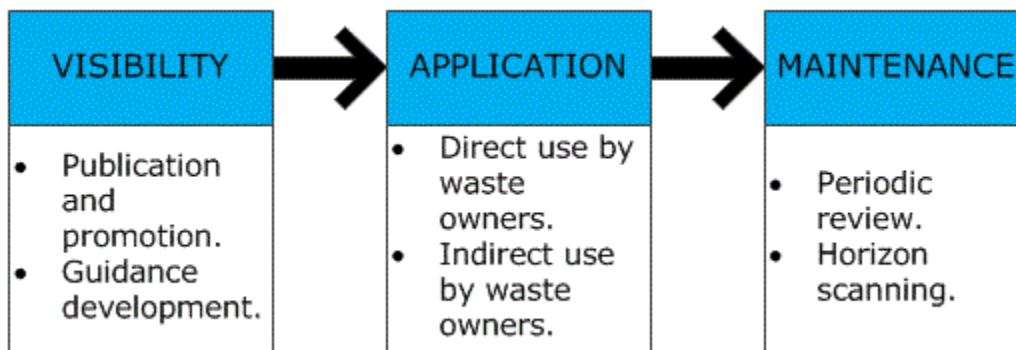


Figure 5 - Process Overview for Integration Phase

The integration phase is that which enables the use of the outputs and outcomes of the national strategic optioneering study, and is executed by the NWP Office and wider NWP stakeholders. The document is published on the LLW Repository Ltd website [10] and promoted to raise awareness within the radioactive waste community through inclusion in reporting, discussion at governance meetings and in transactional discussions with waste owners. The NWP Office has gone further, with some studies and developed and published additional guidance; for example, a waste route map for metallic treatment was developed [11] to support the use of the national strategic optioneering for metallic waste [4]. The development of more detailed guidance also provides another vehicle for promotion and increased visibility of the initial study with potential end users.

The key element of the integration phase is the application of the national strategic optioneering outcomes by waste owners, either directly or indirectly. The development of national strategic optioneering does not remove the requirement on waste producers in the environmental permits required for operation of UK nuclear sites to identify and apply the management solution which represents BAT in their own specific context. However, the national strategic optioneering provides useful

tools and information to support waste owners in meeting these regulatory obligations.

In a direct mode, where the waste in question conforms to the waste stream definitions used in the optioneering, the waste owner can fulfil their BAT obligation through production of a short justification which signposts the national optioneering report and demonstrates how it applies to their waste. Alternatively, in an indirect usage mode, waste owners can utilise the information and assessment rationale from national optioneering but tailor the data and logic to meet the drivers, constraints and needs of their individual situation) for a fuller assessment for their own wastes. There is evidence that both usage modes of the national strategic optioneering have been employed by waste owners in the UK.

There is also a need to ensure that the national strategic optioneering studies remain current and fit-for-purpose during their lifetime so they are subject to periodic five yearly review, or more often if a significant external change might affect an outcome. The NWP Office – through its role leading the implementation of the UK national strategy for the nuclear industry and through engagement with its stakeholders – undertakes regular horizon scanning to remain abreast of changes to the legislative, regulatory, social and technological environments; and uses this information to assess whether there are significant changes which could invalidate the findings of specific national strategic optioneering assessments. The NWP Office uses this information, and management of the timetable for review and update of the optioneering, to keep the strategic assessments fit-for-purpose.

BENEFITS OF THE APPROACH

The approach utilised by the NWP Office and its contractors for development of national strategic optioneering has been designed to provide robustly underpinned decision support guidance for waste owners across the UK nuclear industry. There are a range of benefits of the approach – increased inclusiveness of the voice of the stakeholder; increased agility and responsiveness; increased process effectiveness; increased transparency of the process and outcomes; and reduced bias.

The voice of the stakeholder is an integral part of the process for delivery of national strategic optioneering. Effective stakeholder engagement is built into the process from the outset through identification of stakeholders at the scoping stage to the development of useful guidance to further support usage of the outcomes of the process at the integration stage. The deliberate inclusion of the scoping workshop and stakeholder validation workshop in the process provides punctuation to the scoping and assessment phases; enabling stakeholder views to be heard and incorporated back into the process. This improves the usefulness and relevance of the outcomes to the stakeholder community, and the level of stakeholder “buy-in”.

The use of qualitative assessment of a rich information set against a diverse set range of factors reflects the adage from Plato that “a good decision is based on information, not on numbers”, enables agility and responsiveness to the process. This approach enables the study to avoid the pitfalls of more conventional quantitative scoring approaches where conflicting views on the definition of scores and inconsistency of approach can make the process unwieldy and less engaging for participants. The qualitative approach supports inclusivity of stakeholder views (being clearer and easier to engage with) and is simpler to adjust in line with feedback from participants and potential end users, thus being more responsive.

Delivery of the scoping phase ensures that there is mutual agreement of the scope and boundaries of the study by the interested stakeholders so reducing the potential for future scope creep or disagreement on the scope of the study. The structure of the project team – with close working between the NWP Office and its contractors for delivery of the assessment phase – allows for focused, time and cost effective progress.

The qualitative and evidence based process means that the rationale for decision making across the study (from the setting of the project boundaries to stakeholder validation) is consistently recorded and included in the documentary output of the process. This ensures that the process is fully transparent to stakeholders and provides additional data and meta-data to support the decision making processes of end users.

As highlighted previously, the approach for delivery of national strategic optioneering has also been designed to reduce the potential for bias through delivery by ‘independent’ contractors, qualitative assessment and strong usage of stakeholder engagement.

LEARNING FROM DELIVERY OF NATIONAL STRATEGIC OPTIONEERING

This process has been successfully used over the past five years for review and development of all the NWP national strategic BAT assessments. During this time, a significant amount of learning has been gathered and continuous improvement delivered. This section provides an overview of the key pieces of learning from application of the process for national strategic optioneering.

The transparency of the process to those engaged with its development and end users is of paramount importance. The process used for national strategic optioneering has transparency at its core allowing all interested parties to understand the rationale and underpinning for the decisions made during execution of the

process. The qualitative approach and involvement from stakeholders supports full process transparency,

As highlighted in the process benefits, the inclusivity of the process approach to the voice of the stakeholder is a key part of the process. This helps support minimisation of bias and helps to ensure that the outputs are useful to end users. Delivery of national strategic optioneering over the past five years has demonstrated the importance of ensuring that the right stakeholders are engaged at the right points across the process. Stakeholder engagement is planned during the scoping phase to ensure that there is mutual agreement of the relevant stakeholder group and allows for suitable stakeholder engagements to be planned. The approach used has two distinct points for formal stakeholder engagement – the scoping workshop and the stakeholder validation workshop – which essentially “bookend” the process. As noted previously, effective engagement at both stages has proved invaluable to achieving the best outcomes. On this basis it is considered important that any national strategic optioneering approach should take due care to ensure that stakeholder views are captured and incorporated.

Building on the importance of inclusivity of stakeholders in the process is the importance of effective communication with the stakeholder group on the nature of national strategic optioneering. In the UK, the legislative framework means that there is a specific obligation on waste producers to demonstrate robust decision making through the application of BAT. National strategic optioneering, in its current guise, is unable in itself to replace that legal obligation. It has been important in both communications with stakeholders at workshops and within the documentary output to be clear about the role of national optioneering and how it interacts with the role of waste owners. The key lesson here is that steps need to be taken to ensure that all involved have a suitable understanding of what the purpose, aims and limitations of the process are.

Whilst the involvement of stakeholders is vital to the success of the approach for national strategic optioneering, it must be remembered that this can be accompanied by conflicting and competing views which need to be appropriately managed. One such area of discord identified during the five years of deployment of this process is the status of the national strategic optioneering in the wider environment, with different views from stakeholders on whether adherence to the national optioneering should be mandatory. To date, this has been managed by separate exploration with the stakeholders about what a mandatory status would mean and reflection during deployment of the process that the consensus within the waste owner community that their own decision making autonomy should take precedence. This has demonstrated the need for effective stakeholder engagement and reflection on the outcome of this. In addition, it must be noted that in an environment where decision making responsibility lies with the waste owners, optimised integration (such as the

mandatory use of national strategic optioneering) may require significant cultural change across the stakeholder community which may be too difficult or too slow to achieve. The limitations of the study need to be understood from the earliest phase to ensure that the best possible and most useful outcomes are delivered.

CONCLUSIONS

Waste management decision making is the process used by waste owners to determine and justify choices in across the lifecycle of a waste (from the manner of generation or retrieval to final disposition). The legislative framework in the UK obligates waste owners in the nuclear industry to demonstrate the identification and implementation of BAT. The NWP has – in conjunction with appointed contractors – led the development and publication of national strategic optioneering studies to support waste owners in the delivery of these obligations.

The approach devised by the NWP with their contractors is a four stage process, based on best practice within the UK, involving scoping, screening, options assessment and integration. The use of this approach facilitates: increased inclusivity of the voice of the stakeholder in the process; increased process agility and responsiveness; maximised process transparency; and minimised study bias. This process has been successfully used over the past five years for review and development of all the NWP national strategic BAT assessments.

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