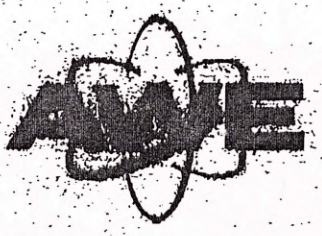
| | | |
|---|---|---|
| Date: September 2005 | [redacted] Summary of Findings of Studies Supporting BPEO Selection | Issue 2 |
| | DMP/EUP/LL2361858 | |



# Enriched Uranium Project

# Summary of Findings of Studies Supporting Best Practicable Environmental Option Selection



[redacted]

| | | |
|---|---|---|
| Date: September 2006 | [redacted] Summary of Findings of Studies Supporting Infill Selection | Issue 2 |
| | DMP/EUP/LL2301888 | |

**DOCUMENT APPROVAL**

| Originator | Checked | Approved for EUP Issue |
|---|---|---|
| [redacted] | | |
| Print Name | Print Name | Print Name |
| Date: 26.9.2006 | Date: 28/9/06 | Date: 28/09/06 |

**DOCUMENT ISSUE RECORD**

| Issue | Description Of Amendment | Date | Originator | Checked | Approved |
|---|---|---|---|---|---|
| 01 | ARTL comments addressed | 23/03/04 | [redacted] | | |
| 02 draft | Update to revised scope. Old Documentum Ref No. DSD05/B/RP/IEWEH/004 | 05/01/05 | | | |
| 02 | Updated to remove "draft" from header and to include signatures from all signatories (filed incomplete in 2006). Distribution List reflects Jan 2006 recipients | 26/09/06 | | | |

**DISTRIBUTION**

The Master (Original) Copy of this document shall be held in the Project File, in the Document Control Centre; all other copies shall be uncontrolled. All users of uncontrolled copies must check with the Project Manager on the revision status of this Project Quality Plan.

**Previous issues of this document are to be destroyed or marked SUPERSEDED.**

[redacted]

[redacted]

[redacted]

| | | |
|---|---|---|
| Date: September 2006 | DIRECTORATE MAJOR PROJECTS<br>Summary of Findings of Studies Supporting EIP EO Selection<br>DMP/EIP/LL3301688 | Issue 2 |

## CONTENTS



[redacted] [redacted]

| | | |
|---|---|---|
| Date: September 2006 | DIRECTORATE MAJOR PROJECTS<br>Summary of Findings of Studies Supporting BPEO Selection | Issue 2 |
| DMP/EUP/LL2361888 | | |

## 1. INTRODUCTION

Best Practicable Environmental Option (BPEO) is a process which is applied at a strategic level in order to ensure that the broader issues involved in a proposed development (such as impacts to the environment, cost and stakeholder interests) are incorporated into the wider decision-making process. This report presents a record of the strategic issues considered in generating, screening and selecting options for the storage and processing of Enriched Uranium (EU).

Currently, uranium processing and storage is undertaken across the AWE Aldermaston site in a number of facilities, some of which were constructed over 40 years ago and are reaching the end of their operational lives. In order to determine how uranium processing and storage will be undertaken in the future an option study was undertaken using the AWE Environmental Option Study (EOS) Methodology (AWE/D6DG/B/EJ/AD/004), which is a multi-attribute analysis technique.

The scope of that study included both EU and depleted uranium (DU) processes and the first issue of this report described the steps taken using the EOS to determine the Best Practicable Environmental Option (BPEO) for EU and DU processing and storage at AWE in order to meet their contractual commitments and company vision. The scope of the project has been changed since the completion of the EOS and is now focused on EU processing and storage. Issue 1 of this document retained the assessment of options for DU, as it was considered possible that the DU aspects of the project would be restored in the future. However, it has now become clear that the change in scope is such that DU processes are likely to remain outside the project scope and discussion of DU-related issues has therefore been removed from this issue of the document.

### 1.1 THE NEED FOR DEVELOPMENT

EU processing and storage operations are currently carried out within the complex and some other facilities at AWE. The requirement for the new EU Facility stems from a number of Company Strategies and Drivers, described by the Technical Policy Group [Ref. 1], particularly concerning the age and condition of with respect to modern standards and Licence Condition 15. The complex, most of which has operated since the 1950s or early 1960s, is now approaching the end of its operating life. A new EU Facility to replace has been set out in the Business Case for the Uranium Strategy Project [Ref. 2] and the business aims for the new facility would be:

The Project Sponsor's requirements, principles and success criteria for the project are contained in the Sponsor Requirements Document [Ref. 3].

The EU Project will develop a solution for EU processing and storage for the Company, taking into account the existing facilities and licences. Brief descriptions of the activities and product lines to be manufactured in the EU Facility are as follows:

[redacted]

## 1.2 THE NEED FOR BPEO

Statutory Guidance establishes an obligation on the Environment Agency (EA) to ensure that proper consideration is given to the identification and evaluation of alternative management options, in order to ensure that the "best practicable environmental option" is chosen, before authorisations are granted under the Radioactive Substances Act 1993 (RSA93). As any future solutions to the processing and storage of EU will inevitably require compliance with RSA93, it is apparent that the decision-making process to determine the best solution should take account of the BPEO.

## 1.3 THE OPTION ASSESSMENT AND SELECTION PROCESS

There is no defined methodology for an assessment of the BPEO because the concept is applied to a wide variety of projects across many different industries. BPEO-type assessments at AWE are typically undertaken through a well-developed methodology termed the "Environmental Option Study" (EOS) [Ref. 4] although it should be noted that the early stages of the current project were completed before the publication of this methodology.

The option selection process generated a list of options for consideration (see Section 2.1 below) which were then subjected to a two-stage screening process (Sections 2.2 and 2.3). The screening process generated a list of options for more detailed consideration and this was done using the EOS methodology, as summarised in Section 3.

[redacted]

### 1.4 THE INVOLVEMENT OF STAKEHOLDERS

BPEO studies must seek to consider criteria which are important to project stakeholders. This is best achieved by defining which criteria are important to different stakeholders and including these in the BPEO study, for example by using them in the scoring and ranking of options. The EU project is subject to security restrictions and cannot be discussed in any detail with stakeholders without the necessary security clearance. This is a particular issue in discussing the project with external stakeholders such as local council members and officers, local community groups and general non-Governmental organisations (NGOs); external stakeholders were therefore not involved in the option studies.

The project sought to address potential stakeholder concerns in two ways:

1. Those involved in option selection meetings tried to include these concerns by specifically considering the issue of the acceptability of the proposed development to a range of external stakeholders.
2. The option selection process used a comprehensive list of criteria which has been developed by AWE to ensure that all significant aspects are considered (the list included 19 general criteria, 43 environmental criteria, 32 safety criteria, 4 cost criteria and 7 risk criteria; the full list of criteria used is given in Appendix A).

It was also important to the project to include the opinions of internal stakeholders (e.g. EU project team, related AWE facilities, AWE safety, technical and environmental specialists). Staff from a number of disciplines and departments across AWE were included as integral members of the option generation, screening and assessment meetings. This meant that a range of opinions was used in the studies, thereby ensuring that a range of factors (e.g. interactions with other facilities, learning from other AWE projects) were included in defining, screening, scoring and assessing options.

## 2. INITIAL OPTION GENERATION AND SCREENING

Having defined the need for the proposed development (see Section 1.1 above) it was recognised that the practices currently used on site are based upon or constrained by methods and technology available when the facilities were constructed. The existing facilities have been updated and refurbished but the age of the facilities and the methods originally adopted mean that the functions served by the facilities could be significantly improved in terms of efficiency, cost effectiveness and waste minimisation and management. A process of option-ering was initiated to define how the fundamental requirements could be met in a way that minimised the impacts on the environment, on worker health and safety and on financial resources.

The option studies described below were undertaken in order to establish the likely impacts of each process option and to examine what steps could be taken to reduce these impacts or what additional studies or R&D projects were needed to help to establish the validity of proposed options.

### 2.1 OPTION GENERATION

The initial lists of options which were generated for consideration for each element of the EU project are outlined below. These lists of options were developed by a large number of people, both individually and in groups, over the course of a number of years prior to the meetings. A preliminary list of options was presented to the screening meetings and these options were defined and added to during the meetings themselves [Ref. 5]. The options therefore capture much of the thought and

planning that took place during the earliest stages of what is now the EU project as well as reflecting the situation at the time of the meetings.

- Do Nothing
- Refurbish
- Build new
- Build new
- Dedicate
- Use appro
- Combine with
- Install into

- Do Nothing (i.e. complete the known programme of work and then no more
- Refurbish
- Install into
- Install into
- Install into
- Install into
- Buy from
- Install in new build
- Withdrew from
- Incorporate with

- Do Nothing (i.e. continue to use until that facility is decommissioned but provide no replacement facility)
- Refurbish
- Install into Savings Measure Box
- Install into New
- Install into
- Install into
- Install into
- Install into
- Keep part of open for
- New Build
- Combined New Build with other functions
- Install into

[redacted]

## 2.2 FIRST OPTION SCREENING MEETINGS

The initial lists of options set out above were discussed in a series of meetings [Ref. 5] attended by between 8 and 13 individuals. Expertise available in the meetings included engineering (operations, production, design, etc), risk assessment, environmental assessment, project management and project sponsorship.

The meetings considered each option against a list of four criteria, each of which were defined by a number of key elements. The four top level criteria were assigned weighting factors to be used in obtaining combined scores for all four criteria. (The criteria and weightings broadly follow those used for the prioritisation of the projects within AWE at the time of the meetings. The option screening meetings were free to amend these but chose not to.)

- Safety and Environmental (weighting = 8)
  - Regulatory interest
  - Impact on safety
  - Environmental impact
- Cost (weighting = 6)
  - Capital costs
  - Through-life costs
- Stockpile Capability (weighting = 7)
  - Impact on programmes
  - Capability maintenance
  - Operational benefit
- Stakeholders (weighting = 5)
  - MoD
  - Security
  - Site development plan
  - Local community
  - [redacted]
  - Employees
  - [redacted]

[redacted]

Following discussion and definition of the options, each option was assigned a score out of 10 for consistency with each criterion. These scores were then multiplied by the weighting factors and the options ranked according to the total weighted scores.[1]

[redacted]

The meeting determined that the three options involving new build within the [redacted] were sufficiently similar to be treated as a single "new build" option, reducing the number of options for consideration to 7. It was then determined that the following options should be removed from further consideration:

- Do Nothing, on the grounds that it would not meet the future [redacted] requirements and would conflict with regulatory requirements.
- Dedicate [redacted] on the grounds that this would be likely to introduce a requirement for additional [redacted] and would impact on [redacted] operations.
- Use approved [redacted] transport containers for [redacted] (this could need extra security in [redacted] on the grounds that there would be an unacceptable risk of increased dose to [redacted] operational staff and would impact on [redacted] operations.

[redacted]

The meeting determined that the following options should be removed from further consideration.

- Do Nothing, on the grounds that AWE has an unlimited liability to [redacted] to the MoD and would not be able to fulfil contractual obligations.
- Withdraw from [redacted] role, on the grounds that AWE has an unlimited liability to [redacted] to the MoD, and would not be able to fulfil contractual obligations.
- Refurbish [redacted] on the grounds that it would be uneconomical to refurbish a large and contaminated facility for a small scale requirement, that the facility is [redacted] that the location of the facility is not consistent with the site development plan, that there would be no significant operational savings to be made by AWE and that the MoD would not make any operational savings.
- Buy from [redacted] on the grounds that the cost of procuring these items over the life of the contract would be [redacted], and that the MoD would not accept a long term option that relied on another [redacted]
- [redacted]

[redacted]

The meeting determined that the following options should be removed from further consideration.

- Refurbish [redacted] on the grounds that it would be uneconomical to refurbish a large and contaminated facility for a small scale requirement, that the facility is [redacted] that the location of the facility is not consistent with the site development plan, that there would be

[1] It should be noted that no sensitivity analyses were undertaken to investigate the effects of using different weighting schemes. However, subsequent analysis shows that the rankings of the various options are not significantly affected by the use of different weighting schemes; almost all rankings do not change and those that do only vary by one place.

[redacted]

no real operational savings to be made by AWE and that the MoD would not make any operational savings.

- Do Nothing:
- Keep part of open for on the grounds that it would require the refurbishment of an existing contaminated facility, that there would be no real operational savings to be made by AWE, that the location of the facility is not consistent with the site development plan, that the MoD would not make any operational savings and that the location of the facility is
- Install into the grounds that close analysis of all of the *'install into an existing building'* options showed it to rank lowest against all criteria and against the weighted total score.

### 2.3 SECOND STAGE OPTION SCREENING

Following the first stage option screening meetings some additional consideration was given with a view to identifying options which are not valid or which pose an excessive risk to AWE [Ref. 6]. It was found that some additional options could be screened out from further consideration, as described below.

#### 2.3.1 OPTIONS ASSOCIATED WITH

These options were screened out on the grounds that extensive modifications would be necessary to the ventilation system, that there is a risk that these modification could not be fitted into the space available and that future programmes would be prevented from proceeding being the only facility that will be available for future use).

#### 2.3.2 OPTIONS ASSOCIATED WITH

These options were screened out on the grounds that the costs associated with the stripping out and refitting of the facility would be excessive, that the project could not use the entire building but would effectively render the remainder of the building unusable for non-uranium activities and that the building is the subject of litigation and future use is impossible to plan.[2]

#### 2.3.3 OPTIONS ASSOCIATED WITH

This option was screened out on the grounds that it was considered likely that the AWE Burghfield site would close and therefore consideration of this option was deemed inappropriate until the future of the Burghfield site was decided.[3]

[2] It should be noted that this option is reassessed following the change in scope of the EU project.
[3] It was subsequently decided to keep the site open and the option was reintroduced for the next stage of the assessment, the EOS.

2.3.4 PURCHASE OF [redacted] FROM [redacted]

This option was screened out on the grounds [redacted] is closing its [redacted] and therefore it is no longer valid.

2.3.5 OPTIONS ASSOCIATED WITH [redacted] AND [redacted]

These options were screened out on the grounds that the structure of the building and the ventilation [redacted] system are inadequate for the purposes required (i.e. they fail to meet regulatory requirements for containment and security), that the costs associated with policing would be high, that there would be a need to provide temporary storage during modifications to the buildings and construction of an extension and that it is uncertain when the [redacted] store would become available for use.

## 2.4 OPTIONS REMAINING FOLLOWING SCREENING

The following options remained after the screening exercises were completed.

[redacted]

- Build new [redacted] within [redacted]
- Build new [redacted] within [redacted]
- Build [redacted] within [redacted]
- Combine with [redacted] in New Build

[redacted]

- Install into [redacted]
- Install into [redacted]
- Install in new build
- Incorporate with [redacted]

[redacted]

- Install into [redacted]
- Install into [redacted]
- New Build
- Combined New Build with other [redacted] functions

[redacted]

[redacted]

The need to incorporate [redacted] capability in the new facility arose later in the project and was therefore not included at this first stage.

[redacted]

The need to incorporate [redacted] in the new facility arose later in the project and was therefore not included at this first stage.

## 3. ENVIRONMENTAL OPTIONS STUDIES

The options remaining after the 2-stage screening process were then considered in more detail using the AWE Environmental Option Study (EOS) methodology [Ref. 4]. An EOS was undertaken for each of the [redacted] elements of the EU facility under consideration at that time. Undertaking an EOS will ensure that relevant environmental and non-environmental considerations are included in the option

[redacted]

selection process, leading to a solution that enables AWE to continue to meet its EU processing and storage commitments with the least impact on the environment [Refs. 7, 8, 9 and 10].

The EOS methodology ensures that key staff and decision-makers are aware of the environmental impacts that may arise during any particular operation and are able to identify the best option by which any such operation may be achieved. The methodology also provides guidance on identifying the need for any external regulatory processes and ensures that appropriate consideration is given to these processes and any associated applications for authorisations or permissions. The EOS methodology should allow the identification of the BPEO by performing the following activities:

- Assessment of the potential environmental impact of any proposed or current activity.
- Assessment of the potential non-environmental impact of any proposed or current activity.
- Comparison of technical options on the basis of both environmental and non-environmental criteria.
- Identification of any legal requirements that may exist for the documentation and authorisation of any potential environmental effects.
- Compliance with corporate environmental policies and strategies.
- The provision of a documented assessment to ensure traceability and provide a basis for review.

A number of key assumptions were adopted by the EOS process:

- [redacted]

### 3.1 EOS Criteria and Weightings

The three EOSs made use of the standard list of criteria in the EOS methodology and supplemented this with additional criteria relating to safety, cost and risk. These criteria were considered separately for each of the [redacted] EU activities and specific weightings were elicited for each case. The full list of criteria and weightings is given in Appendix A.

Each of the studies began by developing initial concept designs for the options remaining after the screening stages. These initial concept designs were used as the basis for the EOS assessments. The assessment process consisted of two meetings. The first meeting discussed the options, determined relevant criteria and assigned scores to each of these criteria, referred to as 'discriminators'. (Non-discriminators represented criteria which were not relevant to the options under consideration or which were equivalent for all options for a given process.) The second meeting was held to review and confirm the results of the first meeting and to assign weightings to the criteria. The reports produced for each of the [redacted] activities were circulated, reviewed and revised prior to issue as final reports.

[redacted]

### 3.2 SENSITIVITY ANALYSIS

The uncertainties associated with an option selection process can be considerable, especially where there are a large number of feasible options. However, for the EU processes which are undertaken at AWE there is a limited number of options due to the constraints imposed by security considerations, the quality and nature of the processes and products and the availability of land. It was found that the majority of the options proposed at the start of the project could be screened out or scored out on clear qualitative grounds. The number of options taken forwards for scoring was limited for each of the processes and it was found that a detailed multi-attribute analysis was not necessary to understand the factors which determined the final scores and the ranking of options. The sensitivity analyses were therefore limited to comparing weighted and unweighted scores and discussing which factors influenced the results.

### 3.3 ASSUMPTIONS AND EXCLUSIONS

The option studies proceeded on the basis of a defined scope which included a number of assumptions and which also excluded certain items. The following assumptions were made for the EU project:

The scope of the project was also limited by excluding the following items:

(Note: following a change in project scope these assumptions and exclusions were found to be questionable and in some cases no longer valid. This led to a reconsideration of the option studies in order to ensure that the conclusions remained justifiable; see Section 4.)

### 3.4 EOS

The EOS for s reported in Ref. 7.

The option of providing in combination with a new build facility for the was considered along with other options rather than with the options. This decision was made because it was considered that the preferred option would need to be selected before the combined option could be assessed (see Ref. 6 and Section 3.5 below). The options which were therefore considered were:

- **New Build**
  The would be a purpose built facility based upon the In the would be distributed in a matrix with a separation distance of between them and the would be constructed from and would be

[redacted] The [redacted] would be provided with a ventilation system designed in accordance with AECP 1054.

- New Build [redacted]
  The [redacted] would be a purpose built facility based upon the [redacted] Up to [redacted] would be stored within each [redacted] and the [redacted] housed in a number of [redacted] providing shielding between [redacted] The [redacted] would be housed within a [redacted] facility and would be [redacted] The [redacted] would be provided with a ventilation system designed in accordance with AECP 1054.

[redacted] This would be a purpose built facility based upon the [redacted] In [redacted] In [redacted] The [redacted] would be [redacted] with a secure [redacted] the unloading and inspection area. The only area that would be classified as Controlled Contamination would be the unloading and inspection area. This area of the [redacted] would be provided with a ventilation system designed in accordance with AECP 1054. The outer area of the [redacted] would be classified as a Controlled Radiation area and would be provided with minimal ventilation to provide fresh air etc.

Bearing in mind that the lowest scores represent the best options, the results of the options scoring were:

| | [redacted] | | |
|---|---|---|---|
| Un-weighted scores | 84 | 97 | 88 |
| Weighted scores | 202 | 235 | 201 |

Based upon these results the options of [redacted] and [redacted] appeared to be almost indistinguishable in terms of likely environmental and other risks. A more detailed consideration of the most highly-weighted criteria did not alter this conclusion and sensitivity analyses demonstrated that the scores were not very sensitive to changes in the weighting factors used.

In order to distinguish between the two options the criteria were revisited to determine scores which could be assessed more accurately or which could be changed following more detailed definition of the concept design. There were three criteria for which scores were amended, all of the amendments being in favour of the [redacted]

[redacted] was assessed as performing poorly in comparison to the [redacted] because the [redacted] system was considered to be inherently better than the use [redacted] was amended to specify that the [redacted] would be [redacted] within [redacted] leading to an equal scoring against this criteria.

- Dose to workers
  It was found, after discussions with the existing [redacted] that the doses to workers in a [redacted] had been significantly over-estimated in the assessment. The score awarded to

[redacted]

the [redacted] was reduced by two points to be equal to that awarded to the [redacted] for the same criterion.

[redacted]

This criterion was initially considered to be a non-discriminator but the presence of a diesel-powered fork lift truck in an [redacted] facility led to the criterion being scored, with the [redacted] scoring one point better than the [redacted]

The weighted results of the scoring after this re-assessment was as follows:

| | | [redacted] | [redacted] |
|---|---|---|---|
| A | ENVIRONMENTAL CONSIDERATIONS | | |
| A1 | INPUTS | 36 | 31 |
| A2 | OPERATIONS | 20 | 16 |
| A3 | OUTPUTS | 14 | 15 |
| Sum A | Weighted sub-total environmental | 70 | 62 |
| B | NON-ENVIRONMENTAL CONSIDERATIONS | | |
| B1 | GENERAL | 28 | 26 |
| B2 | SAFETY | 54 | 58 |
| B3 | COST | 21 | 26 |
| B4 | RISK | 21 | 35 |
| Sum B | Weighted sub-total non-environmental | 124 | 145 |
| Sum A+B | TOTAL WEIGHTED SCORES | 194 | 207 |

The main advantages of the [redacted] are:

- It uses a known technique [redacted] material.
- Designed properly, the risks associated with Criticality are low.
- Depending upon the detailed design, there is some inherent flexibility in the type and size of [redacted] that can be [redacted]
- It has good seismic protection features.
- It has a relatively low cost.

The main disadvantages of the [redacted] are:

[redacted]

- It requires a large active area, significant for decommissioning.

[redacted]

The main advantages for the [redacted] are:

- It offers flexibility in the way that it [redacted] material.

[redacted]

- It relies upon a smaller active area.

[redacted]

- Physical inventory verification could be made easier by the
- Expansion is easily catered for.

The main disadvantages are;

- The require large fork lift trucks to move the around.
- It is a more expensive option.
- It is a novel solution.

The main discriminators between the options in terms of the scoring were the issues relating to criticality, the novelty of the designs and the costs. This was due to the fact that the criticality issues had not been fully explored at the time. Since the meeting these issues have been discussed and it has been agreed that, by specifying the use of th would be just as safe as the The assumption at the scoring meeting was that th was unknown to the UK regulators and would require more extensive demonstration that the design would work and would meet the regulations.

The conclusion of the EOS was that the represented the best practicable environmental option.

3.5 EOS

The EOS fo s reported in Ref. 8.

The option of installing a capability for in the existing facility was retained after the screening stage. However subsequent analysis revealed that there were significant issues associated with security and seismic qualification which could not be overcome. The option was therefore screened out from further assessment.

The option o in a facility that incorporates capacity is considered here rather than in Section 3.2 above. Therefore the options which were considered in the EOS were;

- **New Build**
  This would be a purpose built facility for the production of The facility would include both the process equipment ancillary equipment, change rooms, plant rooms and offices. The facility would depend upon the construction of a new to provide long term of material;

- **Install in**
  This option would use space available within aboratory was originally designed for use as a aboratory but the capability has never been installed. This option would also require the decommissioning of Laboratory and use of some of the 'red area' offices.

- **Combined New Build with**
  This would be a purpose built facility combining the with a new facility. The facility would share ancillary equipment and services, providing both capital and operational cost savings.

Bearing in mind that the lowest scores represent the best options, the results of the options scoring were:

| | New Build | Install in | New Build |
|---|---|---|---|
| Un-weighted scores | 110 | 95 | 84 |
| Weighted scores | 250 | 218 | 195 |

While the option of a new build facility including an scored best, the option of installing a facility in was thought to warrant further consideration. Sensitivity analysis showed that there would need to be several changes in individual scores and/or weightings to change the outcome of the scoring and further amendments to remove an element of duplication from the assessment of costs were shown to change the scores in favour of the "new build option.

The main reason for this combined option being the preferred one is that once the decision to build a has been made, then the additional impact of providing another capability is relatively minor, especially when considering the impact of the other options.

The option to install the facility into scored badly due to;

- The impact of the proposed option of operations
- The increased risk of cross contamination
- The flexibility of the option.
- Greater cost.

The main advantages of the option would be the consolidation of some of the EU operations into an existing operational facility, leading to savings in the management of the facility and the use of existing equipment.

The stand alone New Build option scored badly due to the large scale construction required for a relatively small application. The main advantage of this option would be that as a stand alone facility it would not be hindered by any other option either in construction or operations.

The conclusion of the EOS was that a new build facility for incorporating an facility represented the best practicable environmental option.

**3.6 EOS**

The EOS for provision of capabilities is reported in Ref. 9.

As for the EOS, the option of installing facilities in was removed from consideration when it became clear that issues associated with security and seismic qualification could not be overcome.

The option of installing the capability within [redacted] at the Burghfield site was reintroduced, having previously been screened out, following the decision to keep the Burghfield site open. Therefore the options which were considered in the [redacted] EOS were:

- **Install into [redacted]**

This option involves the installation of the [redacted] equipment into Laboratory [redacted] the removal of any existing equipment within the laboratory and the removal of the entry/exit box [redacted] Laboratory [redacted] The [redacted] facility would become a self-contained EU process area within [redacted]

The benefits of Laboratory [redacted] are that it has its own independent filtered ventilation system which would be modified where necessary for the [redacted] work and which is currently free from any existing [redacted] operations. The implications of the removal of the entry/exit box from Laboratory [redacted] would be that an existing box located in Laboratory [redacted] would need to be converted to become the Bay's entry/exit box. This will involve the decommissioning of a number of [redacted] contaminated boxes. During construction, operations within [redacted] and [redacted] of [redacted] would be severely impaired.

- **New Build [redacted] Facility**

This option is for a stand alone new facility purpose built to house only the [redacted] process equipment and associated service and ancillary equipment. The facility would be a [redacted] approximately [redacted] to [redacted] and around [redacted] in height. The facility would be within the [redacted] probably located either to the south of [redacted] or to the west of [redacted] It is likely that the facility would be co-located with other Uranium new build facilities, should new build be the preferred option for them.

- **Combine with other EU functions in New Build**

This option would combine the [redacted] operations with the [redacted] and [redacted] facilities into one New Build Facility. The implications of this option are that all future EU operations would be provided within one purpose built facility. There would only need to be one additional laboratory included within the Combined Facility to house the [redacted] and equipment, the [redacted] would already be included within the facility. There would be an increased risk to operators due to increased numbers of operations within the facility.

[redacted]

This option would use the existing [redacted] facility [redacted] which would then be transferred to [redacted] for preparation and analysis where [redacted] already used for [redacted] work. This option would not involve any modifications to either [redacted] Facility. The implications of this option are that every time [redacted] operations were required in the [redacted] equipment would require decontamination prior to use. The operations would need to be planned in sufficient time to ensure that both [redacted] work did not interfere with each other. [redacted]

- **Install into [redacted]**

To install the [redacted] apparatus into [redacted] will require the strip out of existing redundant equipment within Room [redacted] and the installation of the [redacted] equipment. There would also need to be some minor modifications to the structure and services. The work required to strip out the existing redundant equipment would include disconnection, capping, decontamination and removal of all existing pipe and duct connections to the [redacted] The [redacted] itself would then be decontaminated, size reduced, removed and transported to a safe storage area. [redacted]

[redacted]

[redacted]

Bearing in mind that the lowest scores represent the best options, the results of the options scoring were:

| | Combined New Build | [redacted] | New Build, [redacted] only | Install in [redacted] | Install in [redacted] |
|---|---|---|---|---|---|
| Un-weighted scores | 58 | 76 | 90 | 83 | 79 |
| Weighted scores | 140 | 197 | 212 | 232 | 208 |

It is clear from these results that combined new build is the preferred option. Sensitivity analysis shows that changes to the weightings or the scores will not affect the overall outcome of the study. The main reasons for the combined option being the preferred option is that once the decision to build a [redacted] has been made, then the additional impacts of providing other capabilities is relatively minor.

The poor score for the use of the [redacted] was unexpected. The advantages of this option revolve around the minimal modifications that would be needed. However the scoring showed that this was outweighed by the main disadvantages associated with [redacted] and the decontamination of the [redacted] boxes that would be required prior to [redacted]. Also there would be [redacted]

The [redacted] option initially appeared attractive but, although there are no serious problems with it in comparison with other options it seems to represent a poor compromise on many of the criteria.

The option to install the facility into [redacted] scored badly due to the [redacted] the increased risk of cross contamination, the flexibility of the option and the cost. The main advantages of the option would be the consolidation of some of the EU operations into an existing operational facility, leading to savings in the management of the facility and the use of existing equipment.

The stand alone New Build [redacted] option scored badly due to the large-scale construction required for a relatively small application, which could be subsumed into other options. The main advantage of this option would be that, as a stand alone facility, it would not be hindered by any other option either in construction or operations.

The conclusion of the EOS was that a new build facility which combined all activities [redacted] represented the best practicable environmental option.

### 3.7 OPTION STUDY CONCLUSIONS

Using the Environmental Option Study methodology, the series of EOS assessments concluded that the preferred option for EU activities is a combined EU facility incorporating a [redacted] facility, facilities for [redacted] and facilities for the [redacted]

[redacted]

A new combined facility offers a number of advantages over other options. By adopting modern technologies the activities will be performed efficiently leading to significant time-savings and, most importantly, generating much less waste. Additional advantages in the pooling and sharing of expertise, equipment and resources will also have long term operational and environmental benefits. Finally, the construction of a single facility on a brownfield site will make the best use of the land available at Aldermaston.

## 4. OPTIONS REVALIDATION

Subsequent to the completion of the above option studies, and of a series of "Best Practicable Technical Option" studies (which do not address strategic environmental issues and therefore do not form part of the BPEO case), the scope of the project was changed leading to the invalidation of a number of the assumptions and exclusions noted in Section 3.3. In order to ensure that the decisions made previously remain valid, despite the change in scope and the alteration of the assumptions and exclusions, the findings of the option studies were re-examined and compared against the revised scope [Refs. 11 & 12].

Some options which were previously screened out were re-evaluated as it was considered that the change in scope could make them cost-effective (i.e. refitting of [redacted] and refurbishment of [redacted]. Also the provision of a conventional waste store was challenged on the grounds that a different type of store may be more suitable, although it was confirmed that a new-build [redacted] is required. Subject to these two minor amendments, the results of the previous assessments were confirmed and no new environmental issues were raised. The drivers which led to the decision to construct a new facility were confirmed as still being valid, the conclusions summarised in Section 3.7 above were confirmed and the new build option remains the preferred option.

## 5. REFERENCES


1. TPG Paper, Uranium Strategy, AWE/DSM/CS/050/TGPP2.
2. Business Case for the Enriched Uranium Project. DSD01/B/GD/M73H011A/001, Issue 03, August 2004.
3. Sponsor Requirements Document for the Enriched Uranium Project, DSD05/B/FS/ES/EH/001, Issue 02, August 2004.
4. AWE Environmental Options Study Methodology. AWE/DSDG/B/EJ/AD/004, Issue 1, February 2002.
5. Uranium Facility Strategy Project First Stage Options Screening Report. DSD16/B/RP/M14H011A/002
6. Uranium Facility Strategy Project Second Stage Options Screening Report. DSD16/B/RP/M14H011A/004.
7. Uranium Facility Strategy Project [redacted] Options Study Report. DSD01/B/RP/M73A011A/003, Issue 1, November 2002.
8. Uranium Facility Strategy Project [redacted] Options Study Report. DSD01/B/RP/M73A011A/001, Issue 1, November 2002.
9. Uranium Facility Strategy Project [redacted] Options Study Report. DSD01/B/RP/M73A011A/005, Issue 1, November 2002.
10. Uranium Facility Strategy Project Final Options Study Report. DSD01/B/RP/M73A011A/008, Issue 1, November 2002.
11. Enriched Uranium Project Option Pre-screening Report. DSD05/C/PM/SE/EH/074, Issue 01, September 2004.
12. Enriched Uranium Project Options (Transition) Stage Re-Validation Report. DSD05/B/PM/SE/EH/086, Issue 01, January 2005.


[redacted]

[redacted]

| | | |
|---|---|---|
| Date: September 2006 | DIRECTORATE: MAJOR PROJECTS<br>Summary of Findings of Studies Supporting BPEO Selection<br>DMP/EUP/LL2381888 | Issue 2 |

**APPENDIX A**

**EOS ASSESSMENT CRITERIA AND WEIGHTINGS**

| Assessment Criteria | | Weighting factors | | |
|---|---|---|---|---|
| Reference | Activity/Description | [redacted] | | |
| A | ENVIRONMENTAL CONSIDERATIONS | | | |
| A 1 | INPUTS | | | |
| A 1.1 | Raw Materials | | | |
| A 1.1.1 | Radioactivity | | | |
| A 1.1.2 | Hazardous | 4 | 4 | |
| A 1.1.3 | Non-renewable | | 2 | |
| A 1.1.4 | Other | | | 1 |
| A 1.2 | Energy | | | |
| A 1.2.1 | Process use | 3 | | |
| A 1.2.2 | General | 2 | 3 | 3 |
| A 1.2.3 | Other | | | |
| A 1.3 | Water | | | |
| A 1.3.1 | Process use | | | |
| A 1.3.2 | General | | 2 | 1 |
| A 1.3.3 | Source | | | |
| A 2 | OPERATIONS | | | |
| A 2.1 | Site | | | |
| A 2.1.1 | Sensitive areas | | | |
| A 2.1.2 | Natural transport potential | 1 | 1 | 1 |
| A 2.1.3 | Environmental management | | | |
| A 2.1.4 | Storage | | 1 | 2 |
| A 2.1.5 | Land quality | | 1 | 1 |
| A 2.1.6 | Surface drainage volume | | 1 | 1 |
| A 2.1.7 | Surface drainage quality | | | |
| A 2.1.8 | Landscape | | | |
| A 2.1.9 | Soil/Geology/Hydrology | | 1 | 1 |
| A 2.1.10 | Climate change | 1 | 2 | |
| A 2.1.11 | Existing contamination (land) | | 2 | |
| A 2.1.12 | Emergencies | 1 | 3 | |
| A 2.2 | Re-cycling/Re-use | | | |
| A 2.2.1 | Internal | | | |
| A 2.2.2 | External | | | |
| A 3 | OUTPUTS | | | |
| A 3.1 | Liquid effluents | | | |
| A 3.1.1 | Trade | 3 | 3 | 3 |
| A 3.1.2 | Foul | | | |
| A 3.2 | Atmospheric Emissions | | | |
| A 3.2.1 | Radioactive | | | |
| A 3.2.2 | Prescribed | | | |
| A 3.2.3 | Non-prescribed | | | 1 |
| A 3.2.4 | Other | | | |

[redacted]

[redacted]

| Date: September 2006 | DIRECTORATE MAJOR PROJECTS<br>Summary of Findings of Studies Supporting BEEO Selection<br>KMP/EUP/LL2301868 | Issue 2 |
|---|---|---|

| Assessment Criteria | | Weighting factors | | |
|---|---|---|---|---|
| Reference | Activity/Description | | | |
| A | 3.3 | Nuisance | | | |
| A | 3.3.1 | Noise and vibration | 1 | | |
| A | 3.3.2 | Visibility (emissions) | 1 | | |
| A | 3.3.3 | Odour | | | |
| A | 3.4 | Waste | | | |
| A | 3.4.1 | Radioactive | | 4 | 4 |
| A | 3.4.2 | Toxic | | | 2 |
| A | 3.4.3 | Explosive | | | |
| A | 3.4.4 | Domestic and office waste | | 1 | 1 |
| A | 3.4.5 | Construction Waste | | 3 | 3 |
| A | 3.4.6 | Packaging | 1 | 1 | |
| A | 3.5 | Products | | | |
| A | 3.5.1 | Radioactive | | | |
| A | 3.5.2 | Hazardous | | | |
| A | 3.5.3 | Packaging | | 2 | |
| A | 3.5.4 | Transport | 1 | 1 | 3 |
| B | | NON-ENVIRONMENTAL CONSIDERATIONS | | | |
| B | 1 | GENERAL | | | |
| B | 1.1 | Equipment/plant availability | 3 | | |
| B | 1.2 | Plant start-up/construction costs | | 5 | |
| B | 1.3 | Operating costs | 2 | 5 | |
| B | 1.4 | Contingency/ emergency costs | | 2 | |
| B | 1.5 | Control requirements | | 3 | |
| B | 1.6 | Maintenance requirements | 2 | 4 | 4 |
| B | 1.7 | Plant capability/ Flexibility | 3 | 1 | 3 |
| B | 1.8 | Disposal route availability | | 4 | 4 |
| B | 1.9 | Significant Decommissioning issues | 4 | | |
| B | 1.9a | Significant Decommissioning issues – short term | | | 3 |
| B | 1.9b | Significant Decommissioning issues – long term | | | 4 |
| B | 1.1 | Established method | | 2 | |
| B | 1.11 | Operating lifetime | | | |
| B | 1.12 | Public perception/ relations | | 1 | 1 |
| B | 1.13 | Corporate strategy/ policy | | 1 | |
| B | 1.14 | Expertise available | | | 3 |
| B | 1.15 | Implications to other operations | | 2 | 2 |
| B | 1.16 | Discounted cost (time to recoup) | | | |
| B | 1.17 | Culture | | | |
| B | 1.18 | Security | | 2 | 2 |
| B | 1.19 | Safety | | | |
| B | 2 | SAFETY | | | |
| B | 2.1 | Industrial | | | |
| B | 2.1.1 | Dropped loads | 1 | | |
| B | 2.1.1a | Dropped loads (construction) | | 1 | |
| B | 2.1.1b | Dropped loads (lifetime) | | 1 | |
| B | 2.1.2 | COSHH | | | 1 |
| B | 2.1.3 | PPE | | | |

| Date: September 2008 | DIRECTORATE MAJOR PROJECTS | Issue 2 |
|---|---|---|
| | Summary of Findings of Studies Supporting BPEO Selection | |
| | DMP/EVP/LL2361958 | |

| Assessment Criteria | | Weighting factors | | |
|---|---|---|---|---|
| Reference | Activity/Description | [redacted] | | |
| B 2.1.4 | Manual handling | | | |
| B 2.1.5 | Fire | | | 3 |
| B 2.1.6 | Spills | 1 | | |
| B 2.1.7 | Slips/Trips/Falls | 1 | | |
| B 2.1.8 | Cuts and abrasions | | | |
| B 2.1.9 | Internal vehicular impact | 1 | | 1 |
| B 2.1.10 | Electricity | | | |
| B 2.1.11 | Confined spaces | | 1 | |
| B 2.1.12 | Fumes | 1 | | |
| B 2.1.13 | Criticality evacuation | | | |
| B 2.1.14 | Construction hazards | | | 3 |
| B 2.2 | External | | | |
| B 2.2.1 | Wind | | | |
| B 2.2.2 | Rain | | | |
| B 2.2.3 | Snow | | | |
| B 2.2.4 | Seismic | | | 1 |
| B 2.2.5 | Lightning | | | |
| B 2.2.6 | Vehicle impact | | | |
| B 2.2.7 | Aircraft impact | | 1 | |
| B 2.2.8 | Flooding | 1 | 1 | 1 |
| B 2.3 | Radioactive | | | |
| B 2.3.1 | Criticality-flooding | 5 | 5 | |
| B 2.3.2 | Criticality-overstacking | | | |
| B 2.3.3 | Dose to operators-normal operations | 3 | | 3 |
| B 2.3.4 | Dose to members of the public- normal operations | | | |
| B 2.3.5 | Dose to operators-Accident scenario | 3 | 3 | 4 |
| B 2.3.6 | Dose to members of the public-Accident scenario | | | |
| B 2.3.7 | Potential for radioactive release | 3 | 3 | |
| B 2.3.8 | Mislocation of material | | | |
| B 2.3.9 | Malicious damage | 1 | | |
| B 2.3.10 | Cross contamination | | 1 | 1 |
| B 3 | COST | | | |
| B 3.1 | Plant start-up/ construction costs | 5 | 5 | 5 |
| B 3.2 | Operating costs | 3 | 5 | |
| B 3.3 | Contingency/ Emergency costs | 2 | | |
| B 3.4 | Discounted cost (e.g. time to recoup) | 1 | | |
| B 4 | RISK | | | |
| B 4.1 | Time-can we build it to programme? | 2 | | 4 |
| B 4.2 | Cost-can we build it to cost? | 2 | 2 | |
| B 4.3 | Performance-Will it do what we want it to do? | | 1 | 4 |
| B 4.4 | Programme-can we build it to time? | | | |
| B 4.5 | Established method | 2 | | |
| B 4.6 | Criticality modelling difficulties | 2 | 1 | 1 |
| B 4.7 | Failure to gain approval | 5 | 2 | 5 |