

Defence Equipment & Support Nuclear Weapons IPT

UK ENRICHED URANIUM (EU) CAPABILITY INVESTMENT APPRAISAL





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FS 40333

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OBJECTIVES OF THE INVESTMENT

1. The objective of this investment is part of the overall objectives of the Nuclear Warhead Capability Sustainment Programme (NWCSP). The particular objective is to retrieve and restore an enduring capability to fulfil the requirements below, in respect of Enriched Uranium.

EXPLANATION OF THE REQUIREMENT

2. The requirements below are traceable to the MoD Nuclear Weapons Integrated Project Team (NW IPT) System Requirements Document (SRD) ref NWIPT/04/35/01 Issue 2 March 2006, which in turn is traceable back to the Nuclear Warhead Programme User Requirements Document (URD) version 5.1, October 2005.

Material Ageing, Life Prediction and Surveillance

3. The URD articulates the need to underwrite the	e safety and performance of the warhead
Component Manufacture (Inc. Research and c	levelopment)
	ETHORNE AND MADE A SECURIOR
Naval Fuel Feedstock Material	
5. NW IPT is committed to the supply of	for the Naval Nuclear
Propulsion Programme	
	型化EAST 产生工作是关键

Storage of Special Nuclear Material (SNM)

6. The URD has a continuing requirement for the safe and secure storage of the Enriched Uranium inventory. Suitable and sufficient storage arrangements compatible with projected programme throughputs and stock levels will be an enduring requirement of the EU capability.

BACKGROUND

7. The Uranium stora facility was init year life to sup	ge and proces	sing capability ed in the 1950	suppo	rting the L	JK Nuclear	Deterrent.	. The
which was pla	nned to comm	ence in 2006 v	vith NII		closure and		0

Plan. The closure and replacement of	was an assumption	of the original	AWEML bid
for the AWE Maintenance and Operating (M	1&O) Contract.		

8. Since the agreement of the M&O contract the Nuclear Warheads Capability Sustainment Programme has been instituted In order to meet the NWCSP and to meet the requirements of Nuclear Installations Inspectorate (NII) Licence Condition 15, the tacility has undergone a Periodic Review of Safety (PRS), which reported in December 2006. The PRS justified a further ten years of operational life until 2016 subject to the rectification of certain shortfalls.

 Design Acceptance Reports are currently being prepared which will report the facility condition, highlighting shortfalls against applicable modern standards for engineering and nuclear safety.

SPECIALIST ADVICE

10. Several sources of specialist advice have been utilised in the compilation of this Investment Appraisal. AWE has provided technical information and costings of the options. Pricing and Forecasting Group (PFG) have validated the cost and schedule models and the scrutineer community in general have given feedback and guidance throughout this phase of the approvals process.

POSSIBLE OPTIONS

- 11. Eight options are considered within this document:
 - A1 Do nothing
 - A2 Do nothing extra
 - A3 Stretch current capability
 - B Refurbish
 - C New build
 - D Procure EU products from elsewhere.
 - E Combine capability
 - Rationalise UK EU Capability.

SCOPE OF OPTIONS

Option A1, A2 and A3 overview

12. Though there are subtle differences between them, Option A1, A2 and A3 are variants on the Do Nothing option. However the result is the same in each case; i.e. that the existing facility must be re-kitted and achieve the award of a further Authority to Operate to permit operations until 2016.

In addition all three options require the building of a new storage facility to store the resulting

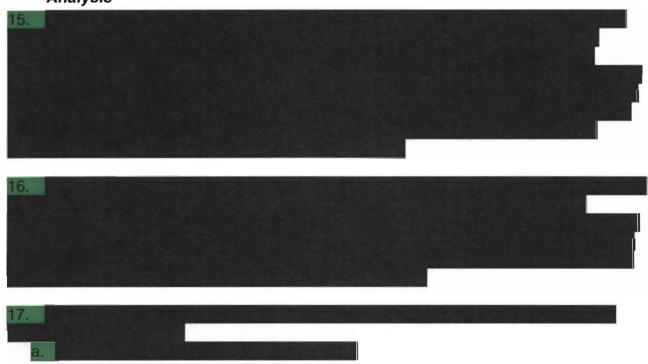
inventory of EU. This storage would be for an indefinite period as the half life of Uranium is 713,000,000 years. The whole life costs and in particular the operating costs of the store have been projected out to 2051 purely as an illustration, to enable a direct comparison to the operating costs of Option C.

Option A1 - 'Do Nothing'

Scope

- 13. The 'Do nothing' option is to do no work on the existing AWE Enriched Uranium facility. This means that the status of the existing facility would remain as it is today (i.e. no investment on re-kitting or refurbishment) and allow the Operating License to lapse in 2006. It is assumed that the facility will begin POCO (Post Operative Clean Out), decommissioning and demolition to a brown-field site as soon as practicable from this point.
- The scope of this option can therefore be summarised as:
 - Carry out necessary work to extend life of facility to 2016
 - b. Prepare and seek regulatory approval of safety case for short term 'Care and Maintenance'
 - c. Create decommissioning Safety Case and obtain agreement from NII
 - d. Enduring storage of the Enriched Uranium stockpile in a new store
 - e. Post Operative Clean Out (POCO)
 - f. Carry out necessary pre-works
 - g. Decommission
 - h. Demolish
 - Remediate site back to a brown-field status.

Analysis





18. Option A1 Do nothing is not a recommended option.

Option A2 - Do Nothing Extra

Scope

- 19. This option can be described as maintaining current investment in existing capability accepting a decline over time. The scope of this option is therefore:
 - a. Continue operations at the present level
 - b. Carry out Periodic Review of Safety but do not invest in improvements required.

Analysis

Option A2 Do nothing extra is not a recommended option.

Option A3 Stretch Current Capability

Scope

- 25. This option can be described as maintaining current investment in existing facility whilst
 - Maintain the current capability but utilise it for as long as possible whilst minimising investment.
 - b. Carry out Periodic Review of Safety but do not invest in improvements required.
 - C.

Analysis

- 26.
 - a.
 b.
 c.
 d.
- 27.

28. Option A3 Stretch Current Capability is not a recommended option.

Option B - Refurbish

Scope

- This option is to refurbish the current AWE EU capabilities to deliver an enduring EU capability. The scope of this option is described as
 - a. Provide a facility with the capability to deliver all Enriched Uranium products and services for the Warhead Programme.
 - Deliver a Nuclear licensable storage and processing facility with civil structure meeting modern standards.
 - Deliver a modern facility in which all processes will conform to Best Practical Means (BPM) and Best Practical Environmental Option (BPEO).

Analysis



Option B Refurbish is not a recommended option

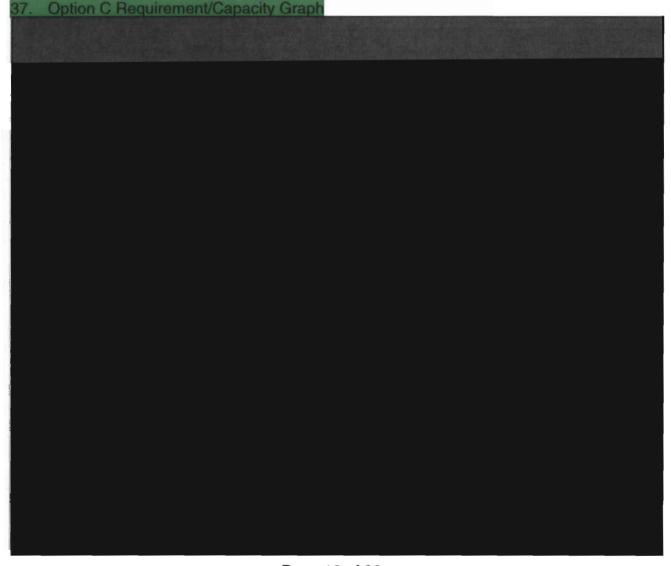
Option C. 'New Build'

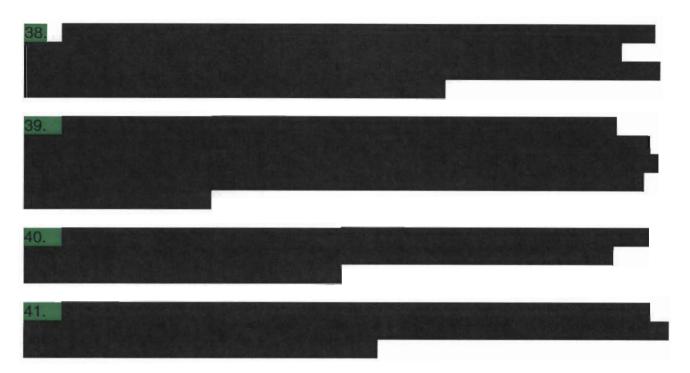
Scope

35. This option is to build a new EU facility on a brown-field site at AWE Aldermaston.

Analysis

36. This option will fully satisfy the requirements of the NW IPT SRD and hence the URD. The new facility will be designed and built to satisfy all relevant legislation and be environmentally sustainable in accordance with the MoD Sustainability Handbook. The design will also facilitate safe and efficient decommissioning when required.



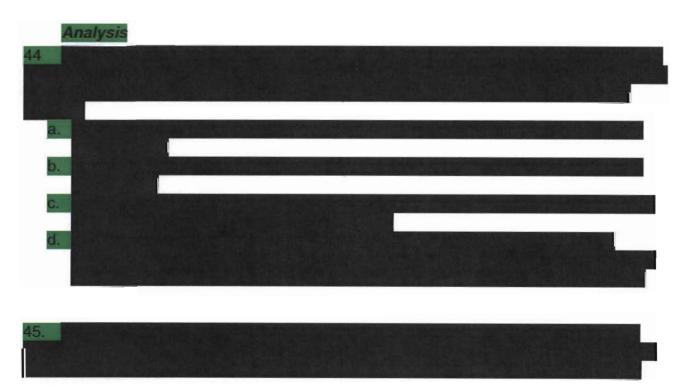


42. Option C, New Build is the recommended option.

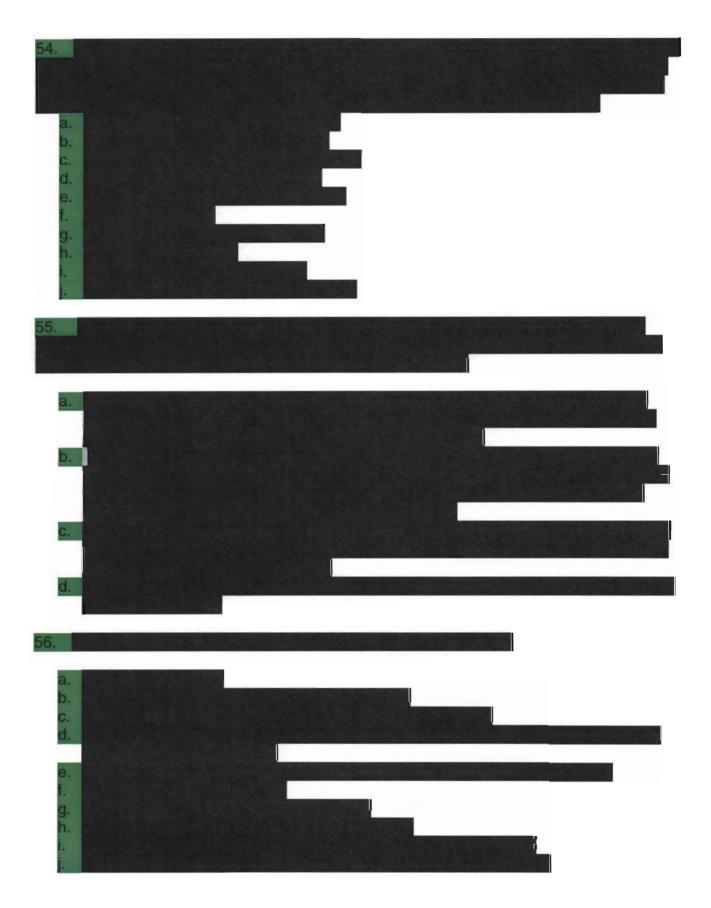
Option D. 'Procure EU products from elsewhere'.

Scope

43. This option involves the procurement of EU products by MoD from sources other than AWE. This procurement would only satisfy part of the requirements of the SRD and URD. Additional capabilities would need to be provided to satisfy the other requirements.



Option D, Procure EU products from elsewhere is not a recommended option Option E. 'Combined Capability' Scope This option involves the combination of the capability to satisfy many requirements of the SRD and URD, in one facility at AWE. Analysis 48. 51. Option E, Combine facilities is not a recommended option. Option F. Rationalise UK EU Capability Scope 52. This option would involve examining other sites within the UK and investigating the possible rationalisation of facilities on these sites to include an EU capability. Analysis



SHORTLIST OF THE OPTIONS

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- 57. A full and comprehensive analysis of the options above is provided in the Options Analysis Document ref DPA/NW/PGL/101/319/01 dated 20/11/06. This document concluded that Option C, New Build is the recommended option, however the core of this analysis is repeated in this document for completeness.
- 58. This Investment Appraisal will provide detailed costs associated with options A1, A2, A3, B and C. Confidence Modelling for Option C has been carried out and the results recorded in this document. The costs for Option D are based on the costs for Option C. An assumption has been made that the difference between these options is that a reduced manufacturing capability would be required within the facility for Option D. The cost of Option D has therefore been estimated as being 98% of the cost of Option C. However, the cost of procurement of the products inherent in Option D can only be estimated and is shown in square brackets in the table. As this results in a rough order of magnitude cost for Option D, net present value has not been calculated
- 59. Option E and F have not been costed in this Investment Appraisal. The Option Analysis document has fully explored these options and discounted them.

SUMMARY OF COSTS

60. Below is a summary of the costs associated with each option at 2006 prices and expressed as Net Present Value (NPV). A fuller breakdown of these costs is shown at Annex A. Assumptions implicit in the compilation of these costs are detailed in the Master Data Assumptions List (MDAL) at Annex E.

	EREAL @ 2006 PRICES	E NPV @3.5%
OPTION A1 - DO NOTHING		
OPTION A2 - DO NOTHING EXTRA		
OPTION A3 - STRETCH CAPABILITY		
OPTION B - FULL		
REFURBISHMENT		
OPTION C - NEW BUILD FACILITY		
OPTION D- PROCURE EU		
PRODUCTS		
OPTION E -COMBINE CAPABILITY		
OPTION F -RATIONALISE UK EU		
CAPABILITY.	N. B. L. S. L.	

WHOLE LIFE COSTS (OPTION C)

61. Whole life costs for Option C are tabulated at Annex C

OPTIMISM BIAS

62. An Optimism Bias check has been conducted by Pricing and Forecasting Group (PFG) on capital cost and schedule date estimates to In Service Date (ISD). To obtain a single deterministic figure without risk, the indicative risk allowance of within the facility build base estimate has been removed. Using responses from the NW

IPT EU project team the confidence figures pass the Optimism Bias check for both time and schedule indicating that the estimates include an appropriate provision for risk and uncertainty. It should be noted that the Optimism Bias exercise has been carried out against the Equipment Model due to the nature of the process equipment and building design. This is a more stringent assessment than the Non-Standard Building assessment model. The results generated are shown in the tables below. These costs are for the combined assessment and demonstration/manufacture stage but exclude the AWE fee

Optimism Bias check results - Cost

	Single Deterministic Figure + OB Factor	90% Confidence Value
Anticipated Business		
Case status at		
submission stage		

Optimism Bias check results - Schedule

	Single Deterministic Figure + OB Factor	90% Confidence Value
Anticipated Business Case status at	July 2016	Feb 2017
submission stage	duly 2010	1 00 2017

SENSITIVITY ANALYSIS

63. The Option Analysis Document ref DPA/NW/PGL/101/319/01 dated 20/11/06 has detailed the merits and demerits of each option and has concluded the only feasible option to be Option C. On that basis Sensitivity Analysis would not produce meaningful results and has not been carried out.

RISK

64. Risk registers have been produced by for options A, B and C, and are detailed in document ref DMP/EUP/LL/19098944 version 9.

PROCUREMENT STRATEGY

65. The IAB approved the procurement strategy for NWCSP in February 2005, this provided for the continuation of the contract with AWE Management Limited (AWEML) under a firm target cost incentive fee price (subject to maximum price), with revisions to the terms and conditions for a 3-year period to March 2008. The EU project assessment phase will be conducted under this contract within the existing price.

rangen	nents beyond	M			
	nonto beyond	March 2008.			
			Marie Town		THE REAL PROPERTY.
		This review	note has been a	pproved by the IAB and	d is
vaiting	Ministerial an	HM Treasury end	orsement.		

67. The NWCSP approval provided for the demonstration and manufacture phases of selected major projects to be separately priced within the existing contract. Post main gate approval, the EU demonstration and manufacture phase will be placed with

- 68. AWE Plc sought bids through competition from industry to support the NWCSP and selected AMEC (NNC), RWE Nukem and WS Atkins as framework suppliers for complex regulated facility projects. AMEC (NNC) was selected as the EU facility design contractor on the basis of their skills and resource profile.
- 69. Private Finance Initiative (PFI) has been rejected as the requirement cannot be delivered as a standalone project and there are no commercial synergies. As AWE PIc would remain the nuclear site licensee there would be no opportunity to transfer risk to a PFI contractor.

CONFIDENCE MODELLING OF OPTION C

70. The risks identified were applied to the project schedule and assigned to the appropriate activities. Confidence modelling was carried out using the Predict software tool. The following results were produced for the cost and schedule as affected before risk mitigation actions have been taken and post risk mitigation actions. This exercise was carried out for the Assessment phase of the project (i.e. Initial Gate to Main Gate) and for the overall project. The costs below are as recorded in the Initial Gate Business Case and include the AWE fee

Cost confidence model (Option C Assessment phase)

	10% confidence	50% confidence	90% confidence
Post mitigating action	£45,700,000	£48,000,000	£50,400,000

Schedule Confidence Model (Option C Assessment phase)

	10% confidence	50% confidence	90% confidence
Post mitigating action	Mar-2010	May-2010	Aug-2010

Cost Confidence Model (Option C Whole project)

	10% confidence	50% confidence	90% confidence
Post mitigating action			

Schedule Confidence Model (Option C Whole project)

	10% confidence	50% confidence	90% confidence	
Post mitigating action	Jan-2016	July-2016	Feb-2017	

AFFORDABILITY

71. The Assessment Phase work is funded to the end of FY 08/09. Funding until FY10/11 has been sought within the Comprehensive Spending Review (CSR) which costs are within the baseline review assumptions and affordable. It is expected that by Main Gate the overall NWCSP cost will have been funded.

PLAN FOR POST PROJECT EVALUATION

- 72. The project will be subject to a Post Project evaluation in accordance with the requirements of Appraisal and Evaluation in Central Government (Green Book). The content of the evaluation will be in accordance with JSP 507 and the Acquisition Management System.
- 73. The EU Project will present two principal opportunities for evaluation and for using the experience and understanding to improve future performance, for both the EU Project and for other NW IPT projects at AWE.
- 74. The Enriched Uranium Project is one of the first major AWE project to go through the Investment Appraisal Board Initial Gate process. As such it will help establish the key features of the process, including the interfaces between NWIPT AWE and PFG. The experience of this process will be given to other projects through the established DPA Learning from Experience (LFE) process and the AWE Review, Learn and Improve (RLI) process.
- 75. The IAB Initial Gate process will review aspects of the EU Project over and above those examined by existing AWE review processes. Any issues arising from the Initial Gate review will be analysed and appropriate actions will be taken to maintain efficient project progress. The lessons learned through the Initial Gate process will also be captured and will inform the Main Gate process in due course.
- 76. A plan for Post Project Review workshops and presentations is included at Annex D.

RECOMMENDATION

77. This Investment Appraisal supported by the evidence provided by the Option Analysis Document ref DPA/NW/PGL/101/319/01 dated 20/11/06 recommends that Option C, New Build is adopted as the solution to the continuation of the UK Enriched Uranium Capability.

SUMMARY OF COSTS

flons					
Decom. & Operation Demolish					
Capital	E REAL @ 2006 PRICES				E NPV @3.5%
		PABILITY RBISHMENT	OSS OF CAPABILITY EXTRA	RBISHMENT MUTTY RODUCTS	EXTRA PABILITY RABILITY REISHMENT
	OPTION A1 - DO NOTHING	OPTION A2 – DO NOTHING EXTRA OPTION A3 – STRETCH CAPABILITY OPTION B - FULL REFURBISHMEN OPTION C - NEW BUILD FACILITY	% breakdown % breakdown OPTION A - DO NOTHING - LOSS OF CAPABILIT OPTION A2 - DO NOTHING EXTRA OPTION A3 - STRETCH CAPABILITY	OPTION B - FILLL REFURBISHME OPTION C - NEW BUILD FACILITY OPTION D PROCURE EU PRODUCTS	OPTION A - DO NOTHING - LOSS OF CA OPTION A2 - DO NOTHING EXTRA OPTION A3 - STRETCH CAPABILITY OPTION B - FULL REFURBISHMENT OPTION C - NEW BUILD FACILITY

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HIAL

WHOLE LIFE COSTS (SUMMARY)

2016	-						
2015							
2014							
2018							
2012							
2011							
2010							
2008							
2008							
2007							
2006							
Fotal NPV)							
2000's E							
W F & D							
	ofile	ofile	ofile	ofile	ofile st likely	mnm	ofile
	Cumulative profile Option A1	Cumulative profile Option A2	Cumulative profile Option A3	Cumulative profile	Cumulative profile Option C – Most likely	Cumulative profile Option C - Minimum	Cumulative profile Option C - Maximum
	Cumulati Option A1	Cumulativ Option A2	Cumulativ Option A3	Cumulat Option B	Cumul	Cumul	Cumul

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WHOLE LIFE COSTS

(Excel spreadsheet on separate file)



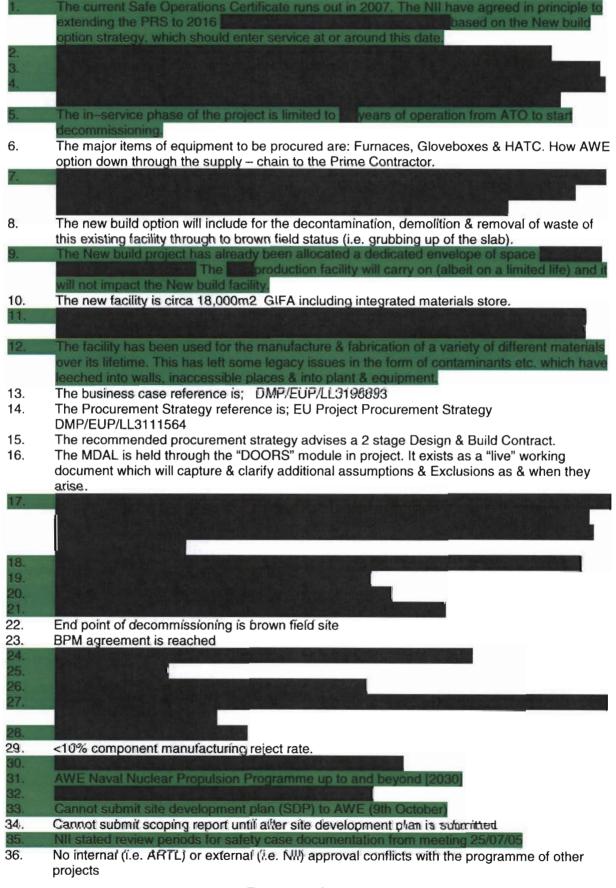
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PLAN FOR POST PROJECT EVALUATION (ASSESSMENT PHASE)

Activity							
NW IPT Workshop	June 07	Jan 08	June 08	Jan 09	June 09	Jan 10	June 10
AWE Project Team Workshop	June 07	Jan 08	June 08	Jan 09	June 09	Jan 10	June 10
Joint Stakeholder Workshop	July 07	Feb 08	July 08	Feb 09	July 09	Feb 10	July 10
AWE Review Learn and Improve	Ang 07		Aug 08		Aug 09		Aug 10
Presentation							
NW IPT Learn from Experience	Ang 07		Aug 08		Aug 09		Aug 10
Presentation							

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MASTER DATA ASSUMPTIONS LIST (MDAL)

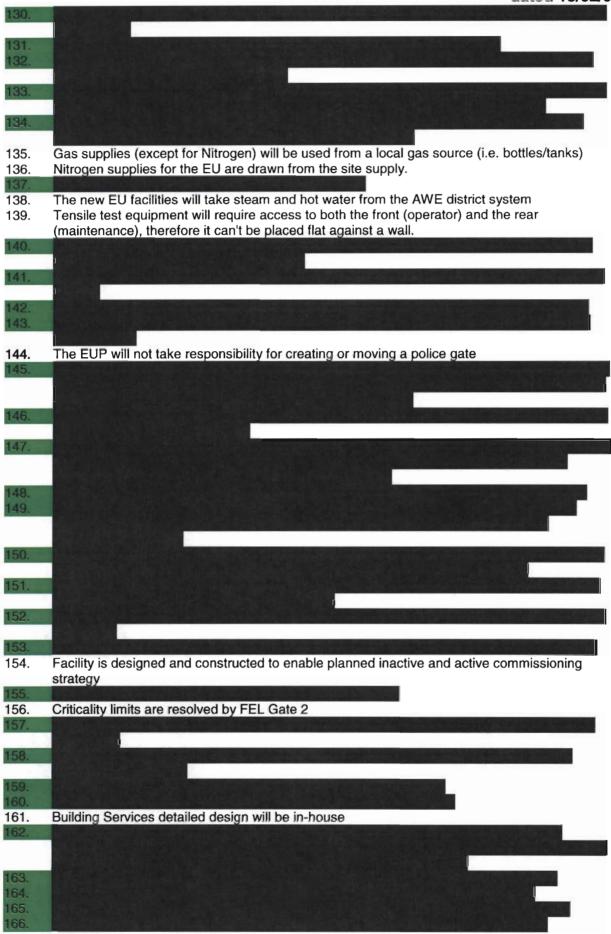


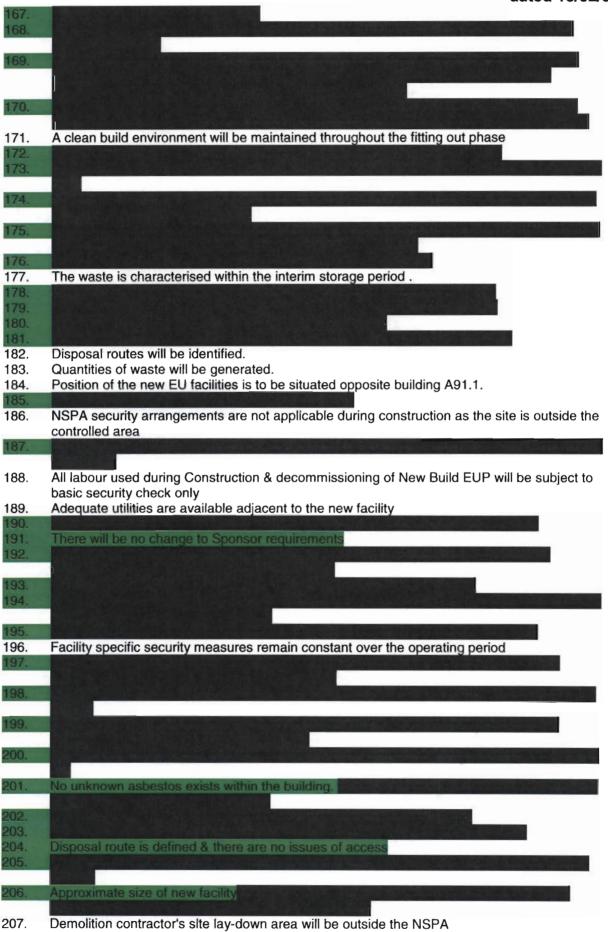
37. 38.	PRBs are held on the 2nd Tuesday of each month The building contains no residual assets & no GFE (Government Furnished Equipment)
39.	All assets are owned by AWE ML
40.	Trained & competent technicians
41.	
42.	
43.	ISO containers are assumed to be free issue & unlimited supply
44.	RAMSCAP containers are assumed to be free issue
45. 46.	
47.	Labour resource remains available throughout project duration and can flex up or down (+/-
	100%) as requirements change
48.	
49.	Regulatory requirements & discharge limits remain constant over the period
50.	Information Sources include: EUP ROM Estimate 16/3/05 - DMP/EUP/LL3105423
51.	
52.	
53.	NSPA perimeter fence access remains same over project operating life
54.	VAT is excluded from all cost modelling assumptions
55.	Energy and utilities costs associated with D&D are included within the D&D figures
56.	There is no cashflow restraint on LTC (Long Term Costs)
57.	Overhead calculation on AWE does not alter over the Whole project lifecycle period
58.	Funding continuity is provided post-submission to support MoD during IAB approval process
59.	POCO resource requirements estimated at process of current levels, facilities costs terminate at
60.	commencement of POCO All facility staff will be reassigned duties elsewhere on site; no redundancy or retraining costs
00.	are included
61.	Funding is consistent with project estimates and programme
62.	No business rates are payable whilst decommissioning
63.	Sunk costs prior to December 2006 are excluded
64.	Clean waste / spoil (building material) & removed topsoil has no residual value
65.	NPV Discount Rate = 3.5% per annum (Treasury Green Book)
66.	Construction working hours are 45 hours (5 days at 9 hours)
67. 68.	Minimal delay in site access routines (workers and deliveries)
00.	Works areas security classification suitable for workers security clearance (aiming for lowest level requirement for construction staff)
69.	On and off site logistics provisions available in time to support construction programmes.
00.	This will include
	- Day and night accommodation
	- Parking (on and off site)
	- Park and ride
	- clearly defined access routes and procedures
	- supply chain (plant & materials)
70.	Cost base date 1Q2006 price levels
71. 72.	Working week is 40 hours
50000	
73.	No indexation or escalation costs have been applied to costs during the WLC estimate period
74.	Department of the last of the
75.	In the event that Option A is selected knowledge / capability may be lost to AWE resulting in
76.	difficulties re-entering the market at a later date and high re-entry costs All insurances are excluded from the scope of this assessment
76. 77.	The WLC includes decommissioning costs
78.	Assume new build facility and store are designed for ease of decommissioning
79.	No severance is payable at the completion of the project
80.	Facilities staff can be redeployed elsewhere during redevelopment of area
81.	Allowances have been included for decommissioning labour
82.	Basis of Calculation of Support Services Operating Costs: For human resources a working

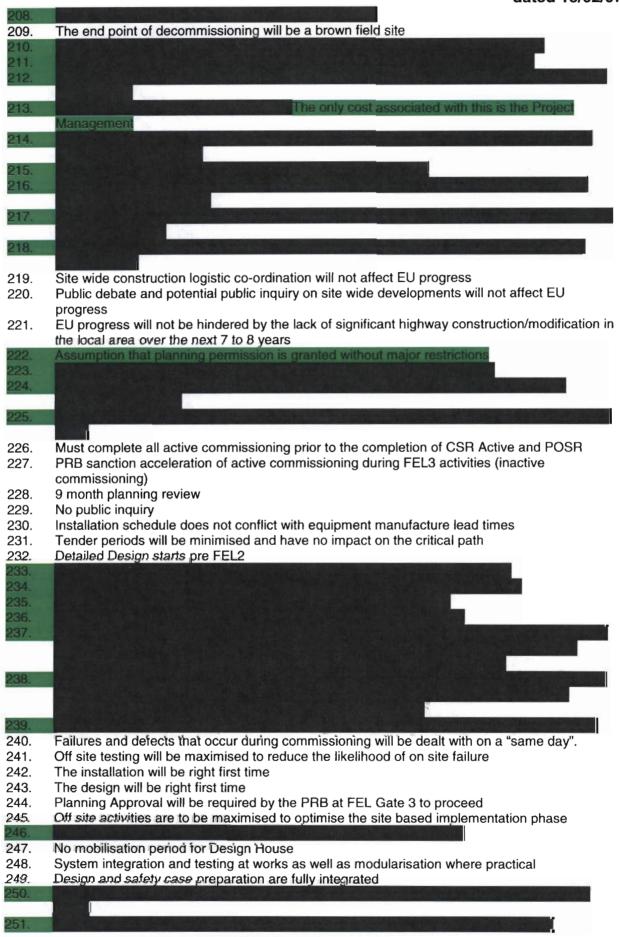
ANNEX E to DPA/NW/PGL/101/319/01/IA dated 13/02/07

year has been taken as 1700 hours net of holidays and sickness. The rates provided are inclusive of all on-costs.

	inclusive of all on-costs.
83.	
84.	In the Whole Life Cost models capital costs that are programmed over several years are evenly spread taking no account of estimated S-curve - refer to project specific cashflow forecasts
85.	There will be a minimum level of Project PM support during the store clean out phase (2 men per year)
86.	WLC models exclude sunk costs
87.	Excludes disposal on - costs (DRIGG etc.)
88.	There are no technology spin - offs from the project
89.	Once facility is re-built, the original store will require demolition
90.	New build option at existing location will be seismically qualified
91.	Site Security accept the re-build option on its existing plot with no caveats or constraints imposed
92.	The new facility will adopt the current packaging.
93. 94. 95.	
96.	Provide Waste Management System (WMGT)
97.	The data available for feedstock will be correct.
98.	Major maintenance will be performed from outside the facility
99.	Maintenance equipment will be provided by Operations.
100.	Assumption that the WDA will set/determine the types of trials required in the new facility during commissioning
101. 102.	
103.	Cost of any project team accommodation move will be borne by directorate
104.	Sponsor requirements are complete and we will design accordingly
105.	New facility will be accommodated in a single building (the accommodation block may be linked)
106.	C&I standard systems will be the norm
107.	Do Nothing - assumes closure imminently - includes decommissioning costs
108.	The furnace in the new facility will require 415 volts maximum
109.	Uranium strategy will provide evacuation centre and route, not the EU project
110.	Accommodation and related infrastructure for contractors will not be provided by EUP
111.	Assumption that we can design 'safe by shape'
112.	Simulation model will define material movements required
113.	Buy in to new technology will be obtained providing it is ALARP
114. 115. 116.	
117.	EUP will fund recruitment for new facility
118.	Facility will be designed for technician level staff
119.	Emergency control point(s) are part of EUP
120.	Phased delivery of assets
121.	An ring fenced (island) site will be used for construction
122.	An EIA is required
123. 124.	IAB approval is not subject to successful planning application
125.	
126.	
127.	
128.	All charge material will be appropriately sized to fit the crucible (separate campaign for size
120.	reduction)









300.	Excludes Soft facilities management (Incl. HR/Records/Reports/Meetings/Auxiliary)
301.	Excludes Grounds Maintenance
302.	Excludes Security
303.	Excludes Transport (Incl. Park & Ride)
304.	Excludes Car Parking
305.	Excludes cost of manufacturing operations over the lifecycle [operations costs include only the
	'support services' costs associated with the building)
306.	Excludes Catering
307.	No royalties are payable or included for transfer of technologies
308.	Excludes Portering
309.	Excludes Laundry
310.	Excludes Telecom's
311.	Excludes Waste management/disposal
312.	Excludes Assurance .