

**SUBMARINE DISMANTLING PROJECT
Independent Peer Review Report**

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1. Introduction

This document is the Independent Peer Review report on the Submarine Dismantling Project (SDP) – MoD Proposed Option Study (MPOS). It comprises the findings of the Independent Peer Reviewer (IPR) in their role as Observer at the Senior Officers' / Assurors' Conference held on the 16th June 2010 at the Holiday Inn hotel, Filton, Bristol UK. These findings are made with reference to the notes of the conference (dated 13th July 2010) and the MoD preferred Options Study Methodology Statement (FNC 36995/63422V Issue 2, dated April 2010).

2. Declaration

The information contained in this report represents the opinions and perceptions of the author, based on their experience and expertise in the field, and are not those of any organisation by which they might be otherwise gainfully employed or could be deemed to represent.

3. Summary of the process followed and documentation

The process ran almost entirely to plan without overruns or shortfalls enabling the tasks to be completed. Unfortunately, despite a significant delay between the Technical Options Study and the Desk Officers' Workshop, the latter went ahead at short notice in the event and the IPR was unable to attend due to a prior engagement. Whilst this was not ideal, it was the correct way forward given that further delays to attempt to ensure the attendance of everyone would have exacerbated the slippage. Since the criteria themselves were adopted from the Technical Options Study the IPR felt comfortable with this. The only other unforeseen outcome arising from the two-stage process from the IPR's point of view was from the Senior Officers' / Assurors' Conference associated with:

- The emphasis on further development of Options 1 & 2 to demonstrate with sufficient rigour that these can be parked within formal analysis,
- Concern about the clear result, especially with regard to sensitivities within the cost model.

However, both recommendations are sensible and will add value to the process.

3.1 Review of the Methodology Statement (FNC36995/63422V Issue 2)

The Methodology Statement is extremely clear and transparent, describing the two stages comprising the process: an MoD Preferred Options Study (MPOS) Workshop that followed a Multi Criteria Decision Analysis (MCDA) approach, which was followed by an MPOS conference of MoD senior staff to challenge and ratify the outputs of the Workshop combined with the investment appraisal work (provided by Deloitte).

On a small point in relation to the Methodology Statement, the concept of diagrams to illustrate the process as given in Annex A is sound but these could

have been more informative. Any attempt to illustrate the process for the purpose of the public consultation in a similar way will benefit from clearer schematics/flow charts.

3.2 Review of the Briefing Pack (FNC36995/63581V)

The briefing pack was clear and succinct, summarising the process to date and the respective roles and expectations of attendees. It is interesting to note that of the 14 criteria, 'technical challenges' is perhaps the most amorphous including within it conventional safety issues and concerns that would not necessarily result in regulator non-compliance but nonetheless harbour the potential to complicate the option under scrutiny. This is further corroborated by the findings summarised in the Technical Options Analysis paper, in that these two criteria (*technical challenges* and *regulatory compliance*) are two of the five major contributing criteria. In the unlikely event that further analysis (as recommended) should uncover significant unforeseen risks associated with either or both of these criteria (thereby potentially throwing open the options open to challenge once again), option 3 still has the dividend that keeping the dismantling activity to one site prevents these issues being exacerbated by movements between sites and transports.

4. Findings of the IPR

4.1 Decommissioning experience in the civil nuclear industry

Reference was made during the conference that SDP options 1 and 2 present heavy technical challenges in terms of transport and the interim storage of the cut-out vessel or dismantled internals. The specific comment was made that the nuclear industry has 'done it all' in the context of Option 3. This is perhaps a slight over-simplification in the opinion of the IPR: whilst the decommissioning of nuclear reactors is widely regarded with some foundation as being much simpler than the high-hazard decommissioning challenges at Sellafield, the focus of the UK nuclear industry in reactor terms has been almost exclusively on Magnox designs excepting some small research reactors and prototypes. None possess an RPV of the same type as a small submarine vessel. Further, the civil nuclear industry has not tackled the decommissioning of any of the larger scale (Magnox) plant due to the benefits that accrue from waiting for radioactivity with intermediate half-life to decay away; indeed it is in the realms of the research reactor and the prototype precursors to the civil fleet that the majority of the success in decommissioning to date has been achieved, such as Jason (Greenwich) and the Prototype AGR at Windscale.

Thus, whilst Option 3 should not present challenges in general mechanical engineering terms, it is an oversimplification to state that the nuclear industry has done it all; the key challenges in the civil nuclear industry tend to be associated with plant that were left in an unplanned state as a result of accident or those for which their history is incomplete. This is in stark contrast with most, if not all, submarines awaiting dismantling. The culture of some of the

organisations working on these tasks may be slightly at odds with the requisite 'can do' attitude essential to the SDP because of this. *Hence, caution should be exercised in drawing conclusions from the decommissioning of civil plant and applying them to SDP: civil plant are of a different scale and often left in an undesirable state compared to laid-up submarines.*

4.2 Managing worker dose on the basis of prior experience

Option 3 was discussed as having the significant benefit that it offers the most flexibility in terms of interim storage locations, which is not in doubt. However, the issue of *worker dose* was raised which was a welcome response of the conference since there was a tendency in the preceding options study for discussion to dwell on dose *to the public* with much less emphasis on the dose *accrued by employees* when the probability of acute exposures through, for example, accidental damage to PPE is more significant albeit still small. Worker dose was assigned a low weighting as a discriminator in the Technical Options Study, which is fair given the experience and attention to detail that is customary in the nuclear sector associated with similar operations, in pursuit of the ALARP principle. However, greater insight might be gained from a study of the many 'cut-up' decommissioning projects that have been completed in the UK, predominantly at Sellafield but also at Harwell, Dounreay and Winfrith. This should be in terms of the *dose accrued* bearing in mind that these will represent worst-case scenarios in terms of the likely contamination in a submarine circuit.

During the construction and commissioning of Sizewell B, an operational dose limit was set that was considered a challenge for the whole sector at the time. This focussed the minds of constructors to be particularly rigorous with waste arisings entering the system prior to operation when clean that might otherwise contribute to the dose burden once the reactor was operational. A similar ethos is indicated in the reference to the MoD's through life management plan. *Continued emphasis on collective dose accrual targets that are challenging for the sector established prior to work commencing will focus minds and imbue a world-class radiation safety culture from the start.*

4.3 International comparisons and the importance of extenuating circumstances

The issue was raised by senior members of the conference as to the likely political and public concern if Option 3 was adopted, given that the US have adopted Option 1. This is recorded in the notes from the conference under bullet 8. The IPR is pleased that this was raised because the detail supporting this choice may not be immediately obvious to HMG or the public, in the context of the significant extenuating issues of *intergenerational equity*, and the *ease of storage of reactor hulls in the US* as compared to the UK due to the large area of land available. It is essential that this is stated with sufficient clarity in any public consultation that recommends Option 3. There is plenty (in a relative sense) of information in the public domain as to how the US disposes of its old

submarine reactors, but relatively little (other than the ISOLUS documentation) on the important supporting issues of relevance to the UK project.

A related issue that could arise is the concept that Option 1 might present a similar degree of flexibility in terms of site to the other two options. There is however a significant distinction given this scenario refers to the movement of a 7000 tonne vessel, especially in terms of conventional safety and the use of cranes that may need greater emphasis. Further, some nations are now considering the other options having primarily opted for 'cut-out' whilst some are heavily constrained by cost, which has ruled out Option 3 in their case. *The merit of Option 3 with regard to these apparently conflicting issues will benefit from a carefully balanced description of each in any consultation papers.*

4.4 Conventional safety issues

It is very likely that Option 3 will achieve submarine dismantling with the least risk in terms of conventional safety, largely because of the inherent conventional risks associated with the movement of heavy items with Options 1 & 2, and the rapid migration of the task in Option 3 from a construction/crane-based activity to radioactive waste treatment and immobilisation. Thus, given the nuclear industry's understandable pre-occupation with dose limitation, often considered almost in deference to conventional safety hazards, Option 3 is likely to be the safest option of the three ranked in the options study exercise.

However, the flavour of the project discussions at the conference, as was also the case for those at the ISOLUS Technical Options study, still appeared to err on the side of caution in terms of *radiation dose* relative to *conventional safety* despite the former being ranked low as a discriminator. This is in stark contrast to widespread perceptions of the safety culture in the nuclear sector today, in which more lost-time accidents arise and result in harm to workers due to conventional hazards than as a result of radiation exposure. Worker dose is very likely to be 'acceptably low' in submarine decommissioning, as there is no intrinsic source of penetrating radioactivity other than the activation of the vessel (excepting unforeseen residues given the fuel has been removed and the circuits are cleaned of CRUD). For similar reasons internal exposure ought to be minimal also, given there is minimal alpha/beta residue at risk of being acquired by workers. Conversely, there are significant conventional safety hazards, such as asbestos removal and treatment, and the use of cranes; both of these examples are known to be high risk, not to mention work required by personnel in confined spaces. It should be borne in mind that most if not all deaths resulting in the UK nuclear power and decommissioning industry over the last 30 years have been the result of conventional safety issues, such as falls from height. The conference appears to have glossed over the issue of conventional safety risks but implicitly requires exacting standards: the death resulting from a fall from height on a 'cut-up' decommissioning task at Windscale stopped the project for 3 years at enormous cost to the programme.

Whilst a similar issue is unlikely to arise on the SDP the conventional hazards will only become truly apparent when a detailed plan is drawn up. *Conventional safety risks should be given higher profile at the planning stage than has been the case thus far.*

5. Summary of recommendations

- 5.1 The justification between cutting up and cutting out, given international differences with UK policy, may require further work to be done to convince strategists and the public: this is acknowledged in the later section of the notes from the conference but also it is acknowledged that there are too many options for all of them to be developed fully. *The merit of Option 3 with regard to these apparently conflicting issues will benefit from a carefully-balanced and informative description of each issue in any consultation papers.*
- 5.2 *Continued emphasis on collective dose accrual targets that are challenging for the sector and established prior to work commencing will focus minds and imbue a world-class radiation safety culture from the start.*
- 5.3 *Caution should be exercised in drawing conclusions from the decommissioning of civil plant and applying them to SDP: civil plant are of a different scale and often left in an undesirable state compared to laid-up submarines.*
- 5.4 In addition to the testing of assumptions that was strongly recommended at the end of the conference (see bullet 33 in the note from the conference for example), a process plan for Option 3 that draws out preliminary risk assessments and highlights the trade-off between radiation safety and conventional safety issues would be beneficial. This is standard practice to determine which approach is ALARP, but has not been addressed as yet in the process going forward. This can be brushed aside as 'standard engineering practice'; nonetheless people and organisations still get it wrong. *Conventional safety risks should be given higher profile at the planning stage than has been the case thus far.*

In conclusion, the IPR agrees that the level of challenge during the conference was of a good standard, as the Chairman of the SDP Advisory Group (AG) pointed out. The IPR felt that the debate had moved on significantly in terms of the buy-in of the AG as a result of this conference.