PROJECT ISOLUS

THE INTERIM STORAGE OF LAID-UP SUBMARINES

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ABSTRACT

Radioactive waste is a consequence of operating nuclear powered submarines and is something that the MoD has to deal with. A project has been created to define, develop and procure a safe and acceptable method for the interim storage of Intermediate Level Waste arising from decommissioned submarines.

The delayed availability of the national radioactive waste facility has had a significant effect on the MoD's intentions for the storage of decommissioned nuclear submarines. The current policy of afloat storage brings problems such as shortage of suitable moorings, rising costs and adverse public perception. Alternative storage options have been assessed. The land storage of reactor compartments will be used as a comparitor in order to benchmark future proposals. The MoD is receptive to all realistic options and has approached industry to encourage innovative approaches to land storage.

Engaging the public in a full and open consultation process will influence how the project is taken forward. The Ministry will investigate and compare practicable and viable options from all sources, before recommending a way forward.

The ISOLUS team presented an update on this project at an International Conference in October 2001. The new paper details how the industry and commercial aspects are to be developed and how the results and recommendations from the front-end consultation process will be incorporated in the future stages of Project ISOLUS.

Introduction

For nearly forty years, the UK has successfully constructed, maintained and operated nuclear powered submarines safely. Of the 27 nuclear submarines commissioned since 1963, 16 vessels are currently in service and 11 submarines have been withdrawn from active duty. Radioactive waste is a consequence of having nuclear powered submarines and is something that the MoD has to deal with. With the abandonment of sea-dumping for the disposal of Intermediate Level Waste (ILW), the MoD policy for decommissioned nuclear submarines[1] has been based upon a prolonged period of afloat storage, prior to final disposal of the ILW in a national waste facility.

Whilst the current storage method is accepted as being safe, a recent study has identified a number of constraints that will affect the viability of continued afloat storage. The study considered a number of options but recommended that the MoD move towards land storage for the long term. Ministerial approval has been granted to further explore the land storage options. The project created to progress this long-term strategy is titled the Interim Storage of Laid Up Submarines (ISOLUS).

1 In the context of this article, decommissioning occurs at the end of the submarine's effective service life. All of the highly active fissile material is extracted from the reactor, some of the reusable equipment is removed and the boat structure and systems are prepared for a sustained period of afloat storage known as 'Lay Up'. The whole process is referred to as De-fuel, De-equip and Lay-up Preparation (DDLP).

This article describes the current policy for decommissioning submarines, explains the reasoning behind the MoD's decision to move towards a land storage methodology and highlights the areas that must be addressed in order to implement safely a new strategy for the interim storage of laid up submarines.

Decommissioned submarines

Nuclear powered submarines are constructed from thick high quality steel and have a displacement of between 4,000 and 7,500 tonnes and a length of between 90 and 130 metres. In the centre of the submarine is the unmanned Reactor Compartment. This compartment contains the radioactive elements of the reactor plant which are surrounded by heavy shielding and a substantial containment structure (FIG.1).

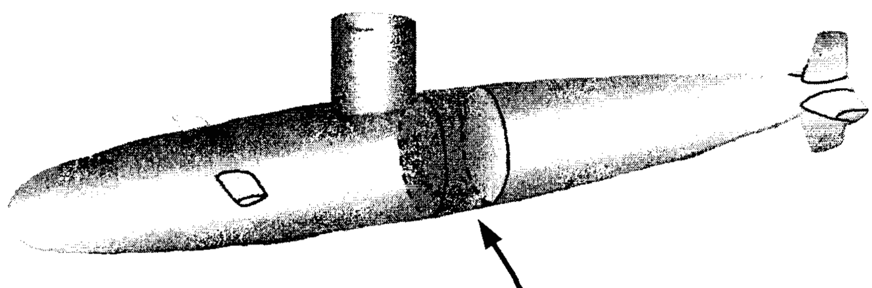

FIG.1 – TYPICAL NUCLEAR SUBMARINE WITH REACTOR COMPARTMENT IDENTIFIED

Nuclear Steam Raising Plant (NSRP)

Royal Naval submarines are powered by a Pressurised Water Reactor (PWR). The plant consists of a primary and secondary circuit (Fig.2). Designed to contain the radioactivity, the principal components of the closed loop primary circuit are:

- The reactor pressure vessel.
- Main coolant pumps.
- A pressuring vessel.
- 2 steam generators.

The heat generated in the core is removed by pumping the primary coolant through the steam generators, which act as heat exchangers and create the steam to power the propulsion and electrical generation turbines of the secondary circuit.

The components that constitute long-lived ILW within the reactor pressure vessel are the steel core barrel (used to support the nuclear fuel elements) and the steel thermal shields. A primary shield tank surrounds the pressure vessel and acts as a biological shield and support structure.

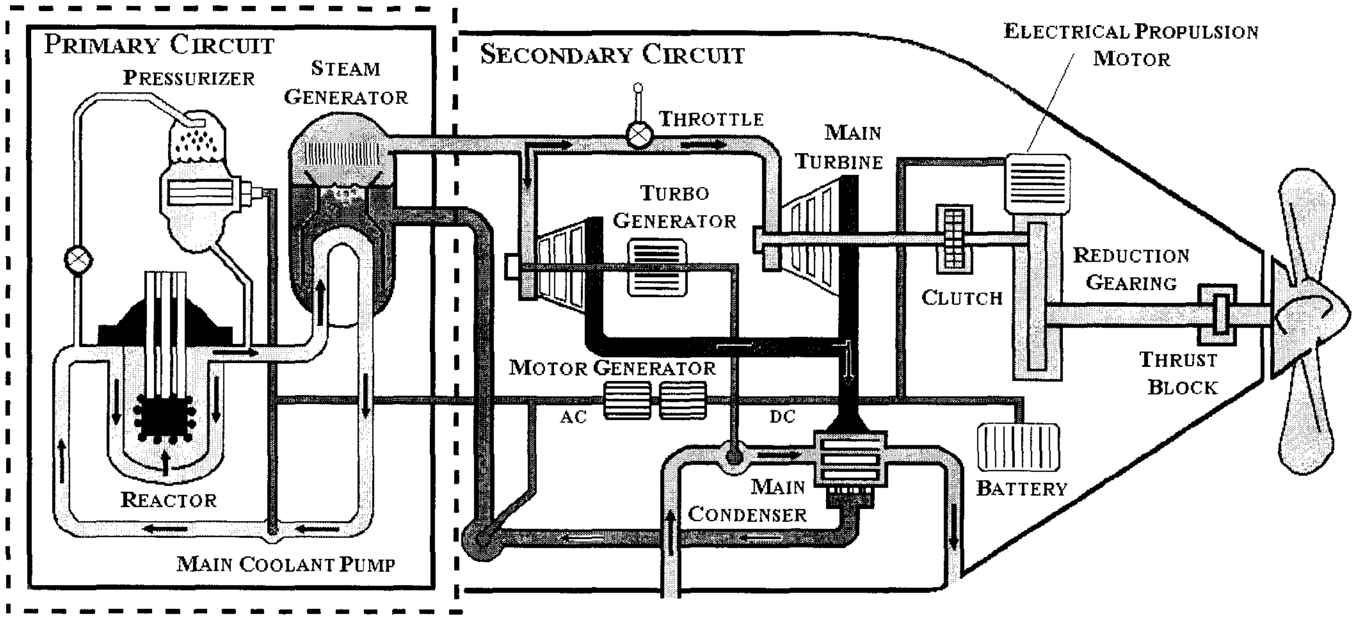

FIG.2 – NUCLEAR PROPULSION SYSTEM

Current storage method

Since HMS *Dreadnought* left service in 1982, decommissioned submarines have been stored afloat at Rosyth and Devonport dockyards. This method presents no hazard to either the workforce or the general public as the radioactivity is contained by the inherent design of the reactor plant, robust shielding and the pressure hull. In a report commissioned for Dunfermline District and Fife Regional Councils (reference.1), it was stated that the external radiation dose to the general public from the presence of the decommissioned submarines is so small that it is not measurable.[2]

Of the 11 submarines that have already been withdrawn from service, 7 are berthed in Rosyth and 4 are berthed at Devonport. Ten of these submarines have undergone the Defuel, De-equip and Lay up Preparation (DDLP) (FIG.3) and the remaining submarine is waiting to be de-fuelled in 2002.

Based upon a storage period of 30 years prior to final disposal, interim afloat storage offers a number of advantages:

- Low start up expenditure.
- Low maintenance costs over the first 30 years.
- Radioactivity continues to decay naturally over this period.

The pressure hull is protected from corrosion by a combination of paint and a cathodic protection system. It would take hundreds of years for the hull to corrode through,[3] but in order to guarantee containment well in excess of the envisaged storage period. A maintenance regime is followed, consisting of:

- Daily external inspections.
- Annual maintenance.
- Five yearly preservation periods.
- Dockings every 10 years.
- Extended docking periods every 30 years.

This is a safe method of storing decommissioned submarines, however there are several factors that are beginning to impinge upon the continued viability of this option:

- The afloat storage space at Devonport is finite. With the number of decommissioned vessels set to increase, it is estimated that the storage capacity will be reached by 2012.
- The Dockyard Sale Agreement precludes berthing submarines that have not undertaken the DDLP at Rosyth. As nuclear refitting work is scheduled to cease at Rosyth, all future de-fuelling work will occur at Devonport.
- The doubts concerning the availability of a national facility for radioactive waste would require the afloat storage period to be extended well beyond the originally assumed period of 30 years. This would result in increased maintenance costs.

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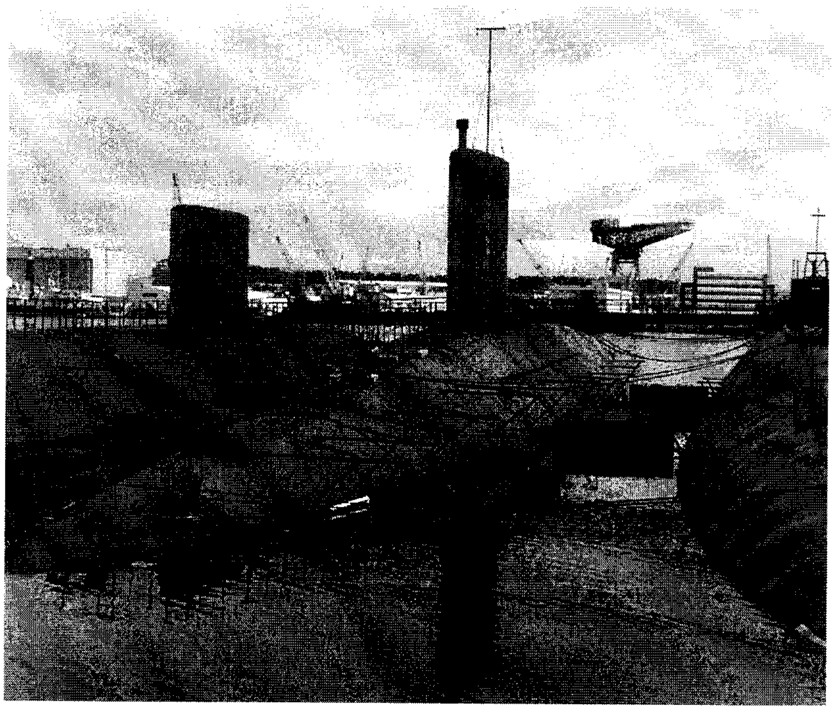
2 Edinburgh Radiation Consultants continue to monitor the radiation levels around Rosyth dockyard on behalf of the Local Authorities.

3 Maintenance of the correct paint scheme and cathodic protection system ensures that there is no detectable thinning of the pressure hulls. The worse case corrosion rate for bare unprotected B quality steel in sea water is estimated to be 0.15 mm/year (reference.2).



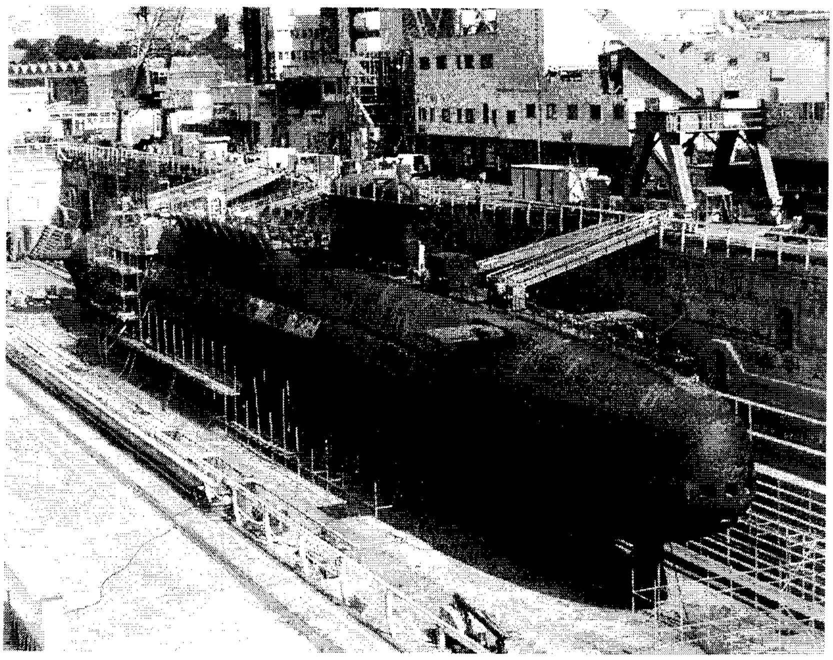


FIG.3 – DECOMMISSIONED SUBMARINES – STORAGE AFLOAT AND UNDERGOING THE DDLP

- The visual impact of the laid-up submarines berthed alongside for a number of years has contributed to a public perception that no action is being taken to deal with this legacy. The MoD was criticized by the Radioactive Waste Management Advisory Committee (RWMAC) for the public perception that 'no policy' existed for the decommissioning of submarines. The RWMAC recommended that a clear policy should be established and publicised (reference.3).

THE WAY FORWARD

Phases of Project ISOLUS

The aim of Project ISOLUS is to define, develop and procure a safe and publicly acceptable method for the interim storage of ILW arising from decommissioned submarines. Project ISOLUS consists of five phases:

(*a*) Concept Phase.

(*b*) Consultation Strategy.

(*c*) Feasibility Phase.

(*d*) Procurement Phase.

(*e*) Implementation and Contract Management Phase.

Concept phase

Recognizing the constraints upon a prolonged afloat storage policy, the Concept Phase of Project ISOLUS undertook a study (reference.4) into alternative storage methods. The study did not select a chosen solution, but investigated and compared practicable and technically viable options as a basis for recommending the way forward.

Continued afloat storage

To continue with the afloat storage of laid-up submarines, two options were considered. Whilst offering a solution to the immediate problem of berthing space, neither option resolves the other difficulties associated with long term afloat storage.

1. Alternative sites for afloat storage

   Using a set of generic criteria, alternative locations were considered for storage berths.

2. Cropped Hulls

   Reducing the size of the vessel to the minimum required to maintain buoyancy would extend the capacity of the existing afloat storage area. However, the cost of 'cropping' is significant, there would be little saving in maintenance costs, and space would only be available until approximately 2050.

Land storage

The land storage options would involve recycling the non-radioactive hull and structure. This demonstrates a positive intent to resolve the problem of a build up of decommissioned submarines but would result in varying degrees of radiation exposure to the workforce. The options are technically feasible but would need to satisfy the As Low As Reasonably Practicable (ALARP) principle.

(*a*) Storage of Separated Reactor Compartments

With the fuel removed, the reactor compartment can be cut out of the submarine and stored on land and the remainder of the vessel scrapped. The system pipes and cables that protrude through the reactor compartment bulkheads would be monitored and sealed. A steel canning plate of appropriate grade and thickness could be welded to the ends of the compartment, thus ensuring that containment is maintained. This method would provide a safe, passive and robust method for storing the radioactive waste. It would significantly reduce maintenance costs, could be easily monitored and retain the flexibility to adapt to alternative disposal initiatives in the future.

(*b*) Storage of Reactor Plant components as unpackaged waste

Following an aggressive decontamination process of the primary circuit, the entire submarine could be cut up. Components classified as ILW (e.g. the reactor pressure vessel and primary shield tank) would be stored as unpackaged waste in a suitable facility. The remaining structure and components would be disposed of as either Low Level Waste (LLW) or free release.

(*c*) Storage of ILW packaged ready for disposal

Alternatively, ILW could be packaged within containers, which would then be stored pending a suitable permanent facility. Packaging of the waste at this stage limits the opportunities to adapt this process to new technology or future initiatives.

Waste management

When the Ministry adopted afloat storage, a Deep Waste Repository was predicted to be available by 2012. It is now envisaged that a waste management facility will be delayed until at least 2040 –2050; this will have a significant impact upon the viability of afloat storage. The new policy for the storage of decommissioned submarines must be capable of adapting to an extended or potentially indefinite storage period, without an adverse impact on cost, available space or public perception. In line with the conclusions of the House of Lords Select Committee (reference.5), future strategy would require the resources for a storage period of at least 50 years.

Comparisons of costs

Comparing the relative costs for afloat and land storage, reveals that the land option becomes more economically viable after approximately 30 years (FIG.4). Lower running costs in the longer term offset the capital investment required for a land store facility and the processing of the backlog of hulls. Although afloat storage is cheaper and easier to implement, the maintenance cost predominates as the storage period increases past 30 years and the number of hulls grows. With several submarines scheduled for decommissioning over the next 10 years, early implementation of a land storage option could save the costs of their afloat lay-up preparations and maintenance docking.

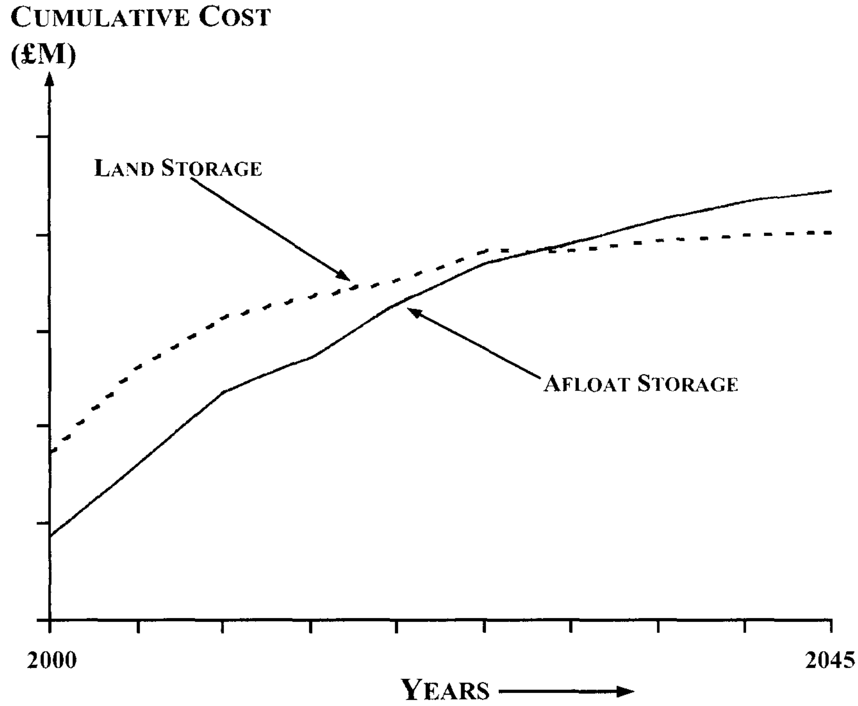


Fig.4 – COST COMPARISON FOR AFLOAT AND LAND STORAGE

Optimum Period Storage

The estimates for the amount of radioactive waste at the 30-year point show substantial reductions in the activity of waste requiring disposal. The decay of short-lived ILW causes the activity of the decommissioned NSRP to decrease significantly over the first decade[4] (FIG.5). As activity levels will continue to decrease for a number of years after the 30-year point, a prolonged storage period would reduce both the costs and the dose burden at final disposal.

Extending the storage period of decommissioned submarines from 30 to 60 years would result in further gains:

- The whole of the reactor pressure vessel (including the steel cladding) could be disposed of as LLW.
- Reduced quantity of ILW.
- The disposal dose burden would be reduced by a factor of 10.

Whilst extending the interim storage time is initially beneficial, eventually there is little to be gained unless the storage were to be continued for so long that it might effectively be regarded as indefinite. Using standard decay calculations and an assessment of the radioactive inventory for a decommissioned submarine (a year after the final shutdown), it is estimated that the optimum storage period for

4 For the first 100 years the dominant radionuclides are Fe55 ($t_{1/2}$ - 2.7 yrs), Co60 ($t_{1/2}$ - 5.3 yrs) and Ni63 ($t_{1/2}$ - 100 yrs). Between 100 and 1,000 years Ni63 becomes dominant. After 1,000 years the dominant radionuclide is Ni59 ($t_{1/2}$ - 76 000 yrs).

decommissioned submarines (which have not undertaken a decontamination process) is approximately 60 years.

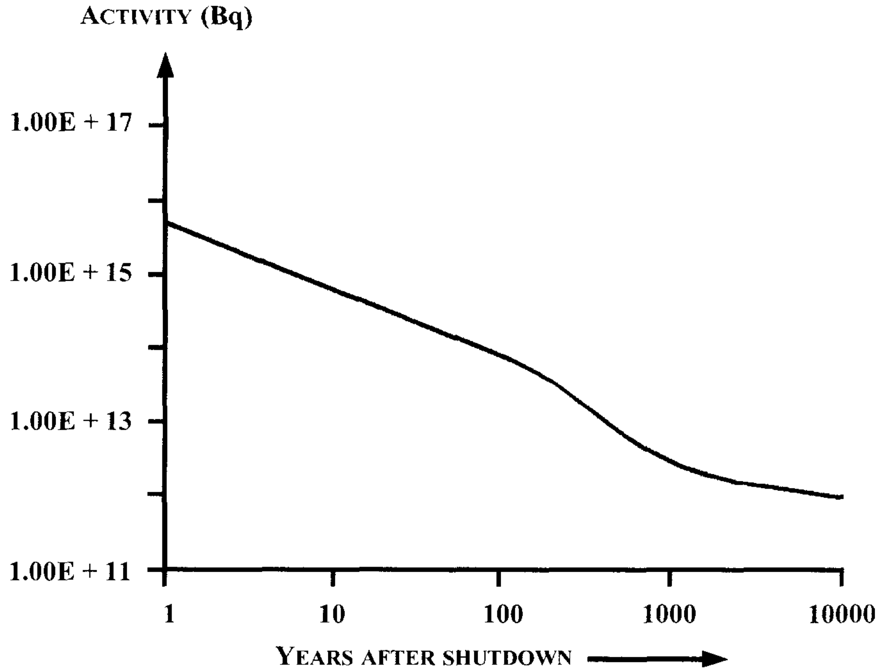


FIG.5 – PLANT ACTIVITY DECAY

Concept Phase recommendations

Using a weighting analysis based on price/cost, environmental, social/political and technical parameters to select an option for more detailed analysis as a comparitor, the Concept Phase recommended that:

- Future storage policies should not be reliant upon the availability of a national facility and should be capable of adapting to indefinite storage.
- The optimum storage period is approximately 60 years.
- Land storage of separated reactor compartments was the best option for use as a comparitor.

Accordingly, land storage of separated reactor compartments has been adopted by the Ministry as the basis for comparison and bench marking of future proposals. The MoD has not selected a solution and remains open minded to all proposals.

USA experience

The USA disposes of separated submarine reactor compartments at a land burial site in Hanford Reservation, Washington State. Having successfully prepared transported and disposed of over 70 reactor compartments from submarines and ships, the US process has demonstrated that the separation of reactor compartments is technically viable and environmentally acceptable.

The UK policy will differ from the method used in the USA. Whilst the Hanford Reservation is the final disposal site for the radioactive waste arising from US submarines, Project ISOLUS is focused on the storage of the ILW prior to disposal at a national waste facility.

Consultation strategy

The issue of submarine disposal will be of concern to a broad spectrum of interested parties. As part of the 'Open Government' policy, a full consultation process will significantly influence how Project ISOLUS is taken forward. The initial stages of the Consultation Strategy will engage the public and show how their views will be taken into account. In conjunction with independent organizations experienced in consultation techniques, the Ministry is exploring the use of a Citizens Panel, Focus Groups and Stakeholders meetings to identify both national and local opinion. The later stages of Project ISOLUS will involve public consultation on the short-list of proposals and again, in finally choosing the actual storage method. Balancing constraints of time and resource with the desire to involve a wide and diverse range of people will require considerable planning and co-ordination.

Some of the consultation work already undertaken includes:

Ministerial Briefing

Accepting the recommendations from the Concept Phase, a Ministerial briefing in May 2000 outlined the MoD's recognition that land storage of ILW arising from decommissioned submarines offered a favourable solution in the long term. Presentations were made to Non Government Organisations (NGOs) (including pressure groups), the media and Other Government Departments (OGDs).

Inviting Public Comments on Afloat Storage

Public comment upon the new policy is welcomed and encouraged. Copies of the ministerial presentation and a declassified version of the ISOLUS Concept Phase report are available to the public. Using the MoD website, people are welcome to e-mail their enquires or questions.[5]

Register of Comments

Comments have been received from a variety of sources, ranging from pressure groups and Local Authorities, to members of the public. A record of these comments and questions will be retained to inform the future decision making process.

Stakeholder Meetings

An initial stakeholders meeting has been held with representatives from OGDs such as the Department of Environment, Transport and Regions (DETR), Nuclear Installations Inspectorate (NII), Environment Agency (EA), Scottish Environmental Protection Agency (SEPA) and RWMAC. Aiming to promote regular and constructive dialogue, it is intended hold meetings will other key parties e.g. environmental organizations.

Feasibility phase

The current phase of the Project ISOLUS is concerned with defining the concept and viability of land storage in greater detail. Carrying on from the work already started during the Concept phase, the milestones for the feasibility phase are:

- Project team formation.

5 Comments and questions concerning Project ISOLUS can be e-mailed to dcomsubs@gtnet.gov.uk.

- Determination of a procurement strategy for eventual disposal activities.
- Conducting a Market Sounding exercise.
- Development of a Public Sector Comparitor for use in evaluating Industry proposals.
- Acquiring initial financial approval from MoD/Treasury.

Project Team

To progress the next phase, a project team has been formed. Relying principally upon MoD resources, the core of the project team consists of suitably qualified persons with expertise in a number of fields including, technical, financial and public involvement matters. BAE Systems Limited have been appointed as Interim Nuclear Advisor to provide independent advice and to conduct technical studies and assessments.

Procurement strategy

The MoD has embraced the use of Private Finance Initiative (PFI) as an important part of the Government's efficiency policy. In conjunction with other forms of Public Private Partnership (PPP), the intention is to pursue PFI funding for all future projects unless it can be demonstrated that PFI would be unworkable, inappropriate or uneconomic.

The Concept Phase identified that the land storage of decommissioned submarines has the potential for implementation as a PFI. Applying standard PFI characteristics, ISOLUS meets the following criteria:

- There is a requirement to supply a service.
- A market exists for competition.
- The project is open to innovative ideas from Industry.
- Contracts would be long term.
- The requirement for capital investment, either now or in the future.
- There is the potential to transfer a degree of risk.

Market Sounding Exercise

To gauge the potential interest from industry, a Market Sounding Exercise (reference.6) has been undertaken. Having outlined the basic requirements of the project, MoD remains receptive to alternative storage proposals and contractors are encouraged to be innovative in their approach. This exercise will also allow the MoD to ascertain and appreciate some of industry's key concerns with regard to the risks to Project ISOLUS. The MoD will review all of the proposals and invite selected companies to present their ideas in more detail.

Interest in Project ISOLUS has already been received from a wide industrial base. Alongside companies that have a traditional nuclear or shipbuilding heritage, responses have been received from construction companies and firms keen to offer their specialist skills as consultants or as part of a consortium.

Public Sector Comparitor (PSC)

In order to determine whether the proposals received from Industry are acceptable, feasible and offer value for money, a PSC will be used as a benchmark. The PSC represents the cost of meeting the requirement using conventional procurement methods. Based upon realistic projections of the costs, the benchmark analysis will encompass areas such as radiological assessments, a Best Practicable Environmental Option and environmental impact statements. The MoD will use the land storage of separated reactor compartments as a PSC.

Procurement and Implementation Phases

The Procurement phase of the project will identify those companies that will be invited to tender and hold a competition between the most viable options. Once the MoD is in a position to recommend a proposal, further consultation will be conducted prior to the nomination of the preferred option.

ISSUES AFFECTING THE DISPOSAL OF NUCLEAR SUBMARINES

Public acceptance

The MoD has a legal obligation to provide visible and demonstrable assurance to the general public, via the regulatory bodies, that nuclear work is undertaken safely. Acquiring a broad consensus of public acceptance for Project ISOLUS will depend largely upon the trust earned through a policy of openness where decisions are based upon publicly accepted criteria. Fully engaging the public, opposition groups and local authorities is most likely to ensure success. Whilst it is unrealistic to expect universal approval for the policy which is eventually chosen, it is more likely to be accepted if there is an accountable and auditable decision process which demonstrates that people have had the opportunity to be consulted and have their opinions taken into consideration.

Regulation and approval

Nuclear submarines are classified as reactors comprised in a means of transport and are not covered by the Nuclear Installations Act 1965 (NIA65). As the NII does not license the NSRP it falls to the MoD's own Regulator, the Chairman Naval Nuclear Regulatory Panel (CNNRP), to assume the responsibility for the regulation of nuclear safety for the Naval Nuclear Propulsion Programme. If however, a commercial company undertakes work for the MoD on a nuclear Licensed site, the process will be regulated by the NII, in consultation with CNNRP. This interface requires a close liaison between the MoD and Civilian Regulators.

The MoD acknowledges and welcomes open and transparent regulation to boost public confidence and allow accountability. When exempt from legislation, it is Government policy to put in place alternative arrangements to ensure that the health and safety standards within the MoD will, so far as is reasonably practical, meet at least the minimum standards that would have prevailed were the legislation applicable. The MoD nuclear safety policy is based upon a process of authorization, which mirrors and is derived from, the NII Licensing process.

The land storage and eventual disposal of decommissioned submarines in the UK will be a new practice, requiring the relevant site licence and discharge authorization. The process will encompass a broad range of activities that will require political and regulatory approval from a variety of agencies including the National and Regional Parliaments, Environment Committee, EA, SEPA, NII and CNNRP.

Environmental issues

Decommissioned submarines present both a radiological hazard and an environmental burden for disposal. To determine the environmental effects of a land storage policy, the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 would require a civil licensee to submit an Environmental Statement.

As the MoD is exempt from this legislation, CNNRP will regulate this process as if the act applies. An environmental statement will still be required from the Licensee, CNNRP will then undergo a period of consultation with the public, regulators, local councils, planning authorities and Environmental Agencies. Following consultation, CNNRP will conduct a full Environmental Impact Assessment in order to determine any significant environmental effects from this new process.

Waste Management

Radioactive waste

The MoD is exempt from Radiological Substances Act 1993 (RSA 93), but has agreed to a regime of voluntary compliance and applies to the EA or SEPA for agreements and authorization for the accumulation and discharge of radioactive waste. For legislation where the MoD is not legally bound by discharge authorisation, 'Noting Letters' and 'Letters of Agreement' will be obtained from the Civil Agencies in lieu of their normal authorization.

For a commercial company contracted to prepare, store or dispose of nuclear submarines, the storage of radioactive waste on a Licensed Site will be governed by NIA 65. Any waste transfer or discharge from the site will, however, need to satisfy RSA 93 and comply with the relevant authorisation.

The MoD will retain ownership of the radioactive waste stream until final disposal.

Activity of waste generated at disposal

The radioactive waste arising from the disposal of nuclear submarines is no different in nature to that generated through similar processes in the civil sector. Although subjected to intense neutron bombardment throughout their service life, the majority of radioactive fittings will constitute either LLW or free release within one year of reactor shutdown. Of the 82 tonnes of material which could constitutes ILW at final shut down, only an estimated 18 tonnes will remain ILW after a storage period of 30 years.

Parts of the primary circuit will be contaminated with corrosion and wear particulates frequently referred to as CRUD.[6] Much of the CRUD is deposited in areas of reduced flow. The main active constituent of CRUD is cobalt 60 which is the largest contributor to the Average Radiation Level (ARL) and results in such contaminated areas being classified as short lived ILW until the cobalt decays.

With the relatively short half-life of Cobalt 60, the radiation level within the reactor compartment reduces significantly over a prolonged period of storage. Based upon readings from a reactor compartment survey, this is represented by the

6 CRUD is defined as Chalk River Unidentified Deposits. This term is applied to the irradiated wear and corrosion particles found within the primary circuit of the NSRP.

predicted ARL curve for a RESOLUTION class submarine (FIG.6) and shows a significant reduction in the dose rate in the first few years post shutdown.[7]

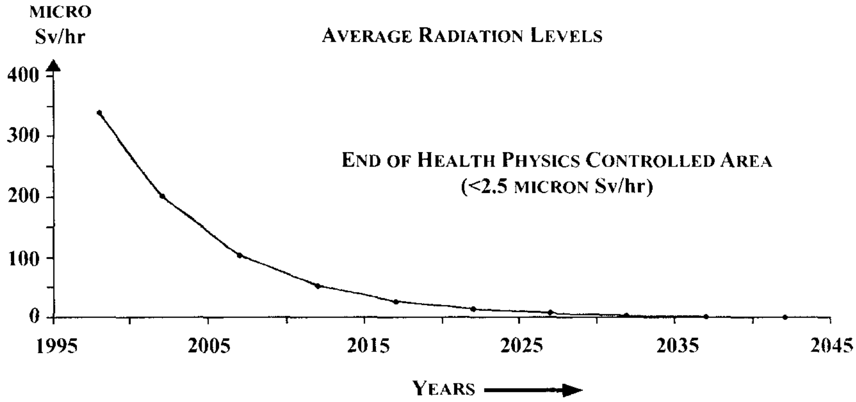


FIG.6 – RESOLUTION CLASS SUBMARINE REACTOR COMPARTMENT SCANS

TABLE.1 – *1998 UK Radioactive Waste Inventory figures for decommissioned submarines (reference 7)*

Waste Stream Classification	LLW	Short-lived ILW	Long –lived ILW
Components	Reactor Compartment structure, Primary pipework	Reactor Pressure Vessel, Primary shield tank, Some RC structure, CRUD.	Core Barrel, Thermal Shields, Reactor Pressure Vessel cladding
Predominate Isotopes and Half life		Fe 55 ($t_{1/2}$=2.73 years) Co 60 ($t_{1/2}$=5.3 yrs)	Sm 146 ($t_{1/2}$=1.03 x 10^7 yrs) Ni59 ($t_{1/2}$=7.6 x 10^4 yrs)
Time to LLW		<30 – 60 yrs	>$10e^4$ yrs
Volume (m^3) (including voidage)	40	32	9

Package or Store

The timing for decommissioning is essentially a balance between the desire to deal with the legacy of nuclear submarines, and the need to minimize the effects to the public, workers and the environment. The options fall between:

- Dismantle and package the ILW at decommissioning.
- Prolonged storage of the submarine reactor compartment before dismantling and disposal.

An early decision to dismantle and package the radioactive components using existing technology would demonstrate a positive intent. However, the disadvantages are the difficulty in satisfying the principle of ALARP, high cost and larger volumes of ILW and LLW.

Through open and accountable ownership, it is possible to demonstrate that long-term land storage of partially dismantled submarine is a responsible, safe and cost

7 The ARL for more modern classes of submarine are approximately 50% lower than the RESOLUTION class, reflecting improvements in design. It is estimated that the Reactor Compartment will no longer be a Health Physics controlled area after 30 years.

effective method of dealing with the legacy. The waste is in a safe format that enables retrieval and eventual disposal. The dose burden at disposal is dramatically reduced after a storage period of 30 years and the amount of waste for disposal will significantly reduce with time. Land storage would require capital investment in the construction and eventual decommissioning of storage and a disposal facility.

Disposal

It is essential that waste from decommissioned submarines is consistent with the waste package specifications of UK NIREX Ltd. In an attempt to formulate future waste management strategies, NIREX have undertaken a peer review of the radioactive waste inventory information reported for nuclear submarines. Incorporated within the National Inventory, ILW from decommissioned submarines poses no unique or significant problems for disposal, which do not arise for other waste (reference.8).

Industrial waste

As well as dealing with the radioactive waste arising from the decommissioning of submarines, consideration must be given to the safe and effective disposal of the industrial waste that exists within these vessels. Identification and the safe disposal of substances such as asbestos, chromates and other hazardous materials will be part of the overall waste management plan.

Storage site selection

The most emotive element of Project ISOLUS is likely to surround the selection of a suitable site for the storage of the ILW in whatever form is finally agreed. Open, objective and accountable evaluation will be crucial when determining the selection criteria and in particular, the decision weightings and therefore, it will be important to involve the stakeholders and the public at an early stage.

Suitable generic locations will be from one of the following categories:

- MoD authorized site.
- MoD non-authorized site (which will require authorizing if selected).
- Industrial licensed site.
- Industrial non-licensed sites (which will require licensing if selected).

Existing licensed sites are more likely to be acceptable to the regulatory bodies and the general public.

Summary

The delayed availability of the national radioactive waste facility has had a significant adverse affect on the MoD's intentions for the storage of decommissioned nuclear submarines. As continued afloat storage brings problems of shortage of suitable moorings, rising costs and adverse public perception, Project ISOLUS has been set up to develop and procure a safe and publicly acceptable method for the interim storage of radioactive material arising from decommissioned submarines.

The Concept Phase of Project ISOLUS has assessed alternative storage options. The principal recommendations are:

- Future storage policies should not be reliant upon the availability of a national facility and should be capable of adapting to indefinite storage.

- The optimum storage period is approximately 60 years.
- Land storage of separated reactor compartments was the best option for use as a comparitor.

The MoD has chosen to develop the land storage of reactor compartments as a PSC in order to benchmark future proposals from industry. This option offers:

- A safe, passive, robust and secure method for storing the radioactive waste.
- The ability to adapt to an extended storage period.
- Easy access for radiological monitoring.
- Retains the flexibility to adapt to future disposal initiatives.

The next phase of the project will explore further the viability of land storage. Key points will be to determine if a Private Finance Initiative is suitable as a procurement strategy, to develop the PSC and to establish budgetary provision.

The public will be engaged in a full and open consultation process which will significantly influence how Project ISOLUS is taken forward. The consultation strategy will employ a variety of techniques to capture a broad spectrum of opinion.

The land storage and eventual disposal of decommissioned submarines in the UK will be a new practice, requiring the relevant site licence and discharge authorization. This will involve a number of regulatory bodies including the MoD regulator, CNNRP. Whenever exempt from legislation, the Ministry will, so far as is reasonably practicable, act as if the legislation applies.

The most emotive element of Project ISOLUS is likely to be the selection of a suitable site for the storage of ILW. The MoD will not focus upon a storage site until there has been opportunity to involve the public as part of the consultation strategy.

The MoD is receptive to all realistic proposals and has approached industry to encourage innovative ideas for land storage. Having investigated and compared the viable options, Project ISOLUS will consult widely before recommending a way forward.

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8. NIREX Scoping Study into the Preparation of Decommissioned Nuclear Submarines Reactor Compartments for Final Disposal, dated August 2000.