

Nuclear Free Local Authorities **RADIOACTIVE WASTE POLICY**

Briefing No.48 – ONR submarine dismantling at Rosyth

Prepared for NFLA member authorities, April 2014

Public consultation on the request for consent to dismantling of seven nuclear submarines at Rosyth Royal Dockyard

1. Overview of report and submission response

This edition of the NFLA's Radioactive Waste Policy briefing provides its overview and model response to the Office for Nuclear Regulation's (ONR) consultation on the request for consent to the dismantling of seven nuclear submarines at Rosyth Royal Dockyard. It is a component part of the Ministry of Defence's (MoD) Submarine Dismantling Project (SDP), of which the NFLA has been heavily involved with for over a decade.

This report has been discussed with offices in Fife Council, where the Rosyth Dockyard is located. If NFLA members wish to submit their own response to this ONR consultation then please send by the **21st April 2014** to: Health and Safety Executive, ONR - EIADR team, 4N.1 Redgrave Court, Merton Road, Bootle, Liverpool, L20 7HS.

Email: EIADR-SDP-Rosyth@hse.gsi.gov.uk

NFLA remain fully involved in wider aspects of this project. The NFLA Chair and NFLA Secretary are attending a stakeholder dialogue on the shortlist of five sites for storing intermediate level radioactive waste from dismantled submarines. This is taking place on the 9th April in Penrith and a full report of its proceedings will be provided to the NFLA Scotland Forum on the 25th April and the NFLA Steering Committee on the 27th June.

2. Background

In 2011 the Ministry of Defence (MoD) consulted on its Submarine Dismantling Project (SDP). (1) This consultation considered options for dealing with the waste inside 17 of the Royal Navy's out-of-service nuclear powered submarines which are afloat in storage – ten at Devonport and seven at Rosyth dockyards – and a further 10 submarines still in service, making a total of 27. The new Astute Class submarines currently being brought into service and the next planned class of submarines (known as Successor) were not within the scope of the consultation.¹

Three possible options for removing radioactive waste from the submarines were proposed:

- Separating and storing the whole reactor compartment, which weighs around 700 tonnes.
- Remove and store the Reactor Pressure Vessel (RPV), which weighs around 50-80 tonnes. Any remaining ILW (in pipework connected to the RPV for example) would then be packaged in a shielded container that is suitable for transport and storage;
- The RPV and other radioactive waste would be removed but then immediately size-reduced and packaged into boxes for storage.

¹ Interestingly page 69 of the Environmental Statement makes the point that there is an opportunity to reduce the existing radioactive discharge limits at Rosyth after the submarine hulks have left the Dockyard. It states that this would be in compliance with the OSPAR Convention's strategic objective that pollution of the OSPAR maritime area from ionising radiation will be prevented through progressive and substantial reductions of discharges. The corollary of this is that if the UK Government continues to order new nuclear submarines it will not be in compliance with its OSPAR commitments.

In its response to the 2011 Consultation the NFLA argued that, although the MoD claimed both worker doses and planned discharges of radioactivity were predicted to “*remain within currently permitted limits*”, it was clear that the two RPV Removal options failed to meet the ALARA (As Low as Reasonably Achievable) principle. The fact that discharges of radioactivity into the environment are expected to occur at all when there is a technique available which involves minimal discharges into the environment – namely the Reactor Compartment (RC) Separation Option – means that RPV removal options should be ruled out on the grounds that they are not the Best Available Technique and do not apply the precautionary principle. The NFLA concluded that by applying a series of environmental principles to the problem of what to do with decommissioned submarines the option of storing the intact reactor compartments above ground at the sites where the submarines are currently either stored afloat or defueled appeared to be the best option.

Environmental Principles

The NFLA Steering Committee agreed a set of clear environmental principles which should be used for the management of nuclear waste in October 2004 at its Annual General Meeting in Hull. These are:

- **The idea that radioactive waste can be "disposed" or be rejected in favour of radioactive waste management;**
- **Any process or activity that involves new or additional radioactive discharges into the environment be opposed, as this is potentially harmful to the human and natural environment;**
- **The policy of 'dilute and disperse' as a form of radioactive waste management (i.e. discharges into the sea or atmosphere) be rejected in favour of a policy of 'concentrate and contain' (i.e. store safely on-site);**
 - **The principle of waste minimisation be supported;**
 - **The unnecessary transport of radioactive and other hazardous wastes be opposed;**
 - **Wastes should ideally be managed on-site where produced (or as near as possible to the site) in a facility that allows monitoring and retrieval of the wastes; (2)**

When estimated radiation dose to workers were later revealed to be between 0.94 and 1.0 millisieverts per year (mSv/yr) for the two RPV options compared with 0.18mSv/yr for the Reactor Compartment (RC) Separation option, this confirmed the NFLA view. (2)

The MoD announced its decision to go ahead with its favoured option of removing the RPVs and storing them intact prior to disposal in March 2013. (3) The RPV removal and storage option will still require the 50 – 80 tonne pressure vessel to be cut up into smaller pieces for packaging and disposal eventually, but waiting longer to undertake this process allows for some of the radioactivity to decay before size reduction begins.

3. Waste Hierarchy

It is also worth noting that the NFLA has difficulty with the application of the waste hierarchy to nuclear waste management. The ALARA principle should mean that all reasonable steps are taken to protect people from radiation, even when emissions are below the legal limits. Factors such as cost can be taken into account. The use of the waste hierarchy tends to be used to promote 'recycling' - i.e. converting used materials into new products. Unfortunately, in the context of radioactive waste – contaminated and activated metals – it is rarely possible to recycle all of the material. Radioactive contamination needs to be removed from the waste before the remaining material can be used in new products.

This raises the likelihood of a conflict between the potential environmental benefits to be gained from metal recycling and some important principles of radiological protection. Firstly it breaches the principle to 'concentrate and contain' radioactivity rather than 'dilute and disperse' it throughout the environment. Secondly it breaches the ALARA principle. Any waste or contaminated metal recycling plant will require an authorisation to release radioactivity into the atmosphere, rivers or the marine environment. The contaminated metal recycling plant operated by Studsvik at Lillyhall in Cumbria, for example, releases radioactive caesium-137 and americium-241 into the environment.

Rosyth dockyard has permission from SEPA to transport contaminated metal waste to a processing facility in Sweden, near Nyköping, also operated by Studsvik. (5) A recent inspection report carried out by the Swedish Radiation Protection Authority was highly critical of monitoring carried out by Studsvik. It said the company lacked a co-ordinated approach to measuring aerial emissions, and it had no idea about discharges to water. (6)

4. The Current Consultation

The Environmental Statement which is under consideration in this consultation has been submitted by Rosyth Royal Dockyard Ltd, (RRDL), the site licensee, to support the Initial Dismantling of the seven laid up submarines at Rosyth Dockyard in Fife, Scotland. (7)

'Initial Dismantling' refers to the removal of radioactive material from each of the seven submarines while docked in a licensed dock at Rosyth Dockyard. Each submarine will then have its hull restored and will be returned to the MOD, so that it can then be transported to a conventional UK ship recycler for the ship dismantling to be completed.

The Active Waste Accumulation Facility (AWAF) on the Rosyth Dockyard site will be used for limited size reduction, preparation and temporary storage of radioactive material prior to dispatch to appropriate waste treatment or 'disposal' facilities.

Consent is required from the Office for Nuclear Regulation (ONR) prior to dismantling any nuclear reactor, including submarine reactors. The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 as amended in 2006 (EIADR) require the licensee under the Nuclear Installations Act, 1965 (NIA 65) (as amended) to prepare and submit an Environmental Statement (ES) to accompany any such application to the ONR.

The ES should demonstrate that the environmental impact of the proposed work has been identified, described and assessed in an appropriate manner and that any detrimental effects on the environment and communities are minimised. The aim is to make the decision making process open and transparent. EIADR requires that the public and other relevant stakeholders be consulted regarding the environmental impacts of the options being considered for a proposed decommissioning project

5. The Proposal

The MOD has decided, subject to successful demonstration and regulatory approvals, to implement the option of removing the Reactor Pressure Vessels (RPVs) from the submarines at both Rosyth and Devonport Nuclear Licensed Dockyards. The entire RPV will then be stored for an interim period at an existing nuclear site owned by the MOD, the Nuclear Decommissioning Authority (NDA) or private industry. The selection of the interim storage site will be subject to consultation. When the Geological Disposal Facility (GDF) becomes available, the RPV will be size reduced and the packaged waste sent for final disposal. The disposal of a whole RPV to the GDF is being explored as an opportunity.

No Intermediate Level Waste (ILW) will be removed from any submarine until an ILW storage solution is agreed. Five nuclear facilities across the UK have been identified as potential sites to store ILW from disused nuclear-powered submarines: Aldermaston and Burghfield in Berkshire, Sellafield in Cumbria, Capenhurst in Cumbria and Chapelcross in Dumfries and Galloway. A public consultation on these sites will be held in late 2014. (8)

Low Level Waste (LLW) already has an established disposal route, so the MoD has decided to carry out the initial dismantling in two phases. First, subject to receiving the necessary regulatory approvals, LLW will be removed in conjunction with planned submarine maintenance activities. The ILW will remain in-situ within the Reactor Compartment (RC) and each submarine will be returned to afloat storage until a later date when an ILW storage solution has been agreed.

An interim ILW store is not likely to be available until after 2019, when it is anticipated planning permission and other consents for the store may be in place. Only then will Stage 2, take place. This will involve the re-docking of the submarine, and removal of the RPV and Primary Shield Tank (PST). Certification of the submarine as free of radioactive material (to below regulatory limits) will then be completed, and the submarine will be made ready for handover to the MoD and possibly a further time afloat, before consignment for final dismantling at a commercial UK Ship Recycling Facility (SRF).

6. Waste Strategy

A Waste Strategy is being developed for the management of waste - liquid, gaseous and solid - from submarine dismantling. Details of anticipated wastes, quantities and management are given in a Waste Management Strategy (WMS) Report. Unfortunately the WMS report does not appear to be available.

Given that:

- (a) It is the intention to remove the RPV, rather than leaving the RC intact and,
- (b) It is the intention to maximise the recycling of material where possible,

every effort should be made to limit the mobilisation of radioactivity into the atmosphere and discharge into the environment.

Radioactivity is likely to be mobilised when parts of the submarine are being cut out from the vessel or cut up for size reduction and packaging. Various bits of metal cutting are proposed including:

- (1) Removal of the steam generators.
- (2) De-planting of all Nuclear Steam Raising Plant (NSRP) pipe work and small items of plant. All items will be bagged and appropriately tagged/labelled prior to leaving the Reactor Compartment (RC). (Does any of this require Size Reduction as well as removal?)
- (3) The RPV head has to be separated from the RPV.
- (4) The RPV head has to be size reduced in the Active Waste Accumulation Facility (AWAF).
- (5) The RPV has to be separated from the Primary Shield Tank (PST)
- (6) The PST will be removed by cutting the lower hull and RC forward bulkhead.
- (7) The PST will be cut up within the AWAF

Various items cut out of the submarine will be transported to the AWAF or elsewhere:

- (1) The SG is transported, after removal, but to where?
- (2) RPV Head is transported to the AWAF
- (3) RPV transferred to a transport container and transported to AWAF

9. Toxic Chemicals

Around 25 tonnes of Potassium Chromate liquid must be disposed of. This liquid contains small quantities of tritium, carbon 14 and cobalt 60. Potassium chromate is an oxidising agent and has persistent toxic characteristics. The preferred option for disposal is incineration at a suitably permitted site. This is the route authorised by the Environment Agency for disposal of potassium chromate waste from Devonport Royal Dockyard.

10. Very Low Level Waste (VLLW)

SDP will generate a significant increase in volume of soft trash; namely, gloves, caps, swabs etc. Existing practice at Rosyth Dockyard of co-disposal of LLW and VLLW soft trash is not considered to be consistent with the national policy with regards to the waste hierarchy. An alternative, more compliant disposal route for VLLW will be assessed. This is likely to involve disposing of VLLW in a landfill site. (9)

11. Low Level Waste (LLW)

LLW will either be sent for further waste treatment i.e. shot blasting, decontamination, melting etc. or directly to the Low Level Waste Repository (LLWR) near Drigg in Cumbria for final disposal if unsuitable for recycling. Redundant RPV heads recently disposed of by Devonport Royal Dockyard have all been successfully recycled by Studsvik of Sweden.

Metal scrap, such as stainless steel, carbon steel, copper, aluminium or lead is melted. The end-product is metal ingots that can either be immediately free-released as conventional scrap metal or released after a period of decay storage. The small amount of residual products (slag, sorted material, cutting and blasting residues and dust from the ventilation filters) retain the radioactivity and are sent for disposal to the LLWR. It is currently assumed that the PST can be processed as LLW and will be acceptable for disposal at the LLWR.

12. RPV

It is an aspiration that if the Interim store is ready to receive the packaged RPV, it will be exported direct from the dockside. Should temporary storage be required, the RPV will be transferred to the AWAf and temporarily located there prior to transport to the interim ILW store.

Whole RPV storage and deferred size reduction is currently the preferred option on the basis of cost, safety and environmental benefits. However, it is noted that an opportunity exists for the GDF design to be adapted to take the entire RPV, without size reduction. It is proposed to store the RPV entire in the interim ILW store, designed to safely and securely hold waste for up to 100 years.

13. An incomplete Environmental Statement

The Environmental Statement is supposed to covers all seven submarines at Rosyth. The programme is expected to start in January 2016 with Stage 1 Initial Dismantling being carried out on LUSM (Laid Up Submarine) Swiftsure. Once LLW has been removed the submarine will be returned to afloat storage. A period of reflection on lessons learned will follow before Stage 1 LLW removal commences for other submarines.

Similarly there will be a period of reflection after Stage 2 initial dismantling of Swiftsure - removal and transport probably to the AWAf of the RPV and PST.

Given that limited information is provided on expected radioactive discharges or their impact on workers or the environment NFLA believes that a more complete Environmental Statement should be completed after stage 2 initial dismantling for Swiftsure has been completed before any further Stage 2 initial dismantling is carried out without waiting for Regulation 13 of the EIA Regulations to be invoked. (10)

14. Radioactive Discharges

SEPA has stated that the disposal of SDP wastes cannot be made under the current Authorisation and an application must be made for a new Authorisation. An application has been made by RRDL, for the management, disposal and accumulation of radioactive waste arising from or produced at the Authorised Premises and including the LLW that will be produced in the first stage of Initial Dismantling of the seven submarines at Rosyth. Authorisation for separate disposal of VLLW has also been requested.

The new Authorisation will be made under RSA 93 legislation. According to the Environmental Statement, the application document to SEPA will demonstrate that discharges will be within the existing limits.

At this time, the application for the new authorisation is for Stage 1 activities only. A second application will follow in due course, but the limits applied for are expected to remain the same. Stage 2 activities including the removal of ILW and its ultimate storage/ disposal will be subject to a separate variation/ new authorisation.

15. Liquid Discharges

It is anticipated that liquid discharges will be managed within the existing limits, during Stage 1 and Stage 2. This sounds good in theory, but what we should really be comparing the new discharges with are current actual discharges. In 2012 tritium emissions were only 19% of the authorised limit, and Cobalt 60 and other radionuclides were less than 1% of the authorised limit. So we could be looking at big increases in discharges, even whilst remaining within the current authorised limits. (11)

16. Gaseous Discharges

During Stage 1 gaseous discharges will primarily be associated with deplanting activities in the RC. The ES says that the generation of suspended particles will be low due to the nature of the cutting process. However, the ventilation system from the RC will incorporate HEPA (High Efficiency Particulate Air) filtration prior to discharge in to the environment.

During Stage 2 gaseous discharges will primarily be associated with size reduction of the PST within the AWAf. Again suspended particles are expected to be low and the size reduction containment structure will incorporate HEPA filtration prior to discharge in to the building active ventilation system.

The ES says a detailed assessment of the Stage 2 discharges has not been undertaken. However, it is envisaged that the discharges will be within the existing limits as detailed above.

As with liquid discharges this sounds good in theory, but we should really be comparing the new discharges with are current actual discharges. In 2012 gaseous discharges were zero. (12) So we could be looking at very big increases in discharges.

17. Solid Waste

At this stage it is estimated that about 165 tonnes of LLW will be removed from each submarine in Stage 1. The activity associated with the LLW disposal is estimated to be 18GBq (based on a vessel that has been shutdown for about 20 years). As the majority of the LLW is metallic, it will be disposed of by using shot blasting and melting, which presumably means it will be transported to Sweden for recycling.

During Stage 2, there will be about 240 tonnes of structural and shielding material to be removed. It is anticipated that these components may be radioactive, possibly LLW but further characterisation work is required to determine the appropriate waste treatment/ disposal route.

The RPV and its components weigh about 67 tonnes and the activity associated with the RPV is about 120TBq (at 20 years post shutdown). Following packaging, the RPV will be transported off site to an interim storage facility. The plan is that it will ultimately be disposed of in a geological disposal facility (GDF), either whole or having been size reduced prior to final disposal.

The PST weighs about 16 tonnes. The current assumption is that the PST can be disposed of as LLW, however there are some portions of the PST that will be ILW if the PST is size reduced. Melting/ waste treatment is not an option as a fraction of the PST is likely to be above the acceptance criteria for such a process, as the metal is activated rather than contaminated. Further characterisation work is required to determine the optimum waste treatment/ disposal solution.

18. Dose Rates to the General Public

As discharge limits remain the same, potential dose rates to the general public remain unchanged. (Unfortunately the units used in table 9 are not clear which doesn't help for an informed consultation response).

19. Emergency Planning

It is necessary to determine the radiological consequences associated with the 'most significant hazard'. These will be conservatively assessed, being the unmitigated effective doses to the potentially most exposed individual should the fault be realised. Initial examination suggests the worst case fault is that the RPV is dropped during transfer to the transport trailer on the dockside or in the AWAFF itself. It then splits open, exposing the core barrel and releasing radioactive internal corrosion products to the environment.

Emergency arrangements will be developed to cater for reasonably foreseeable events associated with the Initial Dismantling. The existing arrangements and exercise scenarios will be reviewed with the Organisation Structure and exercise participants i.e. Babcock, MOD, Local Emergency Services remaining the same. The entire business park within the estate boundary will need to be considered.

Anything outwith the estate boundary will be considered by Fife Council, who will develop an appropriate off-site plan.

20. Conclusions

In the view of the NFLA, Submarine Dismantling is being proposed in a manner which is not consistent with a basic set of environmental principles. This means that:

- There will be liquid and gaseous discharges as various radioactive components are removed from the reactor compartment and some are size reduced. Although these are expected to be within currently authorised limits it could still mean very large increases in discharges compared with actual discharges over the past few years.
- Radioactivity will be dispersed with new discharges at Nyköping in Sweden. At the very least assurances should be sought that earlier problems with monitoring have been resolved.
- Very Low Level Radioactive Waste could be disposed of in an unspecified landfill site.
- Radioactively contaminated potassium chlorate liquid could be incinerated at an unspecified incinerator.
- Low Level Waste will be dispatched to the LLW repository near Drigg.
- The RPV and size-reduced PST will be transported to an unspecified ILW waste store.
- An emergency plan has yet to be developed for the worst case scenario which is expected to be the dropping of the RPV during lifting.

Many of the details of this strategy have yet to be decided which makes this consultation exercise premature.

The Waste Strategy Management Report should have been made available on the ONR website. [A copy has been requested by the author of this report, but it is not available at the time of writing]. As a matter of principle references should be made available on consultation websites wherever possible – especially ones referred to in the text in the way that Reference 55 is referred to.

It would also have been helpful to make Reference 80 available. (Doc No. 1312001. Application to SEPA under the Radioactive Substances Act 1993 to dispose of Radioactive Wastes from Rosyth Dockyard. Babcock. December 2013)

Given that limited information is provided on expected radioactive discharges or their impact on workers or the environment; limited information on the destination of various wastes; and limited information on the emergency plan for the worst case scenario. NFLA believes that a more complete Environmental Statement should be completed after stage 2 initial dismantling for Swiftsure has been completed before any further Stage 2 initial dismantling is carried out without waiting for Regulation 13 of the EIADR to be invoked.

21. References

- (1) Submarine Dismantling Project, Consultation Document, MoD, 28th October 2011
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- (2) NFLA Briefing No.31 Ministry of Defence Submarine Dismantling Project Consultation NFLA Overview and Model Response Feb 2012
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- (7) Emissions Inspection Report on Studsvik, 2nd November 2009 (In Swedish)
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