Magnox South

Sizewell A Power Station
2008/09 Lifetime Plan

Technical Baseline and Research & Development Document

TITLE: Technical Baseline and Research & Development Document

Sizewell A Site, Lifetime Plan 2008/2009.

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Contents

1 Introduction

This section of the Lifetime Plan (LTP) submission, the Technical Baseline and Research and Development (TBRD) document is to provide an overview of Sizewell A's technical baseline and research and development work that supports the approach to decommissioning for the remainder of the site's lifecycle.

As part of Magnox South reactor sites, Sizewell A ceased generating on the 31st December 2006, and is now to enter the defuelling phase, followed by decommissioning and cleanup activities with the site's remaining lifecycle, described in the TBRD document in four phases:

- Defuelling
- Care & Maintenance Preparations (C&M Preps)
- Care & Maintenance (C&M)
- Final Site Clearance (FSC) and re-use.

1.1 Approach to Decommissioning

Magnox Electric Ltd, as the Site License Company (SLC) operating the Magnox South nuclear licensed sites, including Sizewell A, is responsible for developing and implementing decommissioning and waste management strategies consistent with the requirements and overall national strategy of the Nuclear Decommissioning Authority (NDA) (Ref. 1) and in accordance with relevant Government policies (Ref. 2).

This TBRD document represents the Sizewell A, site-specific implementation of the current strategy agreed by Magnox Electric Ltd Board for the Magnox business. Work will also be carried out with the Decommissioning Strategy Organisation (DSO), which has been established in Magnox South to carry out research and development work on key waste management and decommissioning issues. The output of this work will underpin and further develop the current technical baseline strategies to be implemented at Sizewell A.

1.1.1 Decommissioning Principles

The following principles guide development of Magnox Electric's strategies and plans for decommissioning and waste management that are subsequently implemented at the sites including Sizewell A:

- The safety of the public and the workforce, together with protection of the environment, are of paramount importance and will be considered ahead of all other factors.
- Strategies will be compliant with legislation, be in accordance with Government, NDA and Company policy, and take due account of stakeholder views and regulatory and industry guidance.
- The priority associated with Decommissioning and Waste Management Strategies will be informed through evaluation of current Safety and Environment Detriment values and the future reduction of these carried out in line with the NDA prioritisation process.
- Preferred strategies will be identified in a systematic, consistent and auditable manner using best available scientific, engineering and economic knowledge and taking account of socio-economic and political factors, risk and uncertainty. A wide range of options will be considered. The results of stakeholder engagement will be fed into the decision-making process.
- Strategies will maintain a flexible approach so as not prematurely to foreclose options, thereby maximising the capability to accommodate changes related to, for example, technical and regulatory developments or waste repository availability. However, all

strategies will have a clearly identified exit route that is currently capable of implementation.

- Strategies and plans will be regularly reviewed to ensure they remain fit for purpose, learning from experience and taking account of emerging technologies through a continuing Research and Development programme.
- Strategies, plans, processes and technologies will deliver value for money for the liability owner over the remaining lifetime of the reactor sites.
- The quantities of radioactive and otherwise hazardous waste arising during the course of decommissioning will be minimised, as far as reasonably practicable.
- Radioactive waste for which there is no currently available, appropriate disposal route will be placed into a passively safe state. Where it is appropriate to package this waste, it will be placed in a form suitable for interim surface storage consistent with the requirements of the relevant disposal organisation.
- Throughout any decommissioning deferral period the sites, including any remaining radioactive waste, will be managed to maintain a passively safe state that minimises the need for control and safety systems, maintenance, monitoring and human intervention.
- Where any decommissioning or waste management work is to be deferred, appropriate knowledge and records will be retained and maintained throughout the period.

1.1.2 Main Objectives

The approach to decommissioning at Sizewell A has been aligned with Magnox Electric Ltd's key objectives in development and implementation of decommissioning and waste management strategies, which is to;

- Ensure the continued safety of the public, the workforce and the protection of the environment.
- Deliver systematic and progressive reduction of hazards on-site.
- Achieve an appropriate balance in the use of environmental, social and economic resources both now and in the future.
- Clear and de-license the site or to achieve other such end state as agreed.

Sizewell A site has developed their detailed TBRD in accordance with the Company's waste management and decommissioning strategy. This is based on the submission to HSE for the quinquennial review (QQR) (Ref. 3) in 2000. The QQR submission was updated in 2005 to a Company Standard, Magnox Electric's Decommissioning and Radioactive Waste Management Strategy" ME/S/036 (Ref. 4) and agreed by the Magnox Electric Board in 2005. It was revised and re-issued in March 2007 and is subject to periodic review and update.
Company technical guidance has also been issued for the preparation of reactor building safestore (Ref. 34 & Ref. 37).

It is recognised that the Sizewell A TBRD may not represent the optimum solution in some areas. Therefore the Research and Development (R&D) proposals are expected to provide opportunities for acceleration and/or optimisation of the clean-up process. This approach is consistent with industry best practice and current technologies that also take account of stakeholder expectations.

1.2 Current Status

Sizewell A ceased the generation phase at the end of 2006. The defuelling phase started in April 2007. Simultaneously, the site started hazard reduction and entered the first stage of site decommissioning, known as Care and Maintenance Preparations (C&M Preps), whereby all buildings except the reactor building will be removed from site. At the end of this phase, currently scheduled for 2019, the site will be ready for the long-term passively safe state, known as Care & Maintenance (C&M) phase. This allows time for radioactive decay of activated material associated with the reactors, prior to Final Site Clearance (FSC) of the site. Following the C&M phase, in around 2102 the site will begin full dismantling and remediation in the Final Site Clearance phase, which will result in the site being delicensed and available for future use by 2110.

The Sizewell A site layout consists of three main areas of decommissioning work:

- Conventional area – containing non-radioactive plant and buildings (turbine hall, cooling water pump house, workshops and offices etc.);
- Radiological Controlled Area (RCA) – including a number of buildings with internal plant and structures that are contaminated with radioactive substances (e.g. cooling ponds, operational waste storage facilities, radioactive effluent treatment plant, active drains, laundry and workshops etc.)
- Reactor building (also within the RCA) – containing two nuclear reactors of the gas-cooled, graphite-moderated, Magnox type. The reactor building also houses activated material within the reactor voids situated around the two reactors.

This document expands on the current baseline for the technical approach to work that has already been planned and costed and on which current plans are based. When opportunities are identified to improve the baseline in terms of cost, schedule, safety and the environment these activities will also be included in the Research & Development section of the TBRD.

Technical work techniques are governed by environment, health and safety legislation and all work undertaken will comply with the relevant regulations. Sizewell A has a comprehensive infrastructure in place including independent verification to ensure high performance standards and that compliance with the requirements is maintained. Expert resource in these fields together with Core Competence, Design Authority, and Intelligent Customer capability is fully maintained. An overview of the work is given below:

1.2.1 Defuelling:

Defuelling is the major site focus following shutdown and involves the removal of all spent nuclear fuel from the reactors and fuel storage ponds and its transfer to Sellafield for reprocessing. Any new fuel is also removed from the site in this period as is any other potentially hazardous, non-radioactive material such as stocks of gases (e.g. carbon dioxide and hydrogen), oils and chemicals.

This primary focus is in accordance with the Magnox Operating Programme (MOP) (Ref. 5). The MOP is an integrated refuelling, defuelling and reprocessing plan across all the Magnox generating and defuelling reactor sites and Sellafield. Its aim is to optimise generation and fuel activities (e.g. transport and reprocessing) to enable the Government aim of significantly reducing marine discharges by 2020. This requires the cessation of generation at all Magnox reactor sites by 2010 and the completion of Magnox fuel reprocessing a few years later so that decommissioning on all the sites can make the necessary progress to enable discharges to be reduced by 2020.

At the time of shutdown the nuclear fuel comprises 99.9% of the radioactivity on the site and hence its early removal is in line with the Government Policy aim of reducing hazards and removing the most active and potentially mobile radioactivity on a relatively short timescale.

The end point for defuelling is that all Magnox fuel will have been removed from the site and transported to Sellafield. This includes the removal of all fuel from the reactors, fuel route and ponds, and the despatch of the final fuel flask to Sellafield. Any unused new fuel will also have been removed from the site. The confirmation of removal of all fuel from the site will need to be agreed with the Regulators before any benefits can be claimed. Introduction and operation of a system of verification of fuel removal is part of the defuelling process.

a) *End of life fuel management.* For optimum fuel reprocessing at Sellafield, the plutonium content of the spent fuel is preferred to be above specific levels. This level in only reached in fuel elements after a certain amount of irradiation. Fuel that is at the periphery of the core, including the top and bottom, require more time in the operating core than fuel in the centre to achieve the same level of irradiation. To avoid the reactor being shut down containing too much "young" fuel, refuelling at peripheral sites was completed in 2005, with all refuelling finished in August 2006 on both reactors. The elements at the top and bottom of the core are part of a fuel retention scheme, where selected upper and lower elements are retained in the core for further irradiation to improve fuel utilisation.
b) *Defuelling safety case.* A defuelling safety case has been written and has completed the internal company approval process including Independent Nuclear Safety Assessment, and agreement of the Nuclear Safety Committee. It has been reviewed by the Nuclear Installations Inspectorate, whose assessment had identified need for additional work, particularly on C&I requirements and decommissioning risks to safety related plant. The Case took effect when the reactors were shutdown in December 2006, and continues through the defuelling period. The agreement of the Case facilitates the Managed Withdrawal from the conventional plant areas to be planned and executed.
c) *Mods to support the defuelling safety case.* The defuelling safety case is dependent on a number of modifications being carried out prior to final permission being granted to commence defuelling. These modifications will increase the shutdown margin to a maximum prior to the commencement of defuelling and the margin will increase as the reactor is defuelled. Modifications include insertion of all the boron balls and control rods, for which an Operating Rule suspension approval by the NII is required, the prevention of rod withdrawal by disabling the control rod drives and safety circuits, and the isolation of bulk CO_2 supplies.
   The verification of defuelling is covered in the safety case, and is based on the principle of two out of three diverse methods of empty channel demonstration to be in agreement. To this end, data loggers have been designed, installed and commissioned on both reactor for the sole purpose of defuelling verification.
d) *Mods to improve fuel route reliability and reduce complexity.* During the defuelling period the fuel route equipment will be required to operate at higher rates than on-load equilibrium refuelling. Defuelling rates can be up to 10 channels per day per reactor compared to 2/3 channels per day per reactor for refuelling. The reliability of the fuel route equipment will be a key factor in the defuelling performance. To maintain the high rates required two packages of work have been planned. One package has already examined bottlenecks in the process and recurrent failure items. The other package considers the reduction in fuel route equipment control complexity afforded by the safety case and operational conditions during the defuelling period.
   The first package of work has already lead to a second location for flask processing in the Flask Washdown Bay, and two new sets of Flask Leak Detection Equipment have been installed and commissioned. Work that has already been completed includes the update of the refuelling control desks and the replacement of the fuelling machine hoist unit drive with a modern gearbox and variable speed drive. An overhaul of the ponds skip crane will be undertaken this year.
   The reduction in control system complexity package has examined a number of the control features on the dry side of the fuel route. Here the greatest benefits come from the

operation at atmospheric pressure in both the reactors and discharge/ponds area. Thus, much of the pressure interlocking, gas pipework and selector valves can be taken out of service.

e) *Continue fuel dispatch as required.* Fuel flasks will be despatched from the site in accordance with the MOP. There is no requirement to empty the ponds before defuelling starts. However, it should be noted that the current spent fuel processing regime has allowed the Sizewell A ponds to be emptied of fuel. It is intended that the ponds will remain empty (of fuel) until bulk defuelling starts as dictated by the MOP. The pond fuel inventory will be managed within the maximum permitted level, taking into account the flask delivery programme, the reactor defuelling programme, as well as heat loading and ponds chemistry.

It is expected that Station Staff will undertake the majority of the work involved with defuelling.

An indication of the main activities and process flows during the defuelling phase is provided at the end of the document in Figure 1 as a ‘process wiring diagram’.

Although there are no specific R&D topics associated with defuelling these activities benefit from the generic R&D programmes managed by the Decommissioning Strategies Organisation (DSO) and referenced in the R&D Tables.

1.2.2 C&M Preps Phase:

In accordance with the Government Policy aims (for example: undertaking decommissioning as soon as reasonably practicable, removing hazards progressively and following the principles of passive safety) early progress is also planned to be made on waste management and decommissioning work following shutdown, particularly on the most active and potentially mobile radioactivity.

In parallel with defuelling, the plan is to start substantial works so as to place the site in a significantly reduced scale, passively safe state that will allow a period of quiescent C&M to be entered. The planned works include:

- The prompt encapsulation of retrieved operational Intermediate Level Wastes (ILW). The retrieval, processing and packaging of the accumulated operational Intermediate Level Wastes (ILW) that are not presently in a passively safe state. The resulting packaged waste, which will then be encapsulated into a passively safe form, will be placed in an on-site ILW store pending the availability of an off-site repository or alternative facility.
- Ponds decommissioning including the removal of fuel and retrieval and decontamination of pond skips and other miscellaneous contaminated items and to prepare the facility for demolition.
- The deplanting and demolition of the buildings within the Reactor Controlled Area (RCA) that is external to the reactor building, the majority of which are expected to be non-active bar the Ponds and AETP which will contain large amounts of LLW.
- Extensive deplanting within the reactor building, but retaining the reactor structures. The Reactor Building will be reduced back to bio-shield and primary gas circuits sealed off close to the reactors. Deplanting of all the boilers, components and outer structures, back to the bio-shield with the removed components disposed of or stored in a passively lay-down safe state until disposal path options are established.
- The deplanting and demolition of the buildings within the non-reactor/conventional area of the site.
- Implementation of a management strategy for any contaminated ground.

- Safestore preparations. Preparing the site and the few buildings remaining at the end of the C&M Preps period, for the quiescent C&M period by ensuring the buildings are weatherproof and secure and installing appropriate monitoring and security systems.
- Installation of a new Electrical and C&I Overlay systems. The existing systems are complex and cover the whole site. Such systems are reaching the end of their working life in some cases and will not facilitate safe and effective decommissioning progress. New systems will therefore be employed to provide a solid basis for site decommissioning.

To support the work undertaken during the C&M Preps period it may be necessary to construct a number of new, mainly temporary, facilities either within existing buildings or as new buildings. These may be necessary for the retrieval, processing, packaging and storage of operational ILW, and for the management of the significant quantities of LLW that results from the dismantling and demolition work. Such new facilities will be removed at the end of the C&M Preps period.

The end-state of the Site following the completion of the C&M Preps phase is a site with a much-reduced scale in terms of buildings remaining. The key remaining buildings will be the reactor building and the security gatehouse. The extent of dismantling/demolition of the removed buildings will be such that radioactive contamination will have been removed at all levels, including below ground level, and all structures removed to at least ground level with any below ground level voids made safe.

At the end of the C&M Preps period, the site will be in a passively safe state requiring minimal human intervention as most hazards, including those that were the most active and potentially mobile, will have been removed or immobilised. The remaining hazards on the site, the reactors, primary gas circuit components and packaged ILW, will be in a safe, secure, fully contained, protected and robust condition.

An indication of the main activities and process flows during the C&M Preps phase is provided at the end of the document in Figure 2 as a ‘process wiring diagram’.

1.2.3 C&M Phase:

Following the period of C&M Preps scheduled for 2019, Sizewell A will enter Care and Maintenance (C&M), a specified period where the site stays in a passively safe, quiescent state and during which no significant dismantling work occurs. This allows the radioactivity on site to decay and allows the radiological benefits to be accrued from the deferral of the final dismantling activities. Throughout the C&M phase, manned sites, surveillance and security, radiological and environmental monitoring and programmed inspection and maintenance of the buildings remaining on site is provided for.

The C&M period at the site is currently planned to continue to 2102. No major work will be undertaken during this phase except for the emptying of the ILW Store. A national ILW repository is assumed to become available during 2040, for the disposal of ILW from Sizewell A, proposed for between 2048 and 2050.

The main activities undertaken during the C&M period will be to maintain appropriate monitoring, surveillance, inspection and maintenance of the site to ensure that it remains in a safe and secure condition. Funding is included in the LTP to provide for roof and cladding replacement after a 30-year period. However, as the site will be in a passively safe state, in accordance with the principles of passive safety, the need for maintenance, monitoring and other human intervention is minimised.

The plans for the C&M period at Sizewell A have not yet been fully worked up or finalised, nor have the Regulators approved them, particularly in respect of the level of site occupancy. A cautious approach has therefore been taken and the need for a transitional period at the end of the C&M Preps phase. During this time, it will be necessary to demonstrate the continuing safety and security of the site prior to fully entering the C&M period when site occupancy can be reduced to a minimum level.

During the C&M period, Sizewell A will remain a nuclear licensed site subject to nuclear licence conditions and independent regulatory scrutiny, to ensure that safety, environmental and security standards remain high.

As part of the Lifetime Plan, Sizewell A will be undertaking optioneering work for acceleration of work scope from the C&M and FSC phases. This work will include potential for boiler removal & disposal, in addition to accelerated final site clearance studies to examine the feasibility and methodology of early FSC. A key enabler to early FSC is provision by NDA of off-site storage or final disposal for ILW packages.

An indication of the main activities and process flows during the C&M phase is provided at the end of the document in Figure 3 as a 'process wiring diagram' below.

1.2.4 FSC Phase:

Following the C&M phase, scheduled for 2102 the site will begin full dismantling and remediation in the Final Site Clearance phase, which will result in the site being delicensed and available for future use by 2110. The exact site end point for the site is yet to be agreed, but for the purposes of this TBRD, it is assumed to be a fully delicensed site for future re-use. Following the C&M period it is planned to complete the removal of the remaining buildings on the site, i.e. the reactor building containing the reactors, the reactor bio-shield and reactor components, and the internal ILW store. In order to progress this work it will be necessary to install new site infrastructure facilities, e.g. offices, workshops, waste treatment plants, etc.

The proposed technical baseline for Final Site Clearance is currently planned to commence in 2102 with completion in 2110, however as previously discussed, Sizewell A is assessing options that would allow for acceleration of FSC activities.

An indication of the main activities and process flows during the FSC phase is provided at the end of the document in Figure 4 as a 'process wiring diagram' below.

1.3 General Assumptions

- Government policy and standards, together with the legislative and regulatory environment, remain unchanged, or changes pending have no significant impact.
- Strategies will be optimised against all relevant factors as required by Government Policy.
- Strategies reflect only currently available technologies.
- Sufficient SQEP resource exists nationally to undertake the scope of work.
- Sufficient external licensed hazardous waste disposal facilities will be available to receive all hazardous material requiring removal from the site.
- The National LLW repository conditions for acceptance continue to apply unchanged; when this facility reaches the end of its working life, an alternative and equivalent site will be available.
- For planning purposes only, a deep waste repository for ILW will be available in 2040. However, the timing of actual waste disposal from any particular site will be some time

after 2040. ILW disposal will be subject to a national prioritisation framework yet to be developed.
- There will be a reasonably practicable interpretation of the 'no danger' clause in the Nuclear Installations Act 1965 (as amended) so as to facilitate delicensing.

The validity and implications of these assumptions are kept under ongoing review.

1.4 Key Site Assumptions

The key assumptions for Sizewell A site include:

New construction projects:
- The Reactor building cladding will require replacing at 30-year period intervals.
- The New Fuel Store will be converted into an ILW store where Solid ILW waste will be stored in compliant waste boxes until an UK National Intermediate Level Waste Repository is available.

Decommissioning & Termination:
- The boilers will be removed from the reactor building and be laid down, to remain there until a disposal route is available or final site clearance.
- The site will be placed into 'Care & Maintenance' phase with ongoing monitoring of the site being carried out from a remote location with periodic, routine inspections and maintenance only being carried out on the site.
- The end-state of the Sizewell A site will be in accordance with the requirements for delicensing specification. Complete removal of all contamination, removal of structures to 1m below ground level and reinstatement of site.

Waste & Nuclear Materials Management:
- Sizewell A site will be able to dispose of waste to the National ILW repository from 2048 to 2050.

The validity and implications of these assumptions are also kept under ongoing review.

1.5 Risk Management Overview

Sizewell A's processes and policies with respect to Risk Management ensure compliance with NDA procedure PCP10. They are intended to develop a risk awareness environment and culture on the site. This supports continual improvement, sharing of lessons learned and good practice throughout the Sizewell A decommissioning programme.

The Sizewell A Risk Management processes incorporate the following elements:
- Identifying risks
- Assessing risks
- Managing risks
- Reviewing risks
- Reporting risks

Specifically the TBRD risk is managed through the following framework:

- Technical risks are identified with respect to the technical maturity of the approach, the uncertainties associated with the task and factors that could influence successful completion.
- Risk impact and probability of occurrence is evaluated.

- Mitigation plans to minimise risk occurrence or impact and contingency plans should risk materialise during project execution are developed.
- Project cost includes contingency funding relative to the risk associated with project execution.
- The risks associated with a technology and any supporting R&D work are referenced and managed through the DV for the delivery of that work.

2 Technology Successes

To further demonstrate the importance of technology and technical support to the delivery of the Sizewell A Lifetime Plan, this section details of some of the successes that have been achieved at the site over the last year that were supported wholly or significantly by technical input.

- In support of developing an adequate Post Operational De-fuelling Safety Case, additional instrumentation has been designed, procured, installed and commissioned to meet the entry to Phase 2 cooling.
- Following modifications to improve fuel route equipment, 5 tons of fuel has been removed from each reactor and despatched to Sellafield. This successfully demonstrated the effectiveness of the modifications, the defuelling data logger and the administrative processes for defuelling.
- A significant amount of re-engineering has been carried out in the ponds recirculation system. New pumps, with a high level of intrinsic safety have been installed, together with many new section of stainless and ABS pipework. The recirculation and ponds level control and indication system has been significantly enhanced, providing diversity and redundancy for many functions. Also, a revised Cat 1 safety case has been written to base-line the revised fuel pond arrangements.

3 Good Practice

In the past year Sizewell A has both initiated and adopted a number of good practices. These have been shared with other Magnox South Sites through project closeout procedures and peer group meetings. For Sizewell A, this includes the following:

- Thermal insulation has been removed from the Reactor 1 and 2, A and B circuits top duct to provide bare metal surfaces to aid reactor passive cooling. Each bag of insulation has been characterised and sorted, allowing numbers to be consigned as hazardous (asbestos) but non-active waste. A small quantity with a measurable tritium burden remains in storage pending further decay and possible disposal as VLLW. This has avoided the need to consign all the material to the Low level waste repository near Drigg, as originally planned.
- To complete the renewal of the liquid discharge line requires alternative discharge and dilution arrangements that do not require the use of main CW pumps. This year, a dispersion study has been completed and presented to stake holders. This outlines the requirements for the re-engineering of the remainder of the line from the seal pit out to sea at the CW outfall.
- Following the cessation of generation, a number of hazards have been removed from site. The bulk CO2 stocks have been completely removed and the CO2 tanks vented to atmosphere. All hydrogen has been vented, and the hydrogen plant decommissioned and removed from site. Large quantities of oil have been recycled from both turbines, as well as some electrical oil. CO2 plant refrigerants have also been recovered for recycling. Some decabling has been carried out, allowing techniques and procedures to be developed. This work has been self performed.

- A team of comprising project leads, engineers and craftsmen has spent some time at Hinkley Point A site examining techniques for decommissioning fuel skips.
- The Site has liaised extensively with Dungeness A on the development of each site's Post Operational Defuelling Safety Case to ensure alignment between the similar sites including shared learning and good practices.
- The Site has continued its co-operation with National Grid, British Energy and others to facilitate the connection of the Greater Gabbard Windfarm re-utilising the Sizewell A 132kV grid connection.
- Following the generator transformer bushing failure at Oldbury, the Site has assisted Oldbury in the investigation of the event. Subsequently, advice has been offered with regard to re-using the Sizewell A Generator Transformer 1 at Oldbury, should the need arise. Use is being made of the study carried out during 2005/06 to use an Oldbury transformer at Sizewell A when there were concerns with SZA Generator Transformer 2. The Mandatory Assessment that followed this event has lead to an enhanced maintenance regime for high voltage bushings at Sizewell A.
- The Sizewell A active effluent line replacement project team has co-operated with the equivalent team at Dungeness to learn from the installation of a similar line there. Much of the technology and techniques have been copied across in the design of the proposed new line at Sizewell A.
- A small number of Sizewell A staff have supported Berkeley Nuclear Licensed Site (BNLS) resolving some of their technical difficulties within their active effluent plant area.
- Post generation, the engineering staff were reorganised into a system engineering group, with the majority seconded into project teams. The number of system engineers has been increased to support preservation of both running and orphaned plant to prevent degradation over a long period.

4 Technical Baseline Table

The Technical Baseline Table for Sizewell A is presented in Tables 1 (work that is progressing in FY 2008-09), 1A (work that is on-hold for FY 2008-09) and 1B (work that has been completed or deleted) in accordance with NDA guidance given in PCP07. The tables provide:

- A description of each major task associated with the current Baseline, with an overview of the proposed technique to be used in carrying out the work.
- Key technical assumptions explaining why the particular process has been chosen and where it has been used before.
- Technical constraints, such as infrastructure, that may limit the application of the technique.
- Areas where further work is required to underpin the proposed processes.

The tables also provide Sizewell A's judgement of Technology Readiness Level (TRL) as a guide to maturity or readiness of the proposed technique or process. NDA has defined the TRL scale between 1 and 9 (see Appendix 1). Justifying a TRL of 9 requires that the technique or process be proven through successful operations and that reliability and maintainability have been demonstrated. If a TRL of 9 cannot be justified, the gap is identified as an R&D requirement.

This development work will then support improvement of the technology maturity categorisation and the subsequent reduction in risk. It will include, for example, pilot and full scale trials, e.g. trials to be conducted on ILW retrieved from the vaults.

This also supports continual improvement in Sizewell A's technical performance with respect to identifying, developing, implementing and sharing good practice for innovations and opportunities to improve the current site baseline in terms of time and cost, safety and environmental impact. This will be incorporated into the developing lifetime plans supporting risk reduction and efficiencies in delivery of work.

The tables are divided into the areas of decommissioning work detailed in the LTP with the entry reference number matching the CWBS number of the detailed work package.

5 Research & Development (R&D) Table

The Sizewell A R& D requirements in support of the Technical Baseline are presented in Tables 2 (work that is progressing in FY 2008-09), 2A (work that is on-hold for FY 2008-09) and 2B (work that has been completed or deleted) in accordance with NDA guidance given in PCP07. The R&D requirements are described as:

- Activities needed to underpin the current Baseline (needs or risk management).
- Innovative R&D activities initiated by Sizewell A in support of acceleration and/or further optimisation of the Baseline (opportunities).

The R&D tables set out the technical need, explaining what has to be done and why, putting the technology gap into context. They provide the key outputs expected from the R&D proposals and sets out, at high level, how these outputs will be used. In addition, dates are given when the solution should be in place to allow successful action on the Lifetime Plan (which will be after the expected R&D delivery date), together with the approximate cost of delivering the completed R&D bounded in four ranges:

<£50k
£50k - £100k
£100k - £1M
>£1M

5.1 Nuclear Research Schedule work

The Decommissioning Strategies Organisation (DSO) and the Reactor Waste and Decommissioning Technology Group (RWDTG) have a major role of oversight, development and management of Waste and Decommissioning Research and Development (W&D R&D). The group provides strategic direction and oversight of Magnox Electric's generic W&D R&D programme by:

· Directing a coordinated and cost effective R&D programme within the "Reactor Sites" in support of radioactive waste management and decommissioning issues.
· Providing an inter-site forum for Magnox Electric Limited for the sharing of technology development work undertaken and led from individual sites.
· Directing the balance between longer term R&D and the needs for more immediate individual site demands.
· Providing a strategic input into R&D programmes.
· Overseeing the preparation and delivery of the Licensees' Nuclear Research Schedule (or its replacement) on an annual basis.

The specific generic work that supports Sizewell A's site's technical baseline and R&D programme by developing the TRL and the mitigation of technical risks is referenced in the R&D table. More detailed information is contained in the R&D table of the Magnox Electric Limited Waste and Decommissioning Research & Development Programme document.

References

1	NDA Strategy 2006
2	Managing the Nuclear Legacy: A Strategy for action (Cm 5552), July 2002 Review of Radioactive Waste Management Policy (Cm 2919), July 1995
3	Magnox Electric plc Quinquennial Review of Decommissioning and Waste Management Strategies: April 2000
4	Magnox Electric's Decommissioning and Waste Management Strategy: ME/S/036, 2005
5	The Magnox Operating Plan (MOP8): ME/P/001 Revision 3, July 2006
6	The Consolidated Safety Case for Reactor Post-Operation and Defuelling including Proposed Changes to Operating Rules: NP/Sc 4773 Rev. 1 Add. 2, October 2005
7	Paper of Principle for the Post Operations and Defuelling Safety Case, Minimum Safety Related Plant Requirements and Maintenance Schedule Changes: Sizewell A: NP/SC 4773 Rev.1, Stage Submission S5, October 2005
8	Options for the Management of Contaminated Asbestos Arising from Reactor Decommissioning: NSTS (03) 4490, December 2003
9	Managed Withdrawal: Electrical & Instrument Equipment Overlay: SZA/PSOR/002 Issue 1, July 2006
10	Principles and guidance for safe decabling and electrical deplanting during reactor decommissioning: RDU/SAB/G/001, 2000
11	Sizewell A Power Station Feasibility Study for On-Site Disposal of Decommissioning Wastes: Golder Associates (UK) Ltd. 04527682.507, July 2005
12	On Site Disposal Licensing Project: Sizewell A Site Inventories: CS/REP/SZA/0008/05, December 2005
13	Sizewell A Power Station Radioactive Waste Management Strategy: SZA/TR/EH/36, September 95
14	Sizewell 'A' Power Station: A Consolidated Safety Case for the Continued Operation of the Radioactive Waste Management Facilities: NP/SC 4804, August 2004
15	Decontamination Options for the Sizewell A Cooling Ponds, Post Operation and Defuelling: Nexia Solutions (06) 7634, October 2006
16	Activity Behaviour in the Fuel Element Cooling Ponds of Defuelling and Decommissioning Magnox Power Stations: RS/E&TS/GEN/REP/0045/06, March 2006
17	Ponds and AETP LLW: Decommissioning Position Statement: Fuel Cooling Ponds at Magnox Sites: RDU/S&A/GEN/REP/0035/00, March 2000
18	Ponds and AETP LLW: Decommissioning Position Statement: Active Effluent Treatment Plant at Magnox Sites: RDU/S&A/GEN/REP/0034/00, April 2000
19	Inert LLW: Best Practicable Environmental Option for the Disposal of Solid Combustible Radioactive Waste: HSED/EPB-TR/004, January 1998
20	Contaminated Land (LLW): Preliminary Investigation (Desk Study) of Land Potentially Affected by Contamination: E&T/REP/SZA/1264/04
21	The Development of Site Specific Strategies for the Long Term Management of Radioactively Contaminated Ground on Reactor Sites: DLU/REP/GEN/0021/01, March 2002
22	Study Of Options For Decommissioning And Demolition Of Sizewell A Magnox Power Station Fuel Cooling Pond Complex: SR Services Limited, March 2006
23	BPEO for Management of ILW Desiccant Stored at Magnox Power Stations: M/TE/MAG/REP/0007/99, February 99
24	BPEO for Management of Sludges at Bradwell, Dungeness A, Hinkley A, Oldbury and Sizewell A Power Stations: M/TE/GEN/REP/0018/99, May 99
25	Decommissioning of Liquid Waste Storage Tanks on Magnox Reactor Sites – Consideration of End-points for Care and Maintenance Preparations: BNFL.ENVT.SERVS/ET/REP/GEN/0813/03, June 2004
26	Decommissioning of Solid Waste Storage Vaults on Magnox Reactor Sites - Consideration of

	End-points for Care and Maintenance Preparations: BNFL.ENVT.SERVS/ET/REP/GEN/0812/03, March 2004
27	Review of Mobile Plant for Wet & Solid ILW & Recommendations to Support Decommissioning: ES/ET/REP/0261, April 2002
28	Best Practicable Environmental for management of Ion Exchange Material at Bradwell, Dungeness 'A', Hinkley Point 'A' and Oldbury 'A': M/TE/MAG/0056/98, 1998
29	Best Practicable Environmental for Management of ILW Sludges stored on Operating Magnox Power Stations: TE/GEN/REP/0010/98, 1998
30	A Review of Wet ILW Management on Reactor Sites: REM(S)034, 2005
31	Wet ILW Dewatering & Encapsulation Plant: ES/ET/REP/TRA/0458/02, April 2004
32	NIREX Advice Report: Proposals for Packaging of IONSIV Cartridges arising from the Operation of Submersible Caesium Removal Units (Stage 2 Submission): NXA/452967, June 2004
33	Review of BNFL Inc Report on Wet ILW Retrieval & Disposal: NDCU/E&T/EAN/MAG/0080/1
34	Strategy for the Management of Fuel Element Debris at Bradwell, Hinkley Point 'A', Oldbury and Sizewell 'A' Power Stations: RDU/S&A/GEN/REP/0037/00, 2000
35	Care & Maintenance Preparations for Magnox Reactor Sites: Recommendations for the decommissioning of underground structures and Services: BNFL.ENVT.SERVS/ET/REP/GEN/0960/04, 2004
36	Nuclear Derivation of the Radiological Impact Parameters used in the Best Practicable Environmental Option Review for Decommissioning of Magnox Power Stations: RDU/S&A/GEN/REP/0006/99, 1999
37	Reactor Building Safestore, Technical Guidance Document: RS/LSPM/GEN/REP/0182/05, December 2005
38	Generic Specification for entry into Care & Maintenance: RS/E&TS/GEN/REP/066/05 January 2006
39	Proposals for remote monitoring of Decommissioning Magnox Sites during the Care and Maintenance Period: M/RS/GEN/REP/0030/03, 2003
40	Revised Reactor Decommissioning and Waste Management Objectives and Principles Magnox Executive Team Meeting Paper: ET 701, April 2003.
41	MAC: BPEO for Management of Miscellaneous Activated Components stored on Operating Magnox Power Stations: RDU/S&A/GEN/REP/0007/99, September 99
42	Final Site Clearance: Best Practicable Environmental Option for Decommissioning of Magnox Power Stations: M/TE/GEN/REP/0055/98, December 1998
43	Arrangements for the development of Waste Management and Decommissioning Strategies for Magnox reactor sites: LS/MI/004, 2005
44	Guidance for Care and Management of ILW Packages: Approved Code of Practice: ET/ACOP/001, Issue 2, October 2004
45	Berkeley Power Station Decommissioning 1988 to 1993: GEN/93/001
46	CDDC Decontamination Manual for Berkeley Power Station Ponds Decommissioning: DECOM/06/01, Dec 2001
47	Berkeley Report of Cooling Ponds Clean-up & Demolition: BK/ED/191, 2003
48	Berkeley Power Station Decommissioning Experience: BK/RD/69
49	Sizewell A Power Station Pre-Decommissioning Plan: Deferred Safestore Decommissioning Strategy: TB/ETB/REP/1106, September 1994
50	Deferred Safestore Decommissioning Strategy: Stage 3: Safestore / Non-Reactor Dismantling Studies: ETB/SS/F6090, January 1993
51	Deferred Safestore Decommissioning Strategy: Reactor Block Dismantling Study for Sizewell A NPS: ETB/SS/F6012, October 1992
52	Interim Review of Management Strategy for Redundant Primary Circuit Components: BNFL/ENVT.SERVS/ET/REP/GEN/1066/04, March 2004

Figure 1: Defuelling Wiring Diagram

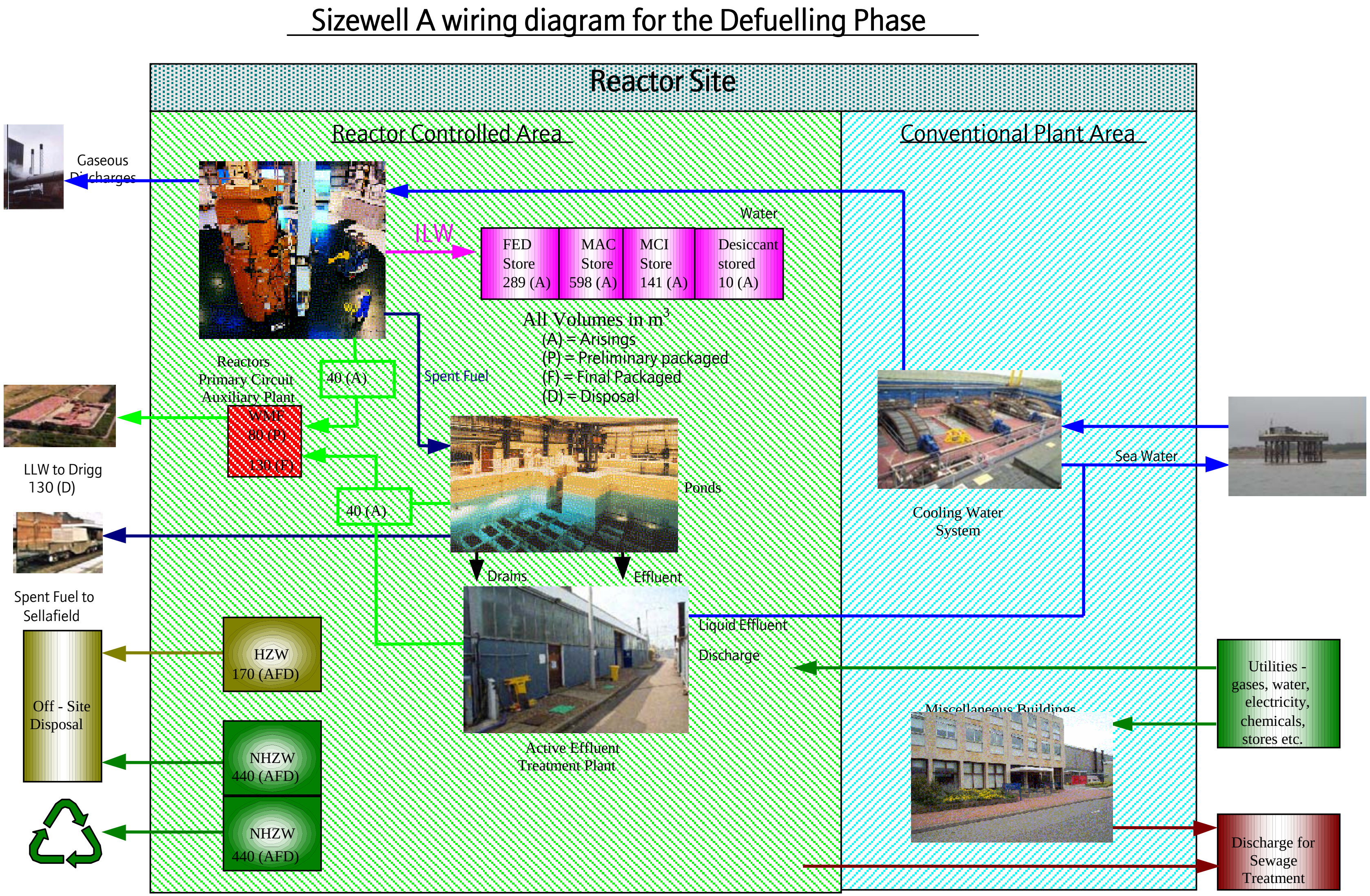


Figure 2: C&M Preps Wiring Diagram

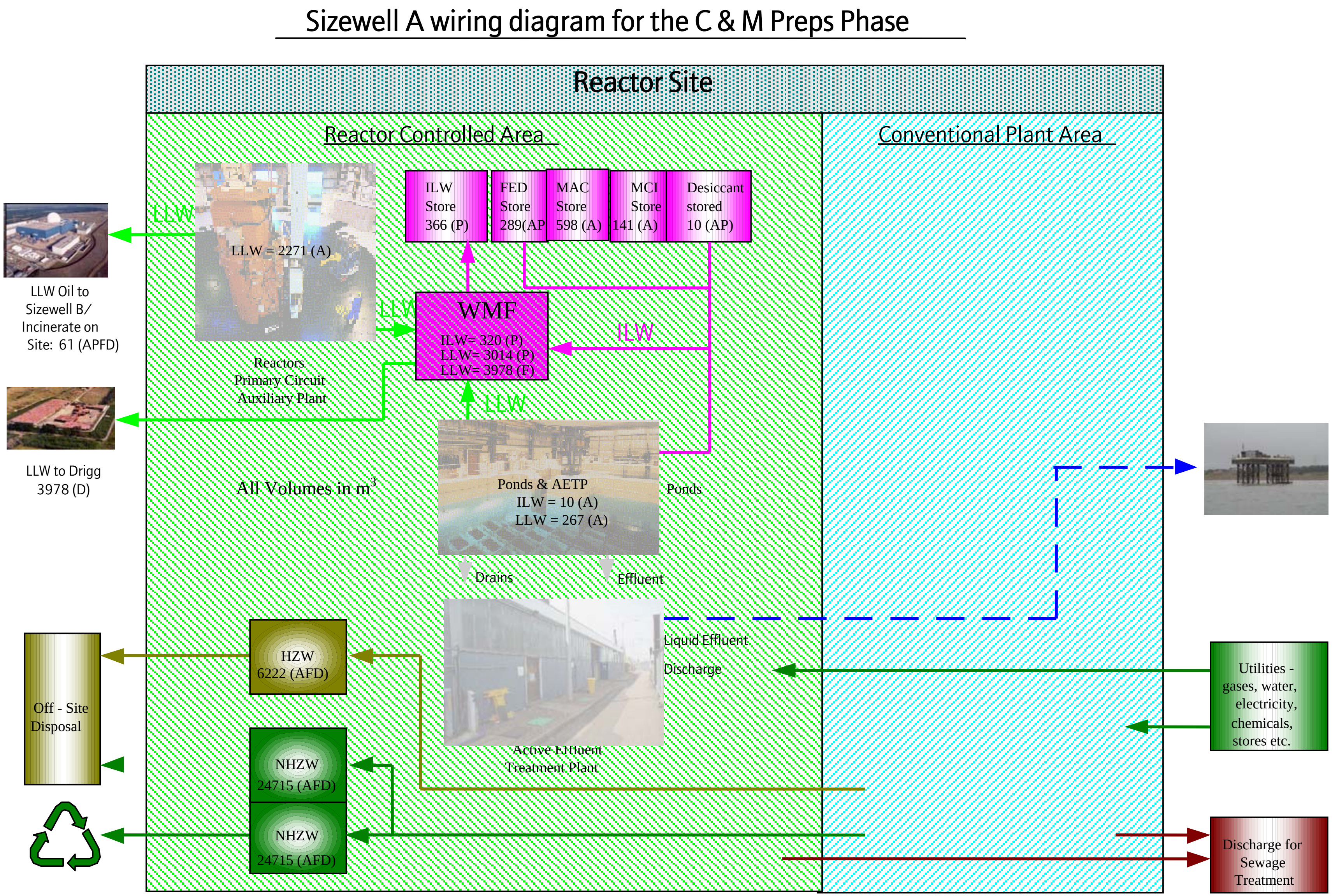


Figure 3: C&M Wiring Diagram

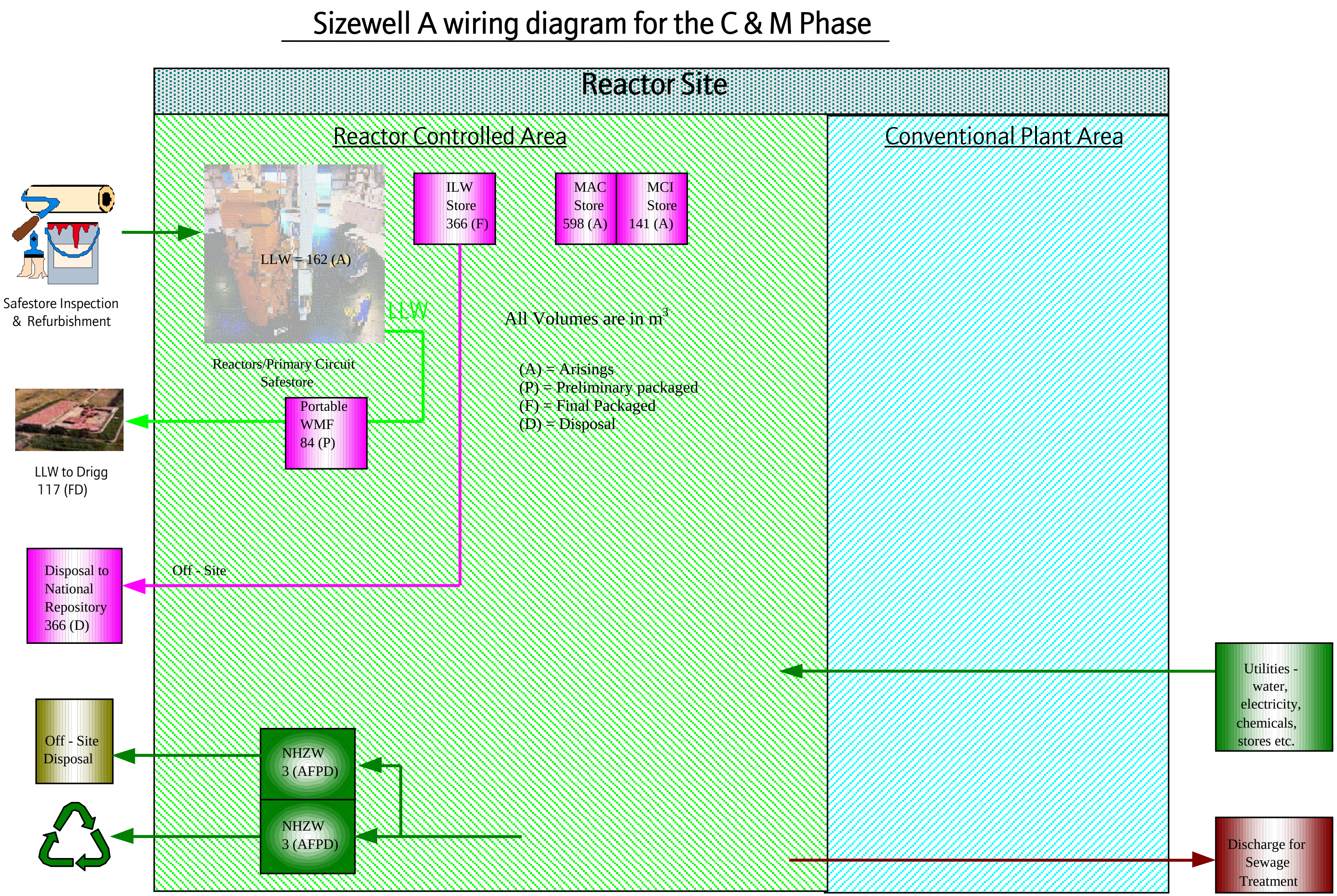
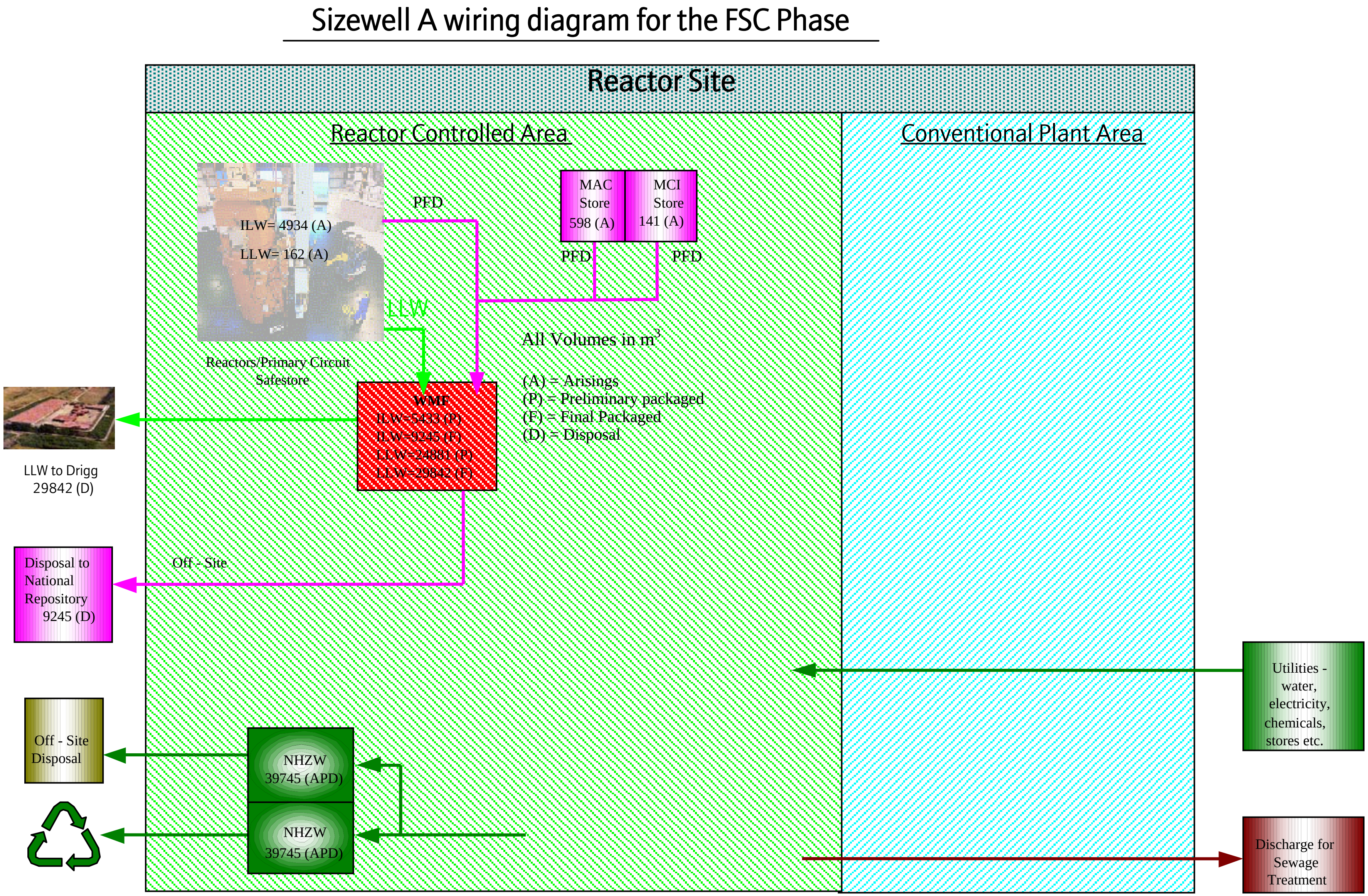


Figure 4: FSC Wiring Diagram



Appendix 1: Technology Readiness Levels Table

NDA Guidance from PCP-07
Technology Readiness Levels Table (TRL)

Basic Technology Research	Level 1	Basic principles observed and reported
Research to Prove Feasibility	Level 2	Technology concept and/or application Formulated
	Level 3	Analytical and experimental critical functions and/or characteristic proof of concept
Technology Development	Level 4	Component and/or bench validation in Laboratory environment
Technology Demonstration	Level 5	Component and/or bench validation in relevant environment
	Level 6	System/subsystem model or prototype demonstration in relevant environment
System/Subsystem Development	Level 7	System prototype demonstration in an operational environment
System Test & Operation	Level 8	Actual system completed and qualified through test and demonstration
	Level 9	Actual system proven through successful operations e.g. through reliability and maintainability demonstration in service

Table 1: Sizewell A Technical Baseline – Work progressing in FY 2008-09

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
1)	**Passive Cooling**	**Completed – see Table 1B**						
2)	**Managed Withdrawal**	**Overview:** On cessation of generation, large parts of the plant become redundant. As the defuelling period progresses, and commencement of passive cooling on both reactors, the amount of redundant plant increases to a point when very little operational plant is outside the Inner Security Barrier (ISB). This provides the opportunity to commence decommissioning and demolition of those redundant plant items. Once the passive safety case requirements have been achieved, all plant and accommodation south and east of the ISB becomes redundant, bar a few remaining services that will be required for some time in the future. The managed withdrawal project involves the re-engineering of these plant systems such that the reactor/ISB and a few areas to the west of the site are self-contained. Wholesale isolation of the conventional plant areas can be achieved, thus splitting the site into an operational area inside the ISB, and a conventional demolition project outside the ISB.						
	Managed withdrawal: people	**Completed – see Table 1B**						
27/27301 27/27223 27/27224 27/27225 27/27226 27/27227	Managed withdrawal: plant	Passive Cooling	Re-engineering of active and non-active liquid discharges output from the sewage plant shared with Sizewell B, will be discharged through a new line discharging directly at the CW outfall structure. Alternative power supplies including the electrical supply to the site, some mechanical services, water supplies and cooling arrangements will be required.	9	Compressed air systems, fire detection and suppression systems, public address systems, and emergency lighting systems will be supplied from within the Reactor Building.	The supply of demineralised water of sufficient quality by an package water treatment plant may not be sufficient for decommissioning requirements. Reduction of plant inventory to that required for defuelling, and then site support only.	Agreement cannot be reached with stakeholder for the discharge of liquid effluent at the CW outfall structure without the need for forced dilution using CW pumps. The continuing use of existing CW system could delay decommissioning.	
27/27200 27/27201	Top Duct Asbestos Strip	Passive Cooling		9	Disposed of as LLW via Winfrith for super-compaction to LLWR, or as Hazardous Waste to licensed landfill.	Waste monitoring per bag to assess level of Tritium activity, will determine the amount of asbestos requiring disposal as LLW.	Tritium characterisation of the boilers, conducted in January 2007, will give guidance to tritium contamination of rest of boilers.	Ref. 8
3)	**Electrical Overlay System**	**Overview:** The existing electrical supply system at Sizewell A Site is an ageing, complex and widespread system, large parts of which can be made redundant when the passive cooling state has been achieved. The Electrical Overlay System will take power from Sizewell B. This will be done using some existing switchboards and cable routes, bringing power directly into the reactor building through two new transformers. Many of the telecommunications and IT cable routes run through the turbine hall and other conventional plant areas. All of these systems will have to be re-routed from off site via safe routes to new telephone exchanges and IT hubs situated with the new accommodation in the north west corner of the site. The system will enable isolation of the existing station electrical supplies and provide a safer environment to carry out de-cabling and de-planting works. It allows for the isolation of the ageing high voltage equipment and the subsequent removal of the compulsory maintenance regime currently undertaken ensuring the safe condition of this equipment. Final isolation and disconnection of the old supply cables will allow the Turbine hall to be available for demolition.						Ref. 9
27/27217 27/27218 27/27219 27/27220 27/27221 27/27222	Installation	**On hold – see Table 1A**						

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
4)	**Conventional Plant Area Deplant and Demolition**	**On hold – see Table 1A**						
5)	**ILW – Retrieval and Processing**	**On hold – see Table 1A**						
27/27367	Opportunity for FED Dissolution		An opportunity for processing FED by dissolution exists at Sizewell A, based on the techniques used at Dungeness. Work will be undertaken to specify, tender and contract out to design a dissolution plant for Sizewell A. Additional work will be undertaken on stakeholder management and approval for the disposal route of all by-products.	4	High activity components are limited in volume/number. No irradiated fuel in FED.	Dissolution plant limited to civil arrangements of the vaults structure. Water supply adequate.	Characterisation of FED not fully resolved. See Generic R&D ref: MEL W&D R&D programme document	Generic R&D ref: MEL W&D R&D programme document
6)	**Ponds Skips and Miscellaneous Contaminated Items (MCI)**	**On hold – see Table 1A**						
7)	**Ponds Decommission-ing**	**On hold – see Table 1A**						
8)	**Other Low Level Wastes**	**On hold – see Table 1A**						
9)	**Radiation Controlled Area (RCA) Deplant and Demolition**	**On hold – see Table 1A**						
10)	**ILW Store**	**On hold – see Table 1A**						
11)	**Contaminated land**	**Overview:** The nature and extent of radioactively and other (such as Hydrocarbons etc.) contaminated ground (and/or groundwater) varies greatly from site to site (and within sites). Sizewell A will generate sufficient characterisation data for areas of contaminated ground on the site. This will aid the selection of the preferred option(s) to ensure passive safety during Care and Maintenance and takes account of the intention to de-license the site during Final Site Clearance.						Ref. 4 (Appendix A)
27/27354	Borehole sampling and characterisation		Non-radioactive (chemical) and Radioactive ground contamination characterisation work is essential. This includes a desk-based review of historical information on historic spills/leaks contaminated ground management, monitoring and site hydro geological mapping followed by intrusive and non-intrusive characterisation intrusive methods (e.g. surface radiological surveys, borehole investigations).	9	Further hydro geological characterisation and a comprehensive sampling and assessment programme of new and existing boreholes will be required.	The Contaminated Land Desktop Study carried out in 2004 investigated the site and identified areas for potential concern for both radiological and non-radiological contamination.	Adequate characterisation techniques are essential to ensure the correct amount of remediation is performed.	SZA Investigation: Ref. 20 Guidance: Ref. 21
27/27354	Remediation	**On hold – see Table 1A**						
12)	**Back to Bio-shield**	**On hold – see Table 1A**						
13)	**Safe Store Preparations**	**On hold – see Table 1A**						

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
14)	**Care & Maintenance**	**On hold – see Table 1A**						
15)	**Final Site Clearance**	**On hold – see Table 1A**						
16)	**Site End State**	**On hold – see Table 1A**						

Table 1A: Sizewell A, Technical Baseline: Works on-hold during FY 2008-09

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
1a)	**Defuelling**	**Overview:** Following the cessation of generation, the major constraint to the removal of plant from service is the requirement to maintain fuel condition. \The purpose of the defuelling programme is to remove all fuel elements from the two reactors and dispatch to Sellafield by March 2011, in accordance with MOP 8. This will remove 99.9% of the radiological hazard from site.						
	Dispatch of fuel to Sellafield	Passive Cooling	Defuelling operations are similar to those used during refuelling. Commissioning of new equipment was completed in 2007-08	9	No significant issues at Sellafiled causing delays to the site programme.	Removal of stuck elements may require modification to existing equipment.		
3)	**Electrical Overlay System**							
27/27217 27/27218 27/27219 27/27220 27/27221 27/27222	Installation		The system will provide electricity supplies to the existing plant items that are required for decommissioning. The key safety feature of this installation is that it will be marked along its routes and be clearly distinguishable from existing installations.	9	An enabler for the electrical overlay system is incorporated in the Defuelling Safety Case.		Agreement with British Energy is needed for the Electrical Overlay System to take power from Sizewell B, Alternative options need investigation.	Ref. 6 Sizewell specific development/agreement work ref: R&D 3.1
4)	**Conventional Plant Area Deplant and Demolition –** **On hold**	**Overview:** After Managed Withdrawal is complete, the areas made redundant, vacated and isolated, they will be able to be decommissioned using conventional demolition means. These facilities will be surveyed and characterised to remove and isolate hazards such as asbestos and electricity. The entire area will be islanded from Reactor systems. Plant and equipment in remote buildings will be removed using standard industry techniques involving both manual and mechanical means as deemed appropriate. Recycle and reuse of materials will be maximised. The CW Systems will be demolished as part of the conventional plant disposal. The offshore structures will be removed to 1m below seabed level. The tunnels external to the site boundary will be made safe, in a manner to be agreed, such that the public would not be put at risk from inadvertent structural collapse. Tunnels and other voids within the site boundary would be backfilled with rubble and concrete as appropriate. Consideration is being given to the development of an engineered on-site waste disposal facility for certain categories of waste. Boundaries, scope and end state are still to be defined. Work packages appropriately tendered and contracts let. Demolition will be performed using industry standard techniques.						
27/27307	Characterise and hazard removal		These facilities will be surveyed and characterised to assess hazardous material content, scope of work, risk assessments etc. A hazard reduction campaign will be carried out to remove and isolate hazards such as asbestos and electricity.	9				
27/27303 27/27304	Isolation: Removal of the	Passive Cooling	Isolating and islanding the conventional plant areas made redundant to allow for demolition. The demolition	9	This work to be jointly undertaken by Station Staff,			Ref. 10

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
27/27305 27/27306	Plant from the System		of the conventional plant areas will be done under contract.		directly supported by additional specialist contract labour.			
27/27303 27/27304 27/27305 27/27306 27/27307	Conventional Demolition	Isolation	Numerous items of plant and buildings outside the RCA require demolition during the C&M Preps phase. Deplant & Demolition of the Turbine Hall will be a major activity within this area. Demolition of the facility will result in a significant 'void' (~30,000m^3) within the turbine hall basement. Within this technical baseline the void will be in-filled with non-hazardous (inert) demolition wastes such as building rubble and soil.	9	Conventional demolition practises will be used throughout the project and voidage backfilled using inert demolition wastes.	Demolition to an agreed brown/green field site condition, and possible engineered waste disposal facility	Development of the project is required to determine the amount of remediation required before implementation.	Ref. 35
27/27355	On-site storage		An engineered on-site waste disposal facility for certain categories of waste, such as inert LLW, thus reducing the amount disposed of to the LLWR and the amount of backfill required to be brought onto site. Current thoughts are to dig a new facility where the existing National Grid Switch-house is situated. The spoil from this new build will be used to backfill the Turbine Hall.	2	This proposal is only at the conceptual stage, and work will be undertaken to agree, examine and develop the possibilities for on site disposal.	Definition of the end point, to continue the demolition to an agreed brown/green field site condition, or to convert a structure into an engineered waste disposal facility.	It is necessary to obtain a number of approvals and authorisations prior to any possible implementation. Progressing generic R&D managed by DSO: Ref MEL W&D R&D programme document	Ref. 11 & 12
5)	**ILW – Retrieval and Processing** **On hold**	**Overview:** The Intermediate Level Waste (ILW) project involves the design, procurement, construction, commissioning, operation and ultimate decommissioning of plant and equipment to retrieve ILW from current storage locations and package in Nirex approved containers, to be transported to the on-site interim ILW store. ILW retrieval and processing is expected to be undertaken by Station Staff, supported by specialist contractors. Test facilities in support of waste retrieval and encapsulation are in place with NSG Environmental to use full scale simulations of waste and containers Industry specific techniques will be governed by working in accordance with regulation. Specific technical detail is taken account of in the preparation of project plans. These waste forms comprise of: • Fuel Element Debris (FED) in the Splitter Vane Stores (SVS). • Desiccant and Catalyst from the Gas Conditioning Plants (GCP) • Ionsiv Resins cartridges in the ponds • Sand and Gravel from the Sand Pressure Filters (SPF) in the AETP During the operational lifetime of Sizewell A Power Station, Intermediate Level Waste has been accumulated in the voids around the reactors, which are accessed from Pilecap. These Miscellaneous Contaminated Items and Miscellaneous Activated Components will be left in situ until FSC to benefit from economies of scale when processing the bulk of FSC work. At this time there will be easier access and the further decay of isotopes. Some of the waste will be able to be reclassified to LLW at the time of retrieval. A safety case for the long term safe storage of Combustible Active Waste (CAW) needs to be made so this waste can be retained in situ until FSC as above. Technological opportunities in wet and dry waste management and treatment is generic work being progressed by the DSO Ref: Ref MEL W&D R&D programme document						Ref. 13 & 14 Ref. 27, 28, 29, 30, 31, 32 & 33 Ref. 41
27/27351 27/27352 27/27353	Fuel Element Debris (FED)	Nirex Containers	Retrieval Equipment - The retrieval techniques will be based on those at Dungeness A. The facility will be a ventilated structure with shielded containment, situated over the SVS cells and the retrieval and sorting equipment based on existing technology. The retrieval grab will retrieve quantities of FED, which will be dose rate monitored, before it is removed from the cell. The FED will be placed on a table, washed to remove sludge to a collection tank and sorted, using remote means, to remove any high activity components (Nimonic springs,	8	The retrieval work inside the facility will be limited to R2/C2. The FED Magnox metal will be treated as ILW, although it is possible that it may be acceptable as LLW for disposal, once sorted.	Concept of delayed encapsulation is not acceptable to the regulators and other key stakeholders. The ILW material needs to be promptly encapsulated after retrieval. Alternative exit strategies such as dissolution with and without a discharge will be	Prompt Encapsulation is covered below. Alternative exit strategies such as dissolution with and without a discharge will be developed to ensure the material is dealt with in a safe, environmentally acceptable and cost	Ref. 26 & 34

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
			thermocouple wires, etc.), which will be placed in a separate shielded NIREX drum. The washed Magnox (> 99% volume) will be drained, dried and put into a suitable NIREX container. The filled containers will be closed, decontaminated and monitored out of the facility, and then lowered to the base of the SVS building, before transfer across site to the ILW Store.			developed to ensure the material is dealt with in a safe, environmentally acceptable and cost effective manner.	effective manner. See overview for progressing R&D reference. On hold site specific development work ref: R&D 5.1	
27/27353	Cross-site transporter		A standard industrial transporter will be developed with the necessary modifications to ensure all safety criteria have been adequately catered for, to carry an overpack to safely transfer the Nirex boxes and interface with the ILW Store.	8	The transporter will be based on commercially available vehicles	Meeting the requirements of the Approved Code of Practice for handling Nirex Containers.	Detailed design of the equipment.	Ref. 44 Sizewell specific development/agreement work ref: R&D 5.6
27/27351	Nirex Containers	ILW Store	Standard Nirex boxes will be utilised to facilitate intermediate term storage in the ILW store. The containers will be inspected periodically whilst in storage, until disposed of to the ILW Repository in the C&M phase.	7	Current strategy is to retrieve the ILW and place in standard Nirex boxes for the period of passive storage.	Current Nirex box designs are being re-evaluated, to optimise grout loading ports and box handling and stiffness issues.	Compliance in meeting the Nirex requirements is essential and easier methods of this are being investigated. See overview for progressing R&D reference.	Ref. 44
27/27355	Prompt Encapsulation		The waste will be promptly encapsulated prior to ILW Storage. This storage policy precludes any options for the final treatment of the waste prior to disposal to an ILW repository during C&M.	7	There are no viable alternative disposition options and the waste has to be encapsulated to achieve passive safety.	Encapsulation Plants are already built around the company although they are over-designed for Sizewell A's needs.	Develop and build a suitable encapsulation plant. Secure agreement for supplies and formulations of encapsulation material. See overview for progressing R&D reference. On hold site specific development work Ref R&D 5.3	
27/27350	Desiccant and Catalyst	Nirex Containers	This will be recovered from the GCP and gas driers and repackaged in Nirex approved containers using a pneumatic or vacuum conveying system, readily available and previously utilised on site. Previously drummed waste will be transferred from the Active Ash store to the decontamination workshop where it will also be repackaged into Nirex approved containers. Each container will have a measured amount of waste so that future encapsulation can be done, if required for disposal as ILW.	8	Working conditions for this operation is expected to be R2/C3. These containers will be transferred to the ILW store once it is available for use. There is no intention to encapsulate the waste at this time, to maximise tritium decay, for possible LLW disposal.	The waste will be stored until a national ILW repository is available. At this point it will be encapsulated in its Nirex containers if it is still classified as ILW and cannot be disposed of as LLW.	Alternative Treatment Options to dispose of Desiccant and Catalyst are being investigated, such as high temperature or washing / drying processes to de-tritiate the waste and be able to dispose of it as LLW. See overview for progressing R&D reference.	Ref. 23

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
27/27251	Sand and Gravel	Ponds & AETP decommis sioning	This will be ILW when removed from the AETP Sand Pressure Filters and will be backwashed to lower the doses and encapsulated into drums, to enable reclassification and disposal as LLW to the national Repository.	7	Working conditions for this operation is expected to be R2/C3.	Transfer of the waste from the SPF's will be using a pneumatic or vacuum conveying system into drums for encapsulation.	Develop treatment and disposal techniques for resins, sands and gravels from the AETP. On hold site specific development work Ref R&D 5.5	Ref. 13
27/27251	Sludge	Ponds & AETP decommis sioning	Sludge will be accumulated from the FED recovery, the Ponds, AETP tanks and Active Drains and will be mobilised and encapsulated in cement. Sludge was previously retrieved in 2006 and encapsulated in 200 litre drums with a sacrificial paddle and disposed of as LLW.	8	The encapsulation process will lower the sludge from ILW to LLW, suitable for disposal to the LLWR, as the cement will decrease the activity per weight.	No TILWSP will be used. Simple technology such as macerator or diaphragm pumps will be used to mobilise and transfer the sludge into drums.	Characterisation of the sludge is essential to ensure it can be re-classified as LLW after encapsulation. See overview for progressing R&D reference.	Ref. 24
6)	**Ponds Skips and Miscellaneous Contaminated Items (MCI)**	**Overview:** The scope of work includes retrieval, decontamination, processing and disposal of spent Magnox fuel skips, the Submersible Caesium Removal Unit (SCRU), other loose furniture in the ponds and spent pre and post filters. This will lead to a reduction in site hazards. Removal of the equipment from the ponds is critical path and enables the ponds to be decommissioned. The project will utilise standard commercially available products wherever possible in order to reduce design and procurement lead times and reduce the risk exposure to unproven/test products. Industry standard transfer equipment will be used for transferring waste to the decontamination workshop. Technological opportunities in wet and dry waste management and treatment is generic work being progressed by the DSO Ref: Ref MEL W&D R&D programme document						Ref. 15 & 16 Ref. 17
27/27255	Skips	All Fuel off site	The skips will be recovered from the Ponds and will be decontaminated, to reduce them from ILW to LLW, so they can subsequently be disposed of to the National LLW repository. Preferably, a central processing facility, maybe at Sellafield, would be developed and skips sent empty in flasks towards the end of the defuelling cycle so that all skips in the ponds can be disposed of after defuelling.	4	Decontaminate skips utilising a High Pressure Water Jetting (HPWJ) facility, as trialled at Hinkley Point A. This is a standard proven product from the car industry and has proven very reliable all over the world to date. The most onerous working conditions for this are expected to be R2/C3.	This process will remove the paint from the skips, which will then be centrifuged out of the liquid and drummed for disposal. This will be treated as per sludge already in the station tanks. Company level requirement to determine the viability of Sellafield having a skip disposal route.	A ultra high pressure water jet (UHPWJ) robotic system for decontamination. Other projects are focussing on melting metal skips for future use as recycled metal in the nuclear market. Metal melt can also be applied to ponds furniture, if viable. See overview for progressing R&D reference. On hold site specific development work Ref R&D 6.1	
27/27255	Non-Fixed Pond Furniture		Pond furniture, which is not fixed to the Ponds floor, such as the Submersible Caesium Removal Unit (SCRU), power tongs and platforms etc., will be decontaminated using standard decontamination methods to dispose of them to the National LLW repository. Other contaminated items will be treated on a case by case basis.	6	Working conditions are not expected to exceed R2/C3. The processing of ponds furniture and other active wastes will largely be undertaken by Station Staff, supported by Specialist contract staff.	Decontamination via conventional methods wherever possible with due consideration of ALARP, environmental impact, safety, cost and schedule as appropriate.	Development and implementation of the potential to dispose of the metal through melting and recycling. See overview for progressing R&D reference.	
27/27255	SCRU Pre and Post Filters		The Submersible Caesium Removal Unit (SCRU) filter units are currently stored in skips in the Ponds. Most spent filters will be LLW when removed from the ponds although a few may be ILW and require cleaning. All	7	The expected working conditions should not exceed R2/C2. ILW filters, above LLW	The use of a Nitric acid bath to clean ILW filter process, as trialled at Hinkley Point A, to lower the activity of	Characterisation/activity assessment of SCRU filters is required. Potential to dispose of the metal through	

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
			filters will then be bagged and disposed of to the National LLW repository.		disposal limits will be cleaned, to lower their activity	the filter units to LLW will be reviewed for its applicability to Sizewell A.	melting and reuse. See overview for progressing R&D reference. On hold site specific development work Ref R&D 6.2	
27/27255	Ionsiv cartridges	All Fuel off site	IonSiv cartridges are from the Submersible Caesium Removal Unit (SCRU) and are currently stored in Skips in the Cooling Ponds. These are categorised as ILW and will be placed in Ductile Cast Iron (DCI) drums in the Flask Passage using remote means, where they will be encapsulated. This work will be done remotely to limit operator dose.	4	Dealt with in line with company policy now being developed. The polymer encapsulation technology has been proven and a Letter of Compliance applied for. Developments with cementation entombment in 500L stainless steel drums are being monitored to see if this gives a preferred option.	Physical movement of the IonSiv cartridges from the ponds into the DCI drums for polymer encapsulation.	A trial plant needs to be built to demonstrate the methodology required for this waste. See overview for progressing R&D reference. On hold site specific development work Ref R&D 5.4	Ref. 32
7)	**Ponds Decommission-ing** **On hold**	**Overview:** The scope of the Ponds Decommissioning Project is to remove all of the fixtures and contaminated material from the Pond Buildings, to prepare the buildings for demolition followed by demolition of the structures. This includes the Ponds building and Active Effluent Treatment Plant (AETP). The baseline strategy for this work is based upon the full decontamination, decommissioning and demolition work of the ponds at Berkeley Power Station. Details of the radiological decontamination and decommissioning techniques are referenced, as well as a possible decontamination and demolition strategy study conducted at Sizewell A. All tasks associated with Ponds Decommissioning will be readily achievable using commercially available and proven technologies and methods. ALARP will be applied to all radiation hazard tasks and may result in minor modifications to existing technologies to enhance worker protection. The demolition of the ponds and similar structures is expected to be undertaken under specialist contract. Technological opportunities in wet waste management and treatment is generic work being progressed by the DSO Ref: Ref MEL W&D R&D programme document						Ref. 15, 16, 17 & 18 Ref. 22, 46 & 47
27/27250	Washdown Bay and Flask Handling Crane	All Fuel off site	Standard Characterisation methods are to be followed by decontamination.	9	Successful decontamination is to be followed by conventional demolition.			
27/27254	Fuel Discharge routes	All Fuel off site	Characterisation will occur in parallel with decontamination. After best decontamination effort to reduce radiation hazard, controlled demolition methods are to be used for removal of contaminated piping, typically using bag and cut methods.	7	Standard abrasive methods to be typically used inside piping or ductwork (hydrolasing, grit blasting, or other).	Minimisation of secondary waste during decontamination efforts.	Internal Pipe cleaning / large surface decontamination techniques need development. See overview for progressing R&D reference.	
27/27254	Clean and Drain Pond	All Fuel off site	The pond walls are to be decontaminated as far as practical, before draining to minimise the radiological hazard.	6	The ponds will then be drained and a fixative applied to support further decontamination.	Clearing of the sludge and then the filtration of the drained pond water and the longevity of these filters.	Development work for decontamination techniques for the pond structures, such as UHPWJ, to minimise radiation hazards prior to draining. See overview for progressing R&D reference. On hold site specific	Ref. 15

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
							development work Ref R&D 5.4	
27/27254 27/27255	Remove fixed Pond Furniture	Clean and Drain Pond	The existing methodologies already developed within the project for handling skips and other LLW will be reviewed and enhanced to accommodate any differences from these that are associated with Pond Furniture	6	Pond furniture will be decontaminated using standard decontamination methods to dispose of them to the National LLW repository.	Decontamination via conventional methods will be with due consideration of ALARP, environmental impact, safety, cost and schedule as appropriate.	Development and implementation of the project. See overview for progressing R&D reference. On hold site specific development work Ref R&D 6.1	
27/27254	Decontaminate Pond Structure	Remove fixed Pond Furniture	The depth of contamination into the concrete will be characterised and removed using scabbling methods as demonstrated at Berkeley Power Station. This waste will be disposed of as LLW to the national repository.	6	The bulk of the contamination from the ponds will be removed.		Demonstrate removal using scabbling methods. On hold site specific development work Ref R&D 7.1	Ref. 22
27/27250	Remove Active Effluent Treatment Plant	Clean and Drain Pond	Characterisation of the equipment and structures will be performed. Decontamination of equipment internals will be done using standard methods	6	Contaminated equipment and piping will be removed and size reduced typically using bag and cut methods.	Develop methods of flushing, hydrolasing or chemical cleaning for decontamination.	Further development work will be undertaken to decontamination techniques for the pond structures. On hold site specific development work Ref R&D 7.1	Ref. 25 & 26
27/27254	Demolish Ponds Structure	Decontaminate Pond Structure	Based on the success of the decontamination, an evaluation will be made to determine if either conventional demolition or contaminated demolition will be used.	6	This evaluation will balance cost, schedule, ALARP and BPM	Additional characterisation is required to base the evaluation on.	Determine how much additional decontamination is required for contained demolition. On hold site specific development work Ref R&D 5.2	Ref. 22
8)	**Other Low Level Wastes** **On hold**	**Overview:** Most LLW will be dealt with by conventional methods using existing facilities. Due to the limited space on site, co-ordination of the LLW processing and storage of ISO containers within the ISB is essential. Plant enhancements will be carried out to maximise throughput of process areas. FED, Sludge and MCI located in the ponds will be retrieved using suction or grab mechanisms, segregated and treated for disposal as described above. Technological opportunities in wet waste management and treatment is generic work being progressed by the DSO Ref: Ref MEL W&D R&D programme document.						Ref. 13, 14 & 19
27/27356 27/27354	LLW Treatment and Disposal		The waste will be transferred into ISO containers in the decontamination workshop facility, which will be used for segregation, size reduction and packaging of all wastes including those from RCA clearance.	8	The waste will be disposed of to the National LLW repository.	Development of the retrieval, segregation and treatment of LLW Wastes.	See overview for progressing R&D reference. On hold site specific development work Ref R&D 6.2	
27/27251	Ion Exchange material	Clean and Drain Pond	IX resins will be will be regenerated with acid to reduce their activity and then retrieved from the AETP after Ponds clean up.	6	Ion exchange resins in the AETP will be encapsulated for disposal as LLW.	Only small quantities of IX resin can be encapsulated in large containers.	Develop polymer encapsulation or mixing resin with sludge for disposal. See overview for progressing	Ref. 28

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
							R&D reference. On hold site specific development work Ref R&D 5.5	
9)	**Radiation Controlled Area (RCA) Deplant and Demolition**	**Overview:** There are a number of facilities within the RCA that will be deplanted and demolished during C&M Preps, such as the Electrical and Switchgear Annexes and Reactor Control Annex. The majority of the plant within the floors of the Reactor Building itself will also be deplanted although the reactor building itself will be left standing. Industry specific techniques will be governed by working in accordance with regulatory requirements. Radiological and other hazard characterisation will be undertaken. Isolations will be made in accordance with the Magnox Electric Safety Rules and Guidance from the Ionising Radiations Regulations (IRRs) Code of Practice. Radiological, chemical and industrial hazards will be will be removed to enable subsequent deplanting and demolition of the facilities. In the reactor building, sections of plant can be isolated as they cease to be required for operational purposes. However, as the opportunities for the use of wholesale isolation techniques to be used in the turbine hall will be less, and with the additional restrictions imposed by radiological conditions, the decommissioning and removal of plant within the ISB will be more involved. Technological opportunities in wet waste management and treatment is generic work being progressed by the DSO Ref: Ref MEL W&D R&D programme document.						Ref. 36, 40 & 43 Ref. 45 & 48
27/27252 27/27202	Preparations		Station Staff will undertake the majority of the safety case preparation, plant isolation, and post operational clean out (POCO). Contaminated and non-contaminated asbestos will be removed using standard practice but additionally for potentially contaminated asbestos, characterisation will determine the subsequent management of the material.	9	The removal of thermal insulation, whether inside the ISB or outside, will all be done under contract.	Asbestos and MMMF from outside the ISB will be disposed of to licensed landfill sites.	Possible implementation of Thermo Chemical Conversion Technology (TCCT), being investigated centrally, to reduce the level of hazard posed by the waste.	Ref. 8
27/27200 27/27201	Boilers	Passive Cooling	Once the reactors have entered passive cooling, then the wet side of the boilers will become redundant. This gives the opportunity to decommission the bulk of the plant within the boiler houses, including any of the external feed and steam pipework remaining from the turbine hall demolition activities. The Back to the Bio-shield section of work will isolate and remove all of the boilers.	9	It is expected that the radiological considerations of the boiler wet-side decommissioning will be minimal, comprising potentially contaminated thermal insulation and pipework surface contamination.	Care will have to be taken within the boiler houses to preserve the primary system boundary, the boiler shell and gas ducts, until permission is given to permanently breach the pressure circuit for final decommissioning.		
27/27252 27/27253 27/27202 27/27203	Active Plant	Boilers	The gas circulator systems, including associated oil systems, will be decommissioned following the boiler pipe work. The bulk of this equipment will be contaminated due to contamination of the oil used to form the seal from the primary circuit. The oil will be incinerated either on site by the new oil burner installed in 2006/07 or sent via the current disposal route to Sizewell B for incineration. The Burst Can Detection system will be available for decommissioning and removal from an early stage during defuelling. Experience has shown this system is contaminated and, to a lesser extent, activated.	9	Station Staff will undertake the Post Operational Clean Out and some preliminary deplanting of active plant inside the RCA during the defuelling period. The bulk deplanting of the boiler house equipment, gas circulators and other "conventional" plant inside the ISB is likely to be undertaken under contract.	The presence of radiological contaminants with the oil will increase the difficulty of plant removal. The cleaning and decontamination of the considerable quantities of small-bore pipe work is problematic, and much of the equipment may be disposed of as LLW.	Development work is being undertaken to develop easier methods of activity characterisation & decontamination techniques, especially for pipe work, for the active plant. It is possible that collecting and sending the metal pipe work for melting and recycling will be possible, minimising the volume for disposal.	Ref 48
27/27204 27/27205 27/27206 27/27207	Non Active Plant	Passive Cooling	The remaining plant systems within the reactor building comprise conventional electrical distribution items, and mechanical systems such as cooling water, compressed air, and diesel generators. This will also include Pilecap	9	None of these routinely contain active components, and radiological concerns are expected to be limited to			

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
			deplanting. Once cleaned and decontaminated, which is not expected to be difficult, most of these plant items will join conventional waste streams.		external surfaces.			
27/27252 27/27253 27/27206 27/27207	Buildings	RCA Deplant	Once deplanted, characterisation of the remaining building structures will be undertaken to ascertain extent, area and depth of contamination and determine if decontamination to free release is possible, practical and cost effective. This will include the R1 and R2 Switchgear Annexes and Reactor Control Annexe building demolition.	9	Further work will be undertaken to further examine demolition techniques for the pond and similar structures, such as contained demolition	If free release is practical, perform pilot demonstration to establish methods and cost.	Quicker decontamination and contained demolition methods will reduce cost and increase free release or on-site disposal volumes of waste.	Ref. 12
27/27253 27/27201 27/27203 27/27205 27/27207	Waste		Wastes will be disposed of in accordance with the sites Best Practicable Environmental Option (BPEO) for conventional &/or contaminated wastes. Radiological decontamination will be undertaken using standard abrasive methods typically used in mechanical deplanting of equipment, piping and ductwork e.g. grit-blasting. After best decontamination effort to reduce radiation hazard, controlled dismantling methods will be used for removal of contaminated equipment and piping, typically using bag and cut methods.	7	Evaluation of the waste and amounts of decontamination required would balance cost, schedule, As Low As Reasonably Practicable (ALARP) and Best Practicable Means (BPM).	Determine how much additional decontamination is required to lead to either conventional demolition or contaminated demolition, based on results decontamination and additional characterisation.	Development work is being undertaken to develop easier methods of activity characterisation. See overview for progressing R&D reference.	
10)	**ILW Store**	**Overview:** The ILW Store will provide passive, safe and secure long-term storage for packaged ILW on the Sizewell A Site until such time as the ILW can be exported for final disposal in a National ILW repository. The ILW is currently awaiting recovery and treatment as outlined above, the majority of the waste being FED, and is all resulting from reactor operations. The New Fuel Store inside the Reactor Building will be modified to serve as an Intermediate Level Waste store. The existing structure will need to be reviewed to confirm its suitability for this purpose with regards to potential loading and extended lifetime requirements. The provision of ILW storage facilities is expected to be largely undertaken under contract. Technological opportunities in wet waste management and treatment is generic work being progressed by the DSO Ref: Ref MEL W&D R&D programme document.						Ref. 44
27/27357	Common Equipment Building Modification		Modifications to the access doors and transfer route, additional shielding from the ILW containers and a container handling system will be required. The store will have minimum maintenance requirements but ventilation and protection systems will be installed, to ensure that the waste is physically and chemically stable, and that the containers are not degrading. However, the waste packages can be inspected when required, are retrievable and can be accessed in response to any foreseen incidents.	4	Pending availability of a national repository to accept the waste it is currently assumed within this LTP to commence disposal of the packages in 2048, the overall process taking two years.	Development of a model for the ageing and durability of cement matrices based upon accelerated testing. Application of MAGGAS model to predict the gas evolution from cemented wastes	Corrosion assessment of containers of cemented wastes. Environmental monitoring equipment will be needed to measure temperature, humidity and hydrogen levels, possibly released due to Magnox corrosion. See overview for progressing R&D reference.	
27/27354	Remediation	Sampling and characterisation	Any contamination found is managed in accordance with the relevant regulatory regimes mostly administered by the Environment Agency. Non-radioactive contamination is not directly relevant to eventual de-licensing of sites, but may influence future land use. The main strategy options include: • Removal of contamination (e.g. by excavation);	9	The Company has a contaminated land Intelligent Customer capability that will be consulted on the application of guidance information on contaminated land.	Excavation and removal requires consideration of the options for treatment, storage and disposal of the resulting waste (typically very low activity LLW dominated by Cs_{137}).	Retention of residual contamination in the ground requires a safety case for the duration of C&M.	

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
			• Enhanced containment *in situ*; • Monitoring the contamination *in situ* without engineered enhancement of containment.					
12)	**Back to Bio-shield**	**Overview:** This includes the complete delagging of asbestos (clean and contaminated) from all plant areas inside the RCA. The boilers will be removed and laid down and the ductwork removed. Reactor floor deplanting will have been done, as described above, including the gas circulators. On hold - generic R&D managed by DSO: Ref MEL W&D R&D programme document						Ref. 52
27/27204	Disconnection of Primary Circuit	Active Plant removal	R1 and R2 Circuit isolation and sealing which consists of separating the gas ducts at the gas valve and sealing The Reactor vessels will then be prepared for safestore by isolation and sealing, welding up pilecap closures and BCD penetrations.	7		The practicality and radiological implications of sealing the circuits as close to Reactor as possible.	The scope of this work is still being developed. See overview for on-hold R&D reference.	
27/27204 27/27205	Removal of Boiler houses	Removal of the Boilers	The Boiler house walls will have the upper sections removed initially and then the boilers will be removed through the top / upper sections. Thereafter, the boiler houses will be demolished. The duct cell height will also be reduced, along with the roof over the Pilecap, leading to an overall Reactor building height reduction. A new Reactor Building roof will be installed about 10 metres above the Pilecap.	3		Controlled demolition of the boiler houses.	The scope of this work is still being developed. See overview for on-hold R&D reference.	
27/27204 27/27205	Removal of the Boilers	Removal of Boiler houses	R1 and R2 Boilers and Ducts will be removed via the top opened sections of the boiler houses and the Heat Exchangers laid down and prepared for safestore by the addition of blanking over all apertures.	2	Boilers will be laid down until FSC, when they will be disposed of.	Removal of Boilers from top.	The scope of this work is still being developed. Possible metal melting of the boilers will allow earlier disposal from site. See overview for on-hold R&D reference.	
13)	**Safe Store Preparations**	**Overview:** The current Lifetime Plan strategy is to create a "Reactor Safestore" that would safely contain an amount of plant and equipment within the existing Reactor building for a period of up to 100 years. The building will be clad in weatherproof sheeting. The end state of the site for C&M Preps is one of much reduced visual impact that will be safe & robust to remain in a quiescent state for the period of C&M. Generic R&D being progressed by progressed by the DSO Ref: Ref MEL W&D R&D programme document.						Approach Experience: Ref. 37
27/27204	Modifications and Cladding	Back to Bio Shield	After the demolition of Switchgear Annexe, Pond, AETP, Boiler Houses and Control Annexe Building, the remaining parts of Reactor building will have cladding renewed or replaced, to form the final Safestore building.	5	The approach will be to clad the building, with the roof lowered, to seal it to prevent water ingress or decay of structure, to last the C&M period, based on work completed at Berkeley.	The cladding strategy is to reclad the whole building 30 years into the Care and Maintenance phase and then refurbish the cladding twice during the remaining lifetime.	Longevity of cladding panels See overview for progressing R&D reference.	
14)	**Care & Maintenance**	**Overview:** The end state of the site following completion of the C&M Preps phase will comprise of the reactor building in safestore which will contain the ILW store, and those services required to operate the site through the C&M period. All other buildings will have been demolished to ground level; voids filled and made safe, and the site partially landscaped to ensure that no hazards, e.g. water hazards, may collect over time. The remaining hazards on the site, the reactors, primary gas circuit components and ILW store will be in a safe, secure, fully contained, protected and robust condition for the duration of C&M to allow radioactivity to decay to lower levels prior to FSC. Packaged ILW will be removed from site to a National ILW repository when it becomes available. Generic R&D being progressed by progressed by the DSO Ref: Ref MEL W&D R&D programme document.						Ref. 46 & 47

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
27/27208 27/27209 27/27210	C&M	Safe Store Preps	The site will be in a passively safe state requiring minimal human intervention as most hazards, including those that were the most active and potentially mobile, will have been removed or immobilised. Cladding panels which make up the safe store of the reactor building will be replaced at 30 year periods.	5	Future strategy development will facilitate a smooth transition from C&M Preps into C&M.		Determine requirements for site manning and surveillance requirements, licensee responsibilities, implementation etc. See overview for progressing generic R&D reference.	
15)	**Final Site Clearance**	**Overview:** At the end of the FSC period all of the radioactive structures, including those below ground level, will have been removed from the site and all structures removed to at least ground level with any below ground level voids back-filled where necessary for safety reasons. Any remaining significant ground contamination will have been removed. Finally, the Site will be subjected to extensive radioactivity surveys to confirm that no unacceptable radioactivity remains on or below the site and that the site can be delicensed. On hold - generic R&D managed by DSO: Ref MEL W&D R&D programme document						
27/27211 27/27212	Preparatory Works and Access Reactor Pressure Vessel	Back to Bio Shield	Necessary site infrastructure is re-introduced to the site to support Final Site Clearance including necessary waste handling facilities, services, accommodation, encapsulation plant etc. Remove control rods and other long items from reactor core and surrounding voids. Open access routes into the space between the steel Reactor Pressure Vessel (RPV) and the concrete bioshield. Break through the pile cap and into the RPV.	7	A containment building will be constructed over the pile cap area. All thermal lagging will be removed using conventional industrial procedures. Conventional industrial diamond drilling and cutting procedures will be used	Access into the voids (such as RHF, NCAW, CAW, reel and filter voids) surrounding the reactors may only be possible after the Reactor dismantling has been completed.	Currently a feasibility study is being conducted to determine the site-specific enabling works required under the proposed 25 year FSC strategy See overview for on-hold R&D reference.	
27/27211 27/27212 27/27213	Preliminary Reactor Dismantling		Erect containment between the top of the RPV and the newly formed sides of the penetration in the pile cap. Progressively remove the Guide Tube Assemblies Install lighting and Closed Circuit Television (CCTV) in the RPV. Lower two Remote Handling Machines (RHM) through hole at top of RPV onto graphite core. Cutting and size reduction operations to be executed using the RHMs.	6	Remote Handling Machines (RHM) to be used in the RPV are presently based on proprietary equipment such remotely operated Brokk vehicles.		Development and implementation of the project. See overview for on-hold R&D reference.	
27/27212 27/27213	Graphite Removal		RHMs to remove the reactor core moderator bricks starting at centre and working outwards. Brick removal to be repeated layer by layer until the base level diagrid is reached.	6	Displaced bricks to be transferred in skips to the pile cap for disposal via the newly constructed waste processing facilities and available waste routes.		Disposal of irradiated graphite. See overview for on-hold R&D reference.	
27/27212 27/27213	RPV Dismantling		Sides of RPV cut away down to the diagrid level. Discarded material to be transferred to the pile cap in skips and disposed of via the existing waste facilities and waste routes.	6	The RPV will be cut away using conventional industrial procedures utilising the external scaffolding/staging.		Development and implementation of the project. See overview for on-hold R&D reference.	
27/27212 27/27213	Reactor Support Structure Dismantling		Remove the diagrid and remaining steelwork located in the void below the RPV. Discarded material to be transferred to the pile cap in skips and disposed of via the existing waste facilities and waste routes.	7	The removal the diagrid and remaining steelwork will be done using conventional industrial procedures.		Development and implementation of the project. See overview for on-hold R&D reference.	
27/27212 27/27213	Radial Shield and Bioshield		Remove the radial concrete shield and then remove the inactive concrete bio-shield.	7	Remove the concrete structures will be done		Development and implementation of the	

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
	Removal		Survey and monitor remaining building structure, decontaminate as appropriate and demolish utilising industry standard techniques.		using conventional industrial / demolition procedures.		project. See overview for on-hold R&D reference.	
16)	**Site End State**	**Overview:** The end-point of the FSC period is therefore assumed to be a delicensed green field site with all structures removed to at least ground level, landscaped and planted with appropriate locally indigenous flora thus allowing the site to be made available for any alternative appropriate use.						
27/27212 27/27213	Contaminated Land	Final Site Clearance	Non-radioactive (chemical) and Radioactive ground contamination characterisation, monitoring and site hydro geological mapping work will be carried out. Any contamination found will be removed or contained, dependant on the agreed site end state.	9	It is assumed the site end state will be a delicensed site, requiring the removal of all contamination.	Excavation and removal requires consideration of the options for treatment, storage and disposal of the resulting waste.	Adequate characterisation and understanding the end state is essential to ensure that the correct amount of remediation is done and the site can be delicensed. On hold site specific development work Ref R&D 11.1 & 11.2	Ref. 21
27/27212	Landscaping		The land will be landscaped to make it acceptable for future usage.	9				

Table 1B: Sizewell A, Technical Baseline: Works completed or deleted during FY 2007-08

Task / Process ID.	Task/Process description	Preceding task	Technique	TRL	Assumptions	Technical constraints	Gaps (ref to R&D table)	Key reference documents
1)	**Passive Cooling**	**Overview:** On cessation of generation, heat generation will subside to a point where the boilers can dissipate any generated heat at which point, the gas circulators can be removed from duty. The commencement of passive cooling on both reactors, expected during the late summer/early autumn of 2007, is a key milestone in the reduction of active plant. This will be determined from measurements of reactor temperatures with cooling reduced to a passive level for a sustained period. It is intended to remove the lagging from the boiler top ducts soon after the reactors are shutdown to maximise the heat loss from the reactors to facilitate the earliest entry into passive cooling. The timing of entry into a passive cooling state provides the opportunity to commence decommissioning and demolition of those redundant plant areas Ref. 6 & 7						Ref. 6 & 7
2. 27/27300 27/27302 27/27450 27/27451	**Managed withdrawal: people**		Provision of temporary accommodation, including telecommunications and IT provisions, in the reactor building itself, or into purpose built temporary modular buildings in the north west of the site.	9	Staff will progressively be moved during 2007, from the existing buildings.		Completed	

Table 2: Sizewell A Research and Development – Work progressing during FY 2008-09

Task ID	Technical need - task + gap	Context of why a problem	Target Date	Cost range	Needs / Risks / Opportunity	Site / Generic / NDA issue	Key outputs / Actions
2.1) Managed Withdrawal	Discharge of Active Effluent into SZB CW Outfall	Legal issues have stalled the process and therefore the existing pipe route will be utilised, stalling CW plant decommissioning. An alternative is required.	2008/09	>£50k	Risk	Site	Find alternative option which is acceptable to the Regulators.
3.1) Electrical Overlay system	Supply of Electricity to site	Legal issues have stalled the process of obtaining a supply from SZB and so a power source to the Electrical Overlay needs to be identified e.g. a new sub-station or from the existing National Grid connection.	2008/09	>£50k	Risk	Site	Determine best and most achievable options for supplying site with electricity.
4.1) Conventional Plant Area De-plant & Demolition	On-site disposal enablers On hold – see table 2A.						
5.1) ILW Retrieval and Processing	FED recategorisation On hold – see table 2A.						
5.2) Ponds Decommission-ing	Contained demolition of ponds On hold – see table 2A.						
5.3) Prompt Encapsulation of FED	Prompt encapsulation of FED On hold – see table 2A.						
5.4) ILW Retrieval and Processing	IONSIV cartridges	Treatment route for IONSIV cartridges is not yet identified. Generic works will be taking place developing treatment methods and Sizewell A will adopt these and tailor them for use.	2010/11	£50k - £100k	Need	Generic	Develop methodology and process for dealing with IONSIV cartridges after defuelling. Generic R&D managed by DSO: Ref MEL W&D R&D programme document.
5.5) ILW Retrieval and Processing	AETP sand and gravels On hold – see table 2A.						
5.6) ILW – Retrieval and Processing	Cross-site transporter On-hold see Table 2A						
6.1) Ponds Skips and Miscellaneous Contaminated Items (MCI)	Skip decontamination On hold – see table 2A.						
6.2) Other Low Level Wastes	On hold – see table 2A.						

Task ID	Technical need - task + gap	Context of why a problem	Target Date	Cost range	Needs / Risks / Opportunity	Site / Generic / NDA issue	Key outputs / Actions
7.1) Ponds Decommission-ing	On hold – see table 2A.						
9.1) RCA De-plant and Demolition	On hold – see table 2A.						
9.2) RCA De-plant and Demolition	On hold – see table 2A.						
11.1) Contam-inated Land	On hold – see table 2A.						
11.2) Site End State	On hold – see table 2A.						
12.1) Back to Bio-shield	On hold – see table 2A.						

Table 2A Changes from Previous R&D submission – work on-hold during FY 2008-09

Task ID	Technical need - task + gap	Context of why a problem	Target Date	Cost range	Needs / Risks / Opportunity	Site / Generic / NDA issue	Key outputs / Actions
4.1) Conventional Plant Area De-plant & Demolition On hold	On-site disposal enablers.	Will allow disposal of inert LLW as backfill on site, therefore saving national repository space and cost, and reducing the traffic of bringing backfill onto site.	2008/09 through to 2016/17	£100k - £1M	Opportunity	Generic	Obtaining agreement from Regulators and Stakeholders, to allow further development of the facility.
5.1) ILW Retrieval and Processing On hold	FED: re-categorise to LLW and dispose as such.	Early indications show that this is a distinct possibility, justifying further research. Scheduled 2007/08 with a cost of £100k	2008/09 when FED retrieval commences	£50k - £100k	Opportunity	Site	Obtain acceptance for disposal of FED waste to UK LLWR, creating large cost savings compared to ILW storage and disposal.
5.2) Ponds Decommissionin g On hold	Contained Demolition of Ponds.	Potential for large cost savings and minimisation of dose to operators. Generic work will take place prior to this and the funding identified will allow Sizewell A to take the findings and utilise them.	2012/15	£50k - £100k	Opportunity	Generic	Feasibility study for the option of contained demolition and approval of the Regulators.
5.4) ILW Retrieval & Processing	IONSIV	Generic work by DSO being progressed – see Table 2					
5.5) ILW Retrieval and	AETP resins, sands and gravels.	To develop treatment and encapsulation methods for this waste stream, when AETP becomes available for deplanting.	2012/14	£100k - £1M	Need	Generic	Identify better options for dealing with AETP waste, especially resins. Carry out small scale

Task ID	Technical need - task + gap	Context of why a problem	Target Date	Cost range	Needs / Risks / Opportunity	Site / Generic / NDA issue	Key outputs / Actions
Processing		Develop easier, faster, safer, with less dose to operators, methods of retrieval, treatment and disposal of AETP waste streams.					encapsulation trials of waste to demonstrate applicability of options.
5.6) ILW – Retrieval and Processing	Cross-site transporter	A proprietary transporter will be developed with the necessary site modifications to ensure all safety criteria have been adequately catered for, to carry an overpack to safely transfer the Nirex boxes and interface with the ILW Store.	2016/2020	£100k – £1M	Need	Site	Identify site interfaces for transporter. Design and implement site specific modifications to allow proprietary transporter to be used at Sizewell.
6.1) Ponds Skips and Miscellaneous Contaminated Items (MCI)	Skip decontamination.	Disposal route for skips not yet identified. Hinkley Point A are leading on this but Sizewell A need to develop a method suitable for use on site after taking into account all other works on other sites.	2010/11	£100k - £1M	Need	Generic	Develop methodology and process for dealing with skips after defuelling.
6.2) Other Low Level Wastes	Retrieval and processing of ponds debris.	Characterisation and retrieval methods need development.	2010/11	£50k - £100k	Need	Generic	Easier, faster and safer methods to characterise and retrieve waste.
7.1) Ponds Decommission-ing	Ponds structure decontamination	Potential for large cost savings and minimisation of dose to operators. Generic work will take place prior to this and the funding identified will allow Sizewell A to take the findings and adapt them.	2011/12	£50k - £100k	Opportunity	Generic	Feasibility study for the option of quicker decontamination methods, which would lead to contained demolition and approval of the Regulators.
9.1) RCA De-plant and Demolition	Reduction of hazard posed by Asbestos	Reactor sites decommissioning will produce large volumes of Asbestos. Development work is being led by Risley to investigate potential new technologies available to reduce the hazard posed by asbestos Being developed centrally	2009/10	£50k - £100k	Opportunity	Generic	Prove TCCT or alternative methods for dealing with asbestos can work and so minimise the hazard and waste quantities.
9.2) RCA De-plant and Demolition	Pilot demonstration of free release of RCA buildings	To establish methods and costs to minimise amounts of decontamination required. Being developed centrally.	2013/15	£50k - £100k	Opportunity	Generic	Easier, faster and safer methods to decontaminate and demolish buildings..
11.1) Contam-inated Land	Adequate Characterisation Techniques	It is essential that adequate characterisation is performed to ensure proper remediation of the site can occur.	2014/15	£50k - £100k	Need	Generic	Excessive remediation of the site will cost the customer large amounts of money.
11.2) Site End State	Understanding the End State	Understanding the end state of the site will define the strategy needed to get there, especially in respect to on-site disposal and contaminated land remediation.	2008/09	>£50k	Opportunity	Site	Stakeholder meetings and Regulatory acceptance of the end-state through consultation meetings.
12.1) Back to Bio-shield	Primary Circuit Isolation, Removal of Boilers and boiler houses	Although the site will benefit from a reduced visual impact, the strategy to accomplish Back to the Bio-shield is not well developed.	2015/16	£100k - £1M	Opportunity	Site	Site based strategy to ensure the Back to Bio-shield project can deliver.

Table 2B Sizewell A, Changes from 2007-08 R&D submission – work completed or deleted

Task ID	Technical Need – Task + gap	Context of why a problem	Target Date	Cost Range	Identification of Change	Key outputs/Impact of change