

# Calder Hall Nuclear Power Station Environmental Management Plan

Issue 4

September 2008



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## EXECUTIVE SUMMARY

In August 2004, Sellafield Ltd applied to the Health and Safety Executive (HSE) for consent to decommission Calder Hall Nuclear Power Station in accordance with the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999. An Environmental Statement accompanied the application.

After a period of public consultation, the HSE duly granted consent in June 2005. Conditions were attached to the consent, primarily relating to the production and maintenance of an Environmental Management Plan covering the ongoing mitigation measures to prevent, reduce and if possible, offset any significant adverse environmental effects of the decommissioning work. The consent specifically requires the Environmental Management Plan to be reissued annually or at intervals agreed with the HSE. This document is the fourth issue of the Calder Hall Environmental Management Plan, the first issue having been issued in September 2005. New information in Issue 4 covers the decommissioning undertaken to date and describes the effectiveness of the environmental mitigation measures for this work.

As Head of Manufacturing for MER, which covers Calder Hall , I give my continuing commitment to reducing to a minimum any adverse effect on the environment as a consequence of our decommissioning operations

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Mark Jackson  
Head of Manufacturing, Magnox East River

September 2008



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## 1. INTRODUCTION

Calder Hall Nuclear Power Station (hereafter Calder Hall) ceased generating electricity in March 2003 after 46 years of operation. In accordance with Government Policy, work has now begun to systematically remove (or decommission) the plant and buildings associated with electricity generation at the site. Prior to commencing this work Sellafield Ltd, the Licensee of the site <sup>1</sup>, were legally required to seek consent from the Health and Safety Executive (HSE) for consent to carry out the decommissioning project <sup>2</sup>.

Application was made to the HSE for consent to carry out the decommissioning project at Calder Hall in August 2004. In support of this application an Environmental Statement <sup>3</sup> was provided, which assessed the impacts of the project on the environment. Following an extensive public consultation the HSE granted consent to carry out the decommissioning project at Calder Hall in June 2005, subject to certain conditions (listed in full in Appendix 2). Condition 2 requires the licensee to prepare an Environmental Management Plan (EMP) which shall:

- list the mitigation measures that are already identified in the Environmental Statement and evidence submitted [to the HSE] to verify information in the Environmental Statement;
- list the options to implement work activities where mitigation measures may be required but where selection of an option will only be possible in the future;
- list the work activities where mitigation may be required but where assessments to identify mitigation measures will only be possible in the future.

It is a requirement of the conditions attached to the Consent to describe the effectiveness of the mitigation measures over time. This EMP is therefore a living document that will be periodically reviewed and revised throughout the decommissioning project. The EMP will be reissued annually or at other intervals agreed with the HSE. Future submissions will include a summary of environmental performance over the previous 12 months and a report on the results will be submitted to the HSE at the Calder Hall NII <sup>4</sup> Annual Performance Review Meeting.

Further information on the HSE's decision to grant consent to decommission Calder Hall can be found in their decision report, which describes the content of the conditions attached to the Consent and the main reasons and considerations for the decision. Copies of the document are available from:

Health and Safety Executive  
Nuclear Safety Directorate Information Centre  
Redgrave Court  
Merton Road  
BOOTLE  
Merseyside  
L20 7HS

Or via the internet from: <http://www.hse.gov.uk/nuclear/nuc23.pdf>

<sup>1</sup> Prior to the transfer of certain civil nuclear liabilities to the Nuclear Decommissioning Authority (1st April 2005) Calder Hall was Licensed to British Nuclear Fuels (BNFL) plc hence it was BNFL plc who originally applied for consent to decommission Calder Hall from the HSE. This change does not constitute a change to the Licensee as defined by the Nuclear Installations Act 1965 (as amended).

<sup>2</sup> European Council Directive 85/337/EEC, as amended by Council Directive 97/11/EC, sets out a framework for the assessment of the effects of certain public and private projects on the environment. The Directive is implemented in Great Britain for decommissioning nuclear reactor projects by the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999.

<sup>3</sup> Sellafield Ltd (2004) Calder Hall Nuclear Power Station Environmental Statement (in support of the application to decommission Calder Hall Nuclear Power Station as required by Statutory Instrument 1999 No. 2892: Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999).

<sup>4</sup> Her Majesty's Nuclear Installations Inspectorate. A part of the Nuclear Directorate of the HSE, senior officers of which have delegated regulation and enforcement powers relating to nuclear licensing under the Nuclear Installations Act 1965.

Any queries relating to decommissioning activities at Calder Hall or requests for copies of this EMP should be addressed to:

The Head of Manufacturing,  
Magnox East River,  
Sellafield Site,  
Seascale  
Cumbria  
CA20 1PG

In addition to the submission of this EMP to the HSE, Sellafield Ltd will also provide copies to the:

- West Cumbria Sites Stakeholder Group
- The NDA

This EMP can be viewed at the following locations:

- Daniel Hay Library, Lowther Street, Whitehaven, Cumbria, CA28 7QZ - Tel: 01946 852900;
- Seascale Library, Gosforth Road, Seascale, Cumbria, CA20 1PN - Tel: 01946 728487;
- Cumbria County Council, The Courts, Carlisle, Cumbria, CA3 8NA - Tel: 01228 606060;
- Copeland Borough Council, Council Offices, Catherine Street, Whitehaven, Cumbria, CA28 7NY - Tel: 01946 852585;
- Sellafield Visitors Centre, Seascale, Cumbria, CA20 1PG - Tel: 019467 27027; and
- Seascale Post Office, 49 Gosforth Road, Seascale, Cumbria, CA20 1PQ - Tel: 019467 28218.

## 2. SCOPE OF THE ENVIRONMENTAL MANAGEMENT PLAN

This EMP details the mitigation measures to prevent, reduce and where possible offset any significant adverse effects on the environment throughout the decommissioning of Calder Hall. The decommissioning project at Calder Hall is divided into four phases as follows:

- defuelling and preparations;
- interim decommissioning;
- care and maintenance;
- final site clearance

These phases are explained in Box 1.

This EMP is divided into three parts with the first part encompassing the defuelling and preparations and the interim decommissioning phases as they run in parallel to a large extent. This is predominantly because mitigation measures may change in the future in light of experience and developing technologies. Where mitigation measures are still to be identified or require changes, these will be described in subsequent issues of the EMP, together with the reasons for the change. Environmental impacts were grouped in topic areas in the Environmental Statement as are the mitigation measures described in this EMP (see Box 2).

### **Box 1 - Summary of the Main Decommissioning Phases**

Defuelling and preparations is the first phase during which the reactors will be defuelled and the fuel elements will be sent to the Fuel Handling Plant for reprocessing. This phase also covers maintenance activities associated with both the defuelling process and the ongoing Calder Hall Site management.

The second stage is interim decommissioning when the following activities will take place:

- Conversion of reactors 2,3 and 4 buildings into Safestores in preparation for the Care & Maintenance (C&M) phase.
- Hazard reduction activities continue with asbestos removal from the heat exchangers and from within the turbine halls. (Assessment of the best option for safe disposal of the asbestos waste is included).
- Removal of redundant facilities including cooling systems, utilities, Turbine Hall B, generators and substations, administration and ancillary buildings.
- All plant, not required for Industrial Heritage purposes or the long term quiescent C&M period, removed.
- Reactors 2, 3 & 4 heat exchangers dismantled and removed. Work on reactor 1 will depend on the decision regarding preservation for Industrial Heritage purposes

Care and Maintenance is the third phase which could potentially last for some decades, during which no significant dismantling will be carried out. The site will continue to be managed, monitored and maintained.

Final Site Clearance is the last phase and is expected to take about 10 years. This involves the dismantling of the remaining structures on the site, including the reactors and the clearance of any residual radioactivity to the applicable standards.

### **Box 2 - Environmental Assessment Topics**

- Air Quality and Climatic Factors;
- Archaeology and Cultural Heritage;
- Ecology;
- Geology, Hydrogeology and Soils;
- Noise and Vibration;
- Landscape and Visual;
- Socio-Economic;
- Surface Water Quality and Drainage; and
- Traffic and Transport.

In addition to the mitigation measures, a brief description of the Calder Hall site and its surroundings is presented in this EMP together with an overview of the types of operations that will be carried out during care and maintenance. Further details for all phases of the decommissioning project at Calder Hall are presented in the Environmental Statement. The Transport Management Plan can be found in Appendix 1.

### 3. STAKEHOLDER ENGAGEMENT

Whilst decommissioning represents a fundamental change in operations at Calder Hall, Sellafield Ltd remains committed to engaging with stakeholders at all phases in the decommissioning process. Regular meetings have been held with the West Cumbria Sites Stakeholder Group (WCSSG). In addition a number of other organisations (see Box 3) are kept informed of activities at the site. The organisations listed in Box 3 were also involved in the public consultation process for the Environmental Statement.

#### Box 3 - Local Stakeholders

- Allerdale District Council;
- Beckermeth Parish Council;
- Copeland Borough Council;
- Cumbria County Council;
- Drigg and Carleton Parish Council;
- Gosforth Parish Council;
- Ponsonby Parish Council;
- Seascale Parish Council; and
- St Bridget's Parish Council.

As well as regular meetings with stakeholders, where appropriate, other interested parties will also be kept informed of specific decommissioning activities. Some examples are shown in Box 4.

#### Box 4 - Examples of Additional Stakeholder Activities

- Informing the Highways Agency and Local Highways Authority when large cranes etc. are to be delivered; and
- Informing local residents of when any short-term activities that may cause a noise nuisance will take place.

#### The Role of the Nuclear Decommissioning Authority (NDA)

The Energy Act (2004) requires that the NDA must prepare a strategy for carrying out its functions and from time to time to revise that strategy. This strategy must set out the steps that the NDA proposes to take for:

- giving appropriate publicity to its responsibilities and strategy;
- explaining them both to persons having a particular interest in matters relating to the carrying out by the NDA of its functions and to the general public;
- ensuring that the NDA is kept informed at all times of the opinions about such matters of persons having such a particular interest; and
- facilitating the communication by such persons of their opinions to the NDA.

The NDA is also required to give encouragement and other support to activities that benefit the social or economic life of communities living near those sites for which it has responsibilities, including Sellafield

The NDA have given their commitment to openness and transparency and to the continued development of a proper and effective stakeholder engagement framework.

## 4. THE SITE AND SURROUNDING AREA

### Location

Calder Hall lies within the Sellafield Nuclear Licensed Site (SNLS), a large industrial site located near the Cumbrian coast approximately 2 kilometres (km) north-west of the village of Seascale, 16 km south of the town of Whitehaven and 40 km north of the port of Barrow-in-Furness. The site is just under 1 km from the Irish Sea coast, adjacent to the River Calder, at an altitude of approximately 20-30 metres (m) above Ordnance Datum. The SNLS comprises approximately 300 hectares (ha), of which Calder Hall represents approximately 27 ha.

### Description

Calder Hall was built and commissioned between 1953 and 1959 finally ceasing generation at the end of March 2003. The station comprised four gas cooled Magnox type reactors each consisting of a graphite core enclosed in a cylindrical steel pressure vessel surrounded by a concrete biological shield. When operating the reactors were cooled using carbon dioxide. Each reactor had four heat exchangers (or boilers), located outside the biological shield, which supplied steam to drive the turbines.

There are two turbine halls, each containing four 30 MW capacity steam turbine generating units, which were cooled by four cooling towers. In addition, there were a number of ancillary buildings on the site that were required to support the station during operations such as administration and welfare buildings, a chemistry laboratory, workshops and stores.

A number of facilities common to other Magnox Power Stations were not required at Calder Hall due to the availability of alternative facilities on the main Sellafield site. First, there are no fuel cooling ponds since spent nuclear fuel is transferred directly to the Magnox reprocessing plant located on the main Sellafield site. Second, liquid radioactive effluent is transferred using a bowser to the Sellafield Effluent Treatment Plant for processing and there is, therefore, no active effluent treatment plant at Calder Hall. Finally, operational intermediate level radioactive waste <sup>5</sup> (ILW) is transferred to the Sellafield Miscellaneous Beta Gamma Waste Store and there are, therefore, no ILW vaults on the site with the exception of a small spent control rod <sup>6</sup> storage facility.

Following the reactors being finally shutdown in 2003, a programme of hazard reduction has been instituted. This included the removal from site of oils and chemicals no longer required, such as carbon dioxide, lubricating oils etc.

<sup>5</sup> ILW – Forms a small part of the total radioactive waste and consists mainly of small reactor components such as thermocouple wires.

<sup>6</sup> Control rods are metal components used in operating reactors to control the heat-generating reaction taking place in the core. Control rods become radioactive by means of activation and when no longer required become a radioactive waste.

## **Local Watercourses**

The River Calder runs between Calder Hall and the main Sellafield site and was partly canalised during the development of the SNLS. It has a catchment area of approximately 45 km<sup>2</sup> comprising predominately agricultural land or upland moorland and runs for approximately 12 km from its headwaters to the coast.

Other watercourses near the site include the River Ehen and Newmill Beck. The River Ehen drains the catchment north of the River Calder, joining the River Calder at the coast. Newmill Beck drains a small catchment to the south of Calder Hall and flows into the River Calder downstream of the site, just upstream of the River Calder's confluence with the River Ehen.

## **Geology and Hydrogeology**

The Calder Hall site comprises a variety of superficial Recent and Pleistocene (glacial) deposits up to 40 m thick that completely covered rockhead before its construction. The construction of Calder Hall and the canalisation of the River Calder have modified the superficial geology. The underlying bedrock is the Permo-Triassic St Bees Sandstone, which is a thick (600 m or more) relatively uniform, fine-grained sandstone. At Calder Hall the sandstone dips gently south-westwards at 5-12 degrees.

The superficial deposits are not identified as aquifers, but where sandy/gravel deposits occur, these may hold quantities of groundwater and could be considered Minor Aquifers. The St Bees sandstone is a Major Aquifer, which is extensively exploited by Sellafield Ltd in and around Sellafield for provision of supplementary industrial water supplies.

## **Sensitivity of the Receiving Environment**

The nearest settlements are the villages of Calder Bridge, approximately 2 km to the north and Seascale, approximately 2 km to the south-east. There are no residential or other sensitive properties within 500 m of the Power Station.

Two Landscapes of County Importance lie along the coast to the north-west and north of Calder Bridge, the Heritage Coast approximately 10 km to the north west at St Bees Head, and the Lake District National Park, the boundary of which lies approximately 2 km to the east of the site. In addition, the Low Church Moss Site of Special Scientific Interest is noted for supporting a variety of wetland habitats. Cumbria Wildlife Trust has notified eight non-statutory Sites of Wildlife Importance within 2 km of Calder Hall comprising:

- Seascale Dunes and Foreshore;
- Starling Castle;
- Sellafield Tarn;
- Gaitskill Wood;
- Brownbank Moss;
- Ponsonby Tarn;
- Calder Bridge Wood;
- Terrace Bank Wood.

Parts of the River Ehen are a Special Area of Conservation (SAC), primarily by supporting the largest population of freshwater pearl mussel (*Margaritifera margaritifera*) in England. Though the presence of freshwater pearl mussel is the primary reason for site selection, the River Ehen also qualifies as a SAC by supporting Atlantic salmon (*Salmo salar*).

## 5. Site Management

### General Site Management

#### Hours of Work

Shift surveillance support is available on a continuous shift basis and some contract work will involve extended day hours and/or weekend work. It is currently not anticipated that any night time working will be required, although from time to time it may be necessary in the interests of safety or to accommodate certain activities which need to be undertaken within a short time period. Noisy operations will generally be undertaken during the hours 08:00 to 17:00.

#### Lighting

The existing night-time illumination of the Power Station will cease during care and maintenance preparations. Whilst there may be some need for flood lighting, where possible, it will be localised to a building or piece of plant.

#### Transport

Vehicle movements to and from Calder Hall will be subject to the provisions of the Transport Management Plan (see Appendix 1). In summary:

- Staff and contractors primarily drive to the Calder Hall site by car, although contractors use a minibus from an off-site car park;
- Traffic onto site has reduced since the introduction of restrictions on single occupancy of vehicles;
- Low level radioactive waste <sup>7</sup> (LLW) will be transported to the national LLW repository at Drigg, Cumbria by rail via the internal railhead as happens at present,
- Any non-radioactive waste requiring removal from the site will be appropriately packaged for transport off-site by HGV. A mixture of HGVs and smaller vehicles will make deliveries, eg transit vans.
- A construction fence has been erected around the Calder Hall site to prevent vehicles from traversing the site unnecessarily;
- Subsidised cycle purchase schemes have been organised to encourage the workforce to cycle to work instead of using cars.

### Decommissioning Methods

#### Conventional Area Decommissioning

Conventional plant and buildings will be de-planted and demolished using standard construction industry methods. The exact methods to be employed will be detailed in method statements for individual projects. All buildings and structures will be demolished to ground level. Any voids will be filled using rubble from the demolition of the buildings. Any remaining structures will be punctured to assist drainage.

Heavy plant will be split into components or sub-component parts prior to removal by crane. Mechanical and flame cutting will be used to prepare the plant for lifting. Buildings will be demolished using a variety of methods including JCB type vehicles, excavators with metal shears and concrete crushing attachments. Some work will also be carried out by hand.

<sup>7</sup> Low level radioactive waste forms around 90% of radioactive waste comprises routine items such as nuclear workers' gloves and overalls paper towels and certain plant equipment.

### **Reactor Controlled Area Decommissioning**

Radioactive plant in the reactor buildings will be decontaminated, where practicable, and dismantled. If practicable, plant and equipment will be decontaminated in situ and recycled. Examples of these decontamination processes are shown in Box 5. Contamination control provisions will be applied (eg work will be done within temporary enclosures) and working procedures will take account of the requirement to minimise exposure to radiation to as low as reasonably practicable (ALARP)

Following decontamination and de-planting, buildings scheduled for demolition during care and maintenance preparations will be demolished, using conventional techniques. Monitoring checks will be made as demolition proceeds, and on the resulting demolished materials prior to disposal.

#### **Box 5 - Examples of Decontamination Techniques**

- Chemical decontamination involves the use of chemicals to remove the surface contamination
- Scabbling involves the physical removal of surface contamination, predominantly on concrete
- Shot blasting uses high velocity shot to remove surface contamination
- Water jetting involves the use of a pressurised water jet to remove surface contamination
- Wipe down where decontamination is removed by 'wiping'; specialist equipment and materials are usually required
- "Sponge Jet" equipment used by waste team which involves abrading the surface of contaminated metal with a stream of sponge beads which remove and absorb surface contamination

### **Waste Management**

#### **Intermediate Level Radioactive Waste (ILW)**

The quantities of ILW arising during care and maintenance preparations are expected to be very small and any arisings will be transferred to the Sellafield Miscellaneous Beta Gamma Waste Store. Neither an ILW store nor any temporary ILW packaging facilities will be required at Calder Hall.

#### **Low Level Radioactive Waste (LLW)**

Solid LLW will be compacted where possible and transferred to the Drigg repository by rail via the internal Sellafield railhead.

Any radioactively contaminated oils will be managed using established processes located on the main Sellafield site, for which the appropriate authorisations are in place. Other radioactive liquid effluent requiring disposal will be periodically transferred by bowser to the Sellafield Effluent Treatment Plant for processing and disposal. This latter process was used while Calder Hall was generating electricity.

#### **Non-radioactive Hazardous Wastes**

Solid hazardous wastes will be managed by authorised contractors who hold the appropriate Carrier's Licence, which will be checked for current validity before a contract is placed and implemented. The specific contractor used will depend on the type of waste requiring disposal. All records are auditable and will be checked annually.

Non-radioactive oils will be sent to an approved contractor and recycled. Oil soaked rags and pads, which are stored in drums, have had any free oil separated from them. This oil has a low level of radioactivity and has been stored, together with other contaminated oil, in a tank on the Calder Hall Site.

## **Asbestos**

Insulation containing asbestos will be removed under stringent safety conditions using specialist personnel working in tented areas subject to airlocks and a negative pressure air pressure system. All work will be carried out in strict accordance with the Control of Asbestos at Work Regulations 2002. The tents will fully enclose and seal the work areas and the entire volume will be smoke tested to ensure its integrity before asbestos removal commences.

Prior to removal, all asbestos lagging will be injected with a surfactant penetrating fluid by a liquid injection technique to maintain a 'dough like' consistency and thereby reduce the number of fibres released into the tented enclosure. Respirators and clothing change facilities will be required for all personnel working in the controlled areas.

Asbestos disposal will be classified after analysis as radioactive, or exempt under the Radioactive Substances Act. So far, asbestos from 6 Heat Exchangers has been classified as exempt and is being sent to a landfill site licenced for asbestos disposal. Any asbestos found to be radioactive will be sent for storage to the Low Level Waste Repository.

Contractors' licences will be checked before the contract is placed. Once the contract is implemented, it is the contractor's responsibility for meeting the nationally set controls for disposal of the waste through approved landfill sites (if appropriate), and the requirements of the Carrier's Licence.

## **Other Wastes**

Non-radioactive waste materials have arisen throughout the operating life of Calder Hall. In general, the management of waste at Calder Hall will aim to minimise the need to use landfill by reducing waste volumes wherever possible by following the hierarchy of waste management, ie reduce, reuse, recycle. Calder Hall follows the Environmental Protection Act 1990 Duty of Care principles for all waste arisings and where waste is transferred, it is accompanied by a transfer note and a full written description of the wastes.

Inert demolition material has been used to fill the cooling tower basins and other voids resulting from the demolition of the towers and other structures. It is not anticipated that any significant quantities of demolition material will need to be transported off-site for landfill.

Scrap metal (eg steel and copper from wiring) and glass will be sent to an appropriate contractor for recycling. If it is not practicable to reuse or recycle any scrap materials they will be disposed of via approved routes in accordance with the Duty of Care principles, principally landfill.

Non-radioactive effluent will be disposed of via authorised routes to the existing interceptor sewer. There are no expected changes to the effluents leaving the site that would require variation under the Water Resources Act 1991. If there are changes to effluents leaving the site then a variation will be sought.

## **Radioactive Discharges and Emissions during Care and Maintenance Preparations**

Radioactive discharges to air and water from Calder Hall during decommissioning will continue to be made in accordance with authorisations granted by the Environment Agency under the provisions of Radioactive Substances Act 1993. It is expected that annual gaseous and liquid discharges will reduce, although there may be some peaks resulting from certain activities.

## 6. WORKS COMPLETED AND WORKS PLANNED FOR FINANCIAL YEARS 2008/09 TO 2010/11

The primary objectives of the decommissioning plan up to 2010/11 are, in order of priority, to:

- i) Manage the existing hazard on the Calder Hall site.
- ii) Manage the progressive reduction in hazard potential on the Calder Hall site.
- iii) Progress items on the critical path to Care and Maintenance.
- iv) Minimise ongoing maintenance costs by 'backing out' of plant and buildings by discontinuing usage and removing services.
- v) Remove other plant and buildings as resources permit.

### Works Completed

The major project completed during 2007/8 was the demolition of the four Calder Hall Cooling Towers on Saturday, 29th September 2007.



### The Calder Hall Cooling Towers

Following the decision to decommission the Calder Hall site, explosive demolition was identified as the safest and most cost effective route for the removal of the towers. The technique, involving the placement of explosive in 60% of the circumference of both shell and legs, is a tried and tested method which had already been used successfully in more than 200 cooling towers in the UK in the last 30 years.

The location and composition of the four 88 metre high towers also created additional challenges. Situated only 40 metres away from Fuel Handling Plant, as well as other sensitive structures on the Sellafield site, the project had to address the impact of a number of key areas, including dust, ground vibration and air over pressure, to ensure that the demolition could be carried out safely and without significant impact on other operational areas on the site. At the same time, the towers had to be prepared for demolition in a way that minimised the amounts of radioactive or hazardous waste materials arising.

During evaluation of the project a number of alternative demolition methods were reviewed however all the research carried out demonstrated that the best practical method for cooling tower demolition was explosive demolition.

Explosive demolition of hyperbolic reinforced concrete cooling towers has been consistently and successfully demonstrated on sites sensitive to air overpressure and ground vibration, and on cooling towers within close proximity to critical installations such as operational electrical sub-stations, chemical plants and power lines either above or below ground level.

The project team documented their findings and evaluations in a Preliminary Safety Report (PSR) that was presented to the Sellafield Site Nuclear Safety Committee. Due to the tower locations on an active nuclear site, a number of potential hazards/implications were identified that required additional evaluation. These included:

- Debris spread
- Ejected high velocity small fragments
- Ground vibrations
- Air overpressure
- Dust release
- Use of explosives

To address these, the work was broken down into preparation of safety documentation, management of stakeholders, site preparation, removal of the cooling tower internal materials, and shell demolition.

Technical notes addressing ground vibration, debris spread, projectiles, noise, air overpressure, dust, the use of explosives, and an assessment of the radiological status of the towers were prepared. These were based on the standard demolition method for these types of structures referred to as 2/3 leg and shell method. Once these were completed, the results of the hazards and impacts were used to assess the potential affect on the surrounding plants.

The technical notes evaluated the potential results not only if the demolition went according to plan but also for a worst case or fault scenario. Not all of the fault conditions that were evaluated were credible, but these were still evaluated and documented to address the comments from the Nuclear Safety Committee.

### **Surrounding Plant Assessments**

All of the facilities within the 200 m zone of the towers were identified in addition to the utility services, railways, and roads that ran through the project area. The technical note results indicated that most of the potential impacts were restricted to the Calder Hall site, however dust and vibration were identified as having some potential impacts outside the area local to the towers.

The Sellafield Ventilation Technical Support Group was engaged to assess the potential impact of the dust on surrounding plants. The assessment indicated that if the plants reacted by placing their facilities in the same configuration they adopt for emergency exercises, such as closing doors / windows then the risk would be mitigated.

## Removal Of Internals

The tower internals consisted of concrete supporting columns and beams, timber framework supporting the plastic pack, and asbestos cement pipes.



Photograph of tower interior showing various layers of internal structure.

## Explosive Loading

Following the successful test blast the learning was incorporated into the method statement and the project implementation plan, and the final documents, together with the test blast report were submitted to the Nuclear Installations Inspectorate for their final approval and the granting of a Licence Instrument for the final demolition.

Given the number of charges to be loaded, a 10 day loading schedule was prepared, leading to a weekend demolition during Sellafield silent hours. The receipt of the Licence Instrument enabled all the statutory notifications to be submitted with the appropriate period of notice as well as the implementation of a detailed stakeholder communications package that included, amongst other things, over 3,000 letters sent out to all households and businesses within the Sellafield sightline, notices broadcast in the local print media and numerous radio and television interviews by members of the project team.

To protect against projectiles and Air Over Pressure (AOP) during the planned explosive demolition primary blast protection was used for the Calder Hall Cooling Towers - a combination of chain link wire fencing and geotextile fabric. As a potential safeguard in the event of a premature detonation, protection was installed on the shell and legs prior to the placing of the charges, as per standard industry practice. As well as minimising the time when explosives were in place unprotected, this method also minimised the potential for damaging the charged explosives (e.g. pulling them out of their holes, or pulling out a wire connection) when installing the protection. The effectiveness of the primary protection was confirmed by the test blasts.



**Primary protection in place on tower legs.**

Once loading was complete and the initial connections made, final secondary protection was installed on all affected plants the day prior to the demolition, which took place on Saturday 29 September 2007. This ranged from the taping up of doors to prevent dust ingress to a complete shutdown of the Fuel Handling Plant.

On demolition day itself, a 200 m exclusion zone was established, manned by 61 sentries, and final plant checks were carried out prior to the final explosive connections being made at the command post firing point. The demolition itself occurred in two phases; the north towers were demolished as a pair first, followed approximately four minutes later by the south pair of towers.

Each pair of towers fell in less than 4 seconds, landing almost entirely within the confines of the tower basis as predicted. Debris spread was also confined to the immediate vicinity of the towers, well within the 10 – 20 m range identified by the technical notes underpinning the demolition.



### Tower debris prior to clean up work commencing.

Following the demolition, post demolition checks were conducted to ascertain whether there were any immediate issues. The only reported damage was cosmetic, consisting of broken glass in some of the facing windows of the reactors closest to the cooling towers. Not unexpected due to the age of the structure and close proximity to the towers, this had been identified as a risk prior to demolition and measures to repair the affected windows were already in place.

Debris from the towers, consisting of approximately 5,600 tonnes of concrete shell and metal reinforcing bars, were separated initially on site using excavators to enable the metal rebar to be sent off site for recycling. The concrete was processed through a crusher and returned to the tower basins and used as infill. This filled approximately two thirds of the capacity of the basins. The remainder of the voids will be filled with similar waste from other projects across the Sellafield site. It was expected that minor trace contamination of the towers could have occurred due to their location on the Sellafield Site and so extensive survey work was carried out to investigate this. Health Physics surveys were first undertaken. No contamination was found on Station A towers but alpha contamination above background levels was found on Station B. To investigate this more thoroughly over 1000 concrete core samples were taken from the four towers. Low levels of alpha contamination were confirmed. Consequently, arrangements were made to monitor the dust produced when the towers were demolished. Reassurance monitoring by Health Physics and Safety monitors was performed and dust samples were collected and analysed by Westlakes Scientific Consulting. Results showed only a minimal increase in dose to the critical group over the normal background levels.



### Other Projects

#### Heat Exchanger de-lagging

In 2007/8 the key decommissioning focus has been to continue the asbestos lagging removal from the reactor heat exchangers and turbine halls. This both reduces the site hazard potential and enables de-commissioning because an item of plant cannot be removed until it has been de-lagged. During the year, 4 more heat exchangers were completely de-lagged and 2 on Reactor 1 have been partially completed.

Currently, 10 of the sixteen heat exchangers have been completed with 4 more planned to be completed by April 2009. In respect of the turbine halls, Turbine Hall 'B' de-lagging has been completed and approximately 50% of the de-lagging work on Turbine Hall 'A' being completed during 2007/8.

The first picture below shows the scaffolding and containments in position for de-lagging. The second picture shows heat exchangers after de-lagging has been completed.



### **Oil storage tank draining**

A further project which was completed in the last 12 months was the draining of two large storage tanks, (F11), containing a mixture of water and a small quantity of oil and solvents. The oil was successfully separated from the water using a purpose-built machine and stored pending disposal. The water was sent to the Segregated Effluent Treatment Plan resulting in a much reduced environmental hazard.

## **Works Planned to 2010-11**

During 2005, English Heritage received an application for 'listing' of certain structures on Calder Hall site on the basis of the architectural and historic interest of the site from an industrial heritage perspective. The Nuclear Decommissioning Authority has stated that it does not intend to fund the preservation of Reactor 1 and will oppose listing. NDA will engage with English Heritage to decide how best to commemorate the site commensurate with the available funding.

The works currently planned for the 2008/09 to 2010/11 financial years are summarised below. The actual work carried out will in practice be dependant on funding and prioritisation against other projects on the Sellafield Site. More detailed information is contained in the Calder Hall Lifetime Plan which is available from the NDA website, ([www.nda.gov.uk](http://www.nda.gov.uk)).

Although not part of the decommissioning project, the de-fuelling of the Calder Hall reactors will be undertaken in parallel with decommissioning. The programme for the completion of the de-fuelling from Calder hall has to be dove-tailed with the de-fuelling programmes of other Magnox stations and is therefore subject to on going review. It is currently planned to embark on limited defuelling in 2010 when opportunities arise between the defuelling of other power stations. The benefits of this will be increased confidence in defuelling equipment which has not been operated since reactor shutdown and retention of a suitable knowledge base over time. Full scale defuelling is expected to commence in 2012 as detailed in the current Magnox Operating Plan 8. This deferral has necessitated changes to other decommissioning work such as heat exchanger removal and Turbine Hall 'B' demolition.

### **Decommissioning works scheduled for the 2008/09 to 2010/11 financial years**

#### **Turbine halls**

Completion of insulation removal from Turbine Hall 'A', including asbestos de-lagging to facilitate hazard reduction.

#### **Heat Exchangers**

It was previously planned to remove 2 heat exchangers as part of a pilot project to demonstrate size reduction, decontamination and recycling of materials. This project has been deferred up to 8 years in order to concentrate on the more urgent issue of dealing with corroding steelwork, such as inspection platforms, attached to the heat exchangers.

Dismantling of the heat exchanger circuits will continue with the removal of the ducts which connect the heat exchangers to the reactors. Reactor 2, top duct 5 should be removed by January 2009 followed by Reactor 2, top ducts 7 & 8 and Reactor 3 circuit 1 top duct during 2009/10.

#### **Other Decommissioning Work**

A survey of assets-buildings and other plant- is to be carried out to decide the future demolition and maintenance strategy. Changes to the maintenance strategy are required as the reactors will not be fully defuelled for approximately 6 years.

## 7. ENVIRONMENTAL PERFORMANCE

It is a requirement of the conditions attached to the Consent that this EMP reports on the effectiveness of the mitigation measures over time. This will be achieved by updating this section each time the EMP is reviewed (normally annually).

The environmental performance review has been structured by first reviewing any unplanned events with environmental consequences that have occurred and then reviewing the mitigation measures associated with each of the specialist topic areas identified in the Environmental Statement. Since Calder Hall is currently in the 'Defuelling and Preparations' phase, only the mitigation measures identified for this phase have been reviewed.

### **Unplanned Events:**

There have been no significant environmental events during the period of the decommissioning project, ie since Consent was received in June 2005.

Calder Hall operates an open reporting regime whereby minor events, near misses and safety and environmental concerns are recorded and investigated. The objective of this is to learn from all events however small in consequence so as to minimise the risk of any significant events. In 2007/8, four such minor events were recorded as having the potential for environmental concern. One of the events involved the discovery of a small quantity of material containing white asbestos at 'A' Station Cooling Towers. After searching, no more material was found. An initial investigation was carried out but no further action was considered necessary. A second event concerned a small quantity of mercury found in the basement of Turbine Hall B. Personnel were evacuated from the area. It was then barriered off and successfully cleaned up by the Chemist. As part of the programme of hazard reduction, a process has been developed for removing mercury from the site during 2009/10.

The other two minor events involved tank bunds. No leakage to the surrounding occurred.

### **Air Quality and Climatic Factors:**

No significant adverse environmental impacts were identified in the Environmental Statement.

### **Archaeology and Cultural Heritage:**

Application for listing of certain structures on the Calder Hall Site received (by English Heritage). Pending any decision, no decommissioning work other than hazard reduction has been undertaken on either Reactor 1 or Turbine Hall 'A'.

### **Ecology:**

No liquid discharges have been made to the River Calder as part of decommissioning operations. No buildings have been demolished during the period of this report other than the cooling towers and consequently, no bat roost surveys have been carried out. Two surveys of Peregrine Falcons were carried out in 2004, as described in part 2, section 10.20 of the Environmental Statement when it was confirmed that there were no nesting Peregrines on any of the cooling towers .

A preliminary bat assessment was undertaken in April 2004, (Appendix 10.3, Environmental Statement). It was concluded that the Calder Site may well be a suitable feeding area for bats with some potential roost/ hibernation locations, although none were observed. Further surveys were recommended before any new demolition.

**Geology, Hydrogeology and Soils:**

No radioactive or non-radioactive ground contamination has been identified as part of the decommissioning operations to date but soil sampling will be undertaken around any proposed blasting site and during excavations. This will be used to decide whether soil needs to be removed and managed to prevent the spread of any existing contamination. If any soil contamination is identified water ingress to excavations will be controlled as much as possible and any water entering excavations will be sampled and analysed.

Detailed surveys of 'B' Station cooling towers revealed some residual low level radioactive contamination in the cement pipework and in the surface of the concrete on the basins. Both materials were controlled to prevent any spread of contamination during the demolition process.

Decommissioning work to date has not required the local storage of significant quantities of fuel oils or chemicals. However, the small quantities that have been used, have been stored within appropriate bunded areas.

**Landscape and Visual:**

No significant adverse environmental impacts were identified in the Environmental Statement. However, it did identify that a visual benefit will occur with the demolition of the cooling towers which has now been completed and the bases have been cleared up.

**Noise and Vibration:**

Decommissioning to date has not involved activities which cause significant noise off-site except the explosive demolition of the cooling towers. Fine cleaning of plant to remove residual asbestos fibres after the asbestos strips uses a form of shot blasting. This is a noisy operation for the operatives and hearing protection is required, but has low impact off-site.

The demolition of the cooling towers had an off-site noise impact at the time of the actual demolitions. A stakeholder plan was put in place to ensure that the affected people off-site were informed in advance, and to ensure that road traffic was managed to avoid any adverse impact

**Socio-Economic:**

The number of Sellafield Ltd employees working at Calder Hall has decreased but all the former Calder employees have been redeployed elsewhere on the Sellafield Site. The number of contractors employed has not changed to the same extent.

	2006	2007	2008
<b>SL employees</b>	153	120	31
<b>Contractors</b>	174	173	142

Sellafield Ltd. continue to give financial support for job creation initiatives in West Cumbria. The company also encourages contractors to make use of locally sourced labour, equipment and services wherever practicable.

**Surface Water Quality and Drainage:**

No liquid discharges have been made to the River Calder as part of decommissioning operations. Precautions have been taken to ensure that there were no releases of contaminants from vehicles, such as prohibiting vehicle movements in the cooling tower area during wet weather to minimise the spread of material to roads etc. Measures used to prevent pollution of watercourses include the temporary blocking of drains, the survey of possible water run-off routes and the use of bunds. Spill kits will be available as a precaution

### **Traffic and Transport:**

No significant adverse environmental impacts were identified in the Environmental Statement. However, a Traffic Management Plan is included in the Environmental Management Plan (Appendix 1). Although decommissioning to date has not required a significant amount of off-site traffic movements, those undertaken have been in accordance with the Transport Management Plan principles. Some measures have already been taken to reduce the impact of traffic movements. These include a fence around the Calder Hall Site to limit movements of vehicles onto site and to restrict through traffic. A scheme to encourage the use of pedal cycles using tax incentives for cycle purchase has been implemented and vehicular access to Sellafield Site in general has been restricted using the Single Occupancy Vehicular Access, SOVA, scheme.

## **8. MITIGATION MEASURES**

There are no significant changes to the mitigation measures that were submitted in the Environmental Statement and reported in this Environmental Management Plan. The following tables list the mitigation measures for each phase of the decommissioning project at Calder Hall. These measures will be incorporated in the project planning by the Project Manager, in consultation with the Environmental Performance Manager. The extent and duration of the mitigation measures will be considered during the planning for each project.

### **Independent Audit**

In order to monitor any adverse environmental effects of decommissioning work, an independent audit is to be put in place. The scope of this audit, the "Environmental Review of Decommissioning Within Calder Hall" is currently being considered. It will be in place by January 2009 and its results will be reported in future revisions of this Environmental Management Plan.

## **DEFUELLING, PREPARATIONS AND INTERIM DECOMMISSIONING**

## Mitigation measures already identified (Condition 3a)

Environmental Impact	Mitigation Measures	Action
<b>Air Quality and Climatic Factors</b>		
No significant adverse environmental impacts identified arising from decommissioning activities.		
Measurements of dust production and deposition were made at the time of the cooling tower demolition by Westlakes Scientific Consulting, ( project number P07011, Dust Monitoring and Analysis). Laser nephelometers were used to measure airborne dust concentration levels. Occupational exposure to the dust was controlled using an exclusion zone and by restricting access to Sellafield Site. Occupational exposure levels were not breached. Dust deposition gauges were used to measure and collect dust samples for radioactivity analysis. Increased levels of Cs-137, Pu-alpha and Am-241 were observed but these levels were low compared to deposition from historical discharges and have minimal potential to increase doses.		
<b>Ecology</b>		
<b>Surface water quality</b>		
<ul style="list-style-type: none"> <li>Release of contaminants and resulting reduction in water quality of the River Calder and its confluence with the River Ehen, which could impact aquatic ecological receptors</li> </ul>	<ul style="list-style-type: none"> <li>Adoption of best management practices to ensure that any discharge complies with EA consent (eg EA PPGs<sup>8</sup> and CIRIA<sup>9</sup> guidance)</li> <li>Prevention of uncontrolled releases of contaminants from vehicles (e.g. wheel washes on site and protective butts on bridge crossings)</li> <li>The mitigation measures listed in the surface water quality and drainage section also apply here</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<b>Bats</b>		
<ul style="list-style-type: none"> <li>If bat roosts/hibernacula are present, demolition of buildings that support bats could result in their injury or death</li> </ul>	<ul style="list-style-type: none"> <li>Surveys, by a qualified expert will be undertaken for each building that may contain roosts/hibernacula prior to demolition. Where necessary, any entrances to roosts/hibernacula will be blocked (under licence from DEFRA) and alternative roosts/hibernacula will be provided</li> </ul>	<ul style="list-style-type: none"> <li>'Hold points' will be established in individual decommissioning project plans for potentially affected buildings</li> </ul>
<b>Peregrine</b>		
<ul style="list-style-type: none"> <li>Disturbance of nesting peregrine</li> </ul>	<ul style="list-style-type: none"> <li>Suitable nest sites will be checked, by a qualified expert, prior to any demolition works that are carried out during the breeding season (March-July). If nesting peregrine are present, demolition works that could have an impact on them will be postponed until after the breeding season</li> </ul>	<ul style="list-style-type: none"> <li>If the demolition of any structure is planned during the peregrine breeding season, checks will be undertaken to ensure that no nests are located on them. If any peregrine are found to be nesting the demolition programme will be delayed</li> </ul>

## Mitigation measures already identified (Condition 3a)

<sup>8</sup> PPGs (Pollution Prevention Guidance Notes) are published by the Environment Agency(EA) to provide guidance relevant to a wide range of industrial activities. Further details are available at the EA website <http://www.environment-agency.gov.uk/>

<sup>9</sup> A company owned by other companies, universities, government departments and other public sector agencies, organisations and regulators. CIRIA's primary aims are to improve the quality, efficiency, cost-effectiveness and safety of both the provision and operation of the modern built environment. Further information is available on the CIRIA website <http://www.ciria.org.uk/>

Environmental Impact	Mitigation Measures	Action
<b>Geology, Hydrogeology and Soils</b>		
<b><u>Non-radioactive contamination</u></b>		
<ul style="list-style-type: none"> <li>Disturbance of existing ground contamination (eg removal of underground storage tanks and pipelines or blasting activities associated with cooling tower demolition), involving exposure or spread of contaminants and possible subsequent rainwater leaching or groundwater ingress</li> </ul>	<ul style="list-style-type: none"> <li>Before any blasting or excavation of any soil that may be required, ground will be surveyed to ensure that no contamination is present</li> <li>Any soils identified as contaminated will be segregated from non-contaminated soils and carefully managed to prevent spread of contamination, then disposed of off-site at appropriate disposal facilities, subject to the necessary regulatory permissions</li> <li>Any water ingress to excavation areas will be controlled to minimise the volume of water that could become contaminated (if contamination were present) and require subsequent management</li> <li>Where soil contamination is identified, any water that enters excavations will also be sampled and analysed. If there is a need to pump contaminated water out of excavations, this will be done such as to ensure that the waste water is disposed of appropriately</li> <li>Any excavated material will be monitored prior to reuse as infill</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans. The effectiveness of these measures will be assessed, as part of the close out of the project, in the Plant Modification Paper.</li> </ul>
<ul style="list-style-type: none"> <li>Contamination arising from temporary storage of demolition materials, by mobilisation or mixing/movement</li> </ul>	<ul style="list-style-type: none"> <li>Demolition wastes will be subject to analysis to determine their suitability for later use as a backfill material to below-ground voids on the site</li> <li>Demolition wastes identified as contaminated will be appropriately managed</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<ul style="list-style-type: none"> <li>Spills and leaks of non-radioactive chemicals</li> </ul>	<ul style="list-style-type: none"> <li>Fuel and lubricating/hydraulic oil or other chemicals stored on site will be stored in tanks located within bunded facilities, as recommended in PPG 2<sup>10</sup> and PPG 6<sup>11</sup></li> <li>Refilling or emptying of these tanks will be in accordance with the guidelines in PPG 6 and PPG 11<sup>12</sup></li> <li>Any accidental spills of fuel/oil/chemicals will follow procedures in the Spill Response Plan for the site compliant with PPG 21<sup>13</sup></li> </ul>	<ul style="list-style-type: none"> <li>Routine control will be enforced through existing site procedures. Any additional requirements will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<b><u>Radioactive contamination</u></b>		
<ul style="list-style-type: none"> <li>Disturbance of existing ground contamination, involving exposure or spread of contaminants and possible subsequent rainwater leaching or groundwater ingress</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>
<ul style="list-style-type: none"> <li>Contamination arising from temporary storage of demolition materials, by mobilisation or mixing / movement</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>

<sup>10</sup> PPG2 – Above ground oil storage tanks    <sup>11</sup> PPG6 – Working at construction and demolition sites    <sup>12</sup> PPG11 – Preventing pollution at industrial sites

<sup>13</sup> PPG21 – Pollution incident response planning

Environmental Impact	Mitigation Measures	Action
<b>Landscape and Visual</b>		
No significant adverse environmental impacts identified arising from decommissioning activities.		
<b>Noise and Vibration</b>		
<b><u>Local Residential Properties</u></b>		
<ul style="list-style-type: none"> <li>Noise and vibration generated during construction work</li> </ul>	<ul style="list-style-type: none"> <li>Good working practices to ensure noise and vibration generation is minimised</li> <li>Cumbria and Lancashire Health Protection Unit will be informed of significant noise generating activities during decommissioning</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<b>Socio-economic</b>		
<b><u>Employment/ Unemployment</u></b>		
<ul style="list-style-type: none"> <li>Long-term loss of 365 job opportunities in the Copeland Borough and West Cumbria <sup>14</sup> area combined</li> <li>Increase in unemployment of up to 265 (worst case) in West Cumbria</li> <li>Increase in unemployment of up to 200 (worst case) in Copeland</li> </ul>	<ul style="list-style-type: none"> <li>Sellafield Ltd will attempt to re-deploy affected staff (including in West Cumbria) and will provide opportunities for early retirement</li> <li>Sellafield Ltd will continue its current financial support for job creation initiatives in West Cumbria</li> <li>Additional mitigation will result from the wider regeneration initiatives currently being undertaken in West Cumbria (eg through the activities of West Lakes Renaissance)</li> <li>Sellafield Ltd will continue to engage with relevant stakeholders (including Cumbria County Council, Copeland Borough Council and NDA) with regard to the socio-economic issues arising from the decommissioning programme at Calder Hall</li> </ul>	<ul style="list-style-type: none"> <li>During the post-operational transition, affected staff were re-deployed and opportunities were provided for early retirement. Any future changes will continue to utilise the established HR policies and practices</li> <li>These activities will be developed in the future in consultation between Sellafield Ltd and the NDA</li> <li>The West Cumbria Site Stakeholder Group will be the main focus for engagement with the relevant stakeholders</li> </ul>

<sup>14</sup> West Cumbria was the study area used in the environmental impact assessment. This is the area covered by the Whitehaven and Workington Travel to Work Areas as used in study prepared for the Environment Council [ERM Economics (2003) West Cumbria: Socio-Economic Study - 2003 Update]

Environmental Impact	Mitigation Measures	Action
<b>Surface Water Quality and Drainage</b>		
<b><u>Turbid Water</u></b>		
<ul style="list-style-type: none"> <li>Release of turbid water into River Calder and its tributary, impacting aquatic ecology and water quality</li> </ul>	<ul style="list-style-type: none"> <li>Adoption of best management practices to control release of turbid water (eg EA PPGs and CIRIA guidance) such as , buffer strips next to watercourses, cut-off drains, sumps for collecting turbid water, minimisation of soil stockpiling and diversion of any site runoff in close proximity to watercourses</li> <li>Surface water discharges will be made in accordance with site discharge limits</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<b><u>Traffic Related Effects</u></b>		
<ul style="list-style-type: none"> <li>Release of turbid water and other pollutants from traffic, impacting aquatic ecology and water quality</li> </ul>	<ul style="list-style-type: none"> <li>A wheel wash will clean all traffic leaving the site</li> <li>Water used in the wheel wash will be recycled, thereby avoiding discharges into the aquatic environment</li> <li>All roads close to the decommissioning site will be kept swept to ensure that there is no soiling of public highways</li> <li>Protective butts on bridge crossings will prevent turbid water running off bridges into the River Calder</li> <li>Vehicles will also be kept in good working order and checks will be made as part of routine environmental audits of the operations</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> <li>These mitigation measures will be considered as part of the development of the Transport Management Plan</li> </ul>
Environmental Impact	Mitigation Measures	Action
<b><u>Minor Spills and Leaks</u></b>		
<ul style="list-style-type: none"> <li>Minor spills and leaks of non-radioactive chemicals, impacting aquatic ecology and water quality</li> </ul>	<ul style="list-style-type: none"> <li>All chemicals, fuels, lubricants, oils and other potential contaminants will be stored on-site in designated areas in accordance with best practice and EA PPGs</li> <li>Designated refuelling bays will be used to refuel plant and vehicles</li> <li>Drip trays and bunds will provide protection from spills and leaks</li> <li>Oil and fuel will be stored within impermeable bunds that will provide 110% of the stored volume</li> <li>Spill response kits will be available</li> </ul>	<ul style="list-style-type: none"> <li>Routine control will be enforced through existing site procedures. Any additional requirements will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<b><u>Traffic and Transport</u></b>		
No significant adverse environmental impacts identified arising from decommissioning activities.		

Activities where mitigation may be required but specific measures cannot yet be selected (Condition 3b)

Environmental Impact	Mitigation Measures Under Consideration
<ul style="list-style-type: none"> <li>Migration of existing ground contamination (radioactive and/or non-radioactive) from the main Sellafield site to Calder Hall</li> </ul>	<ul style="list-style-type: none"> <li>Excavate and segregate contaminated from non-contaminated soils then dispose of to appropriate disposal facilities, subject to the necessary regulatory permissions</li> <li>Monitor in situ if further migration of contamination is unlikely</li> <li>Decontaminate soil if practicable</li> </ul>
<ul style="list-style-type: none"> <li>Historical value of Calder Hall</li> </ul>	<ul style="list-style-type: none"> <li>A strategy to preserve the historical and industrial value of all the magnox reactor sites, of which Calder Hall is one, is in progress Sellafield Ltd will provide supporting information to the NDA as required to assist in making any decisions. Potential options include the following:               <ul style="list-style-type: none"> <li>Conducting a Royal Commission of the Historical Monuments of England (RCHME) level 1 survey</li> <li>Undertaking a comprehensive cataloguing of existing where appropriate</li> <li>Retaining operational records and other documents of interest</li> <li>Displaying items of plant of interest, eg panels from a control room, in a visitors centre and/or museum</li> <li>Refer also to comment under 'Archaeology and Cultural Heritage'.</li> </ul> </li> </ul>

Activities where mitigation may be required but it is not yet possible to identify possible mitigation measures (Condition 3c)

## CARE AND MAINTENANCE

Environmental Impact
There are no activities that have not been assessed for care and maintenance preparations.

Environmental Impact	Mitigation Measures	Action
<p>During care and maintenance no significant works are planned with the possible exception of re-cladding the reactor buildings (should this be required). It is anticipated that the reactors would be re-clad in a similar material to that used at the start of care and maintenance hence the visual impact will remain unchanged</p> <p>No other significant adverse environmental impacts were identified during care and maintenance</p>	No mitigation measures are required	None required

## FINAL SITE CLEARANCE

### Mitigation measures already identified (Condition 3a)

Environmental Impact	Mitigation Measures	Action
<b>Air Quality and Climatic Factors</b>		
No significant adverse environmental impacts identified arising from decommissioning activities.		
<b>Archaeology and Cultural Heritage</b>		
The Nuclear Decommissioning Authority has stated that it does not intend to fund the preservation of Reactor 1 and will oppose listing. NDA will engage with English Heritage to decide how best to commemorate the site commensurate with the available funding.		
<b>Ecology</b>		
<b>Surface water quality</b>		
<ul style="list-style-type: none"> <li>Release of contaminants and resulting reduction in water quality of the River Calder and its confluence with the River Ehen, which could impact aquatic ecological receptors</li> </ul>	<ul style="list-style-type: none"> <li>Adoption of best management practices to ensure that any discharge complies with EA consent (eg EA PPGs and CIRIA guidance)</li> <li>Prevention of uncontrolled releases of contaminants from vehicles (eg wheel washes on site and protective butts on bridge crossings)</li> <li>The mitigation measures listed in the surface water quality and drainage section also apply here</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<b>Bats</b>		
<ul style="list-style-type: none"> <li>If bat roosts/hibernacula are present, demolition of buildings that support bats could result in their injury or death</li> </ul>	<ul style="list-style-type: none"> <li>Surveys, by a qualified expert, will be undertaken for each building that may contain roosts/hibernacula prior to demolition. Where necessary, any entrances to roosts / hibernacula will be blocked (under licence from DEFRA) and alternative roosts/hibernacula will be provided</li> </ul>	<ul style="list-style-type: none"> <li>'Hold points' will be established in individual decommissioning project plans for potentially affected buildings</li> </ul>
<b>Peregrine</b>		
<ul style="list-style-type: none"> <li>Disturbance of nesting peregrine</li> </ul>	<ul style="list-style-type: none"> <li>Suitable nest sites will be checked, by a qualified expert, prior to any demolition works that are carried out during the breeding season (March-July). If nesting peregrine are present, demolition works that could have an impact on them will be postponed until after the breeding season</li> </ul>	<ul style="list-style-type: none"> <li>If the demolition of any structure is planned during the peregrine breeding season, checks will be undertaken to ensure that no nests are located on the them. If any peregrine are found to be nesting the demolition programme will be delayed</li> </ul>

Environmental Impact	Mitigation Measures	Action
<b>Geology, Hydrogeology and Soils</b>		
<b><u>Non-radioactive contamination</u></b>		
<ul style="list-style-type: none"> <li>Disturbance of existing ground contamination, involving exposure or spread of contaminants and possible subsequent rainwater leaching or groundwater ingress</li> </ul>	<ul style="list-style-type: none"> <li>Before any blasting or excavation of any soil that may be required, ground will be surveyed to ensure that no contamination is present</li> <li>Any soils identified as contaminated will be segregated from non-contaminated soils and carefully managed to prevent spread of contamination, then disposed of off-site at appropriate disposal facilities, subject to the necessary regulatory permissions</li> <li>Any water ingress to excavation areas will be controlled to minimise the volume of water that could become contaminated (if contamination were present) and require subsequent management</li> <li>Where soil contamination is identified, any water that enters excavations will also be sampled and analysed. If there is a need to pump contaminated water out of excavations, this will be done such as to ensure that the waste water is disposed of appropriately</li> <li>Any excavated material will be monitored prior to reuse as infill</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<ul style="list-style-type: none"> <li>Contamination arising from temporary storage of demolition materials, by mobilisation or mixing/movement</li> </ul>	<ul style="list-style-type: none"> <li>Demolition wastes will be subject to analysis to determine their suitability for later use as a backfill material to below-ground voids on the site</li> <li>Demolition wastes identified as contaminated will be appropriately managed</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<ul style="list-style-type: none"> <li>Spills and leaks of non-radioactive chemicals</li> </ul>	<ul style="list-style-type: none"> <li>Fuel and lubricating/hydraulic oil or other chemicals stored on site will be stored in tanks located within bunded facilities, as recommended in EA PPG 2 and PPG 6</li> <li>Refilling or emptying of these tanks will be in accordance with the guidelines in PPG 6 and PPG 11</li> <li>Any accidental spills of fuel/oil/chemicals will follow procedures in the Spill Response Plan for the site compliant with PPG 21</li> </ul>	<ul style="list-style-type: none"> <li>Routine control will be enforced through existing site procedures. Any additional requirements will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<b><u>Radioactive contamination</u></b>		
<ul style="list-style-type: none"> <li>Disturbance of existing ground contamination, involving exposure or spread of contaminants and possible subsequent rainwater leaching or groundwater ingress</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>
<ul style="list-style-type: none"> <li>Contamination arising from temporary storage of demolition materials, by mobilisation or mixing/movement</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>

Environmental Impact	Mitigation Measures	Action
<b>Landscape and Visual</b>		
No significant adverse environmental impacts identified arising from decommissioning activities		
<b>Noise and vibration</b>		
<b><u>Local Residential Properties</u></b>		
<ul style="list-style-type: none"> <li>Noise and vibration generated during construction work</li> </ul>	<ul style="list-style-type: none"> <li>Good working practices to ensure noise and vibration generation is minimised</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<b>Socio-economic</b>		
No significant adverse environmental impacts identified arising from decommissioning activities.		
<b>Surface Water Quality and Drainage</b>		
<b><u>Turbid Water</u></b>		
<ul style="list-style-type: none"> <li>Release of turbid water into River Calder and its tributary, impacting aquatic ecology and water quality</li> </ul>	<ul style="list-style-type: none"> <li>Adoption of best management practices to control release of turbid water (eg EA PPGs and CIRIA guidance) such as , buffer strips next to watercourses, cut-off drains, sumps for collecting turbid water, minimisation of soil stockpiling and diversion of any site runoff in close proximity to watercourses</li> <li>Surface water discharges will be made in accordance with site discharge limits</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<b>Traffic Related Effects</b>		
<ul style="list-style-type: none"> <li>Release of turbid water and other pollutants from traffic, impacting aquatic ecology and water quality</li> </ul>	<ul style="list-style-type: none"> <li>A wheel wash will clean all traffic leaving the site where appropriate</li> <li>Water used in the wheel wash will be recycled, thereby avoiding discharges into the aquatic environment</li> <li>All roads close to the decommissioning site will be kept swept to ensure that there is no soiling of public highways</li> <li>Protective butts on bridge crossings will prevent turbid water running off bridges into the River Calder</li> <li>Vehicles will also be kept in good working order and checks will be made as part of routine environmental audits of the operations</li> </ul>	<ul style="list-style-type: none"> <li>These mitigation measures will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> <li>These mitigation measures will be considered as part of the development of the Transport Management Plan</li> </ul>

Environmental Impact	Mitigation Measures	Action
<b>Minor Spills and Leaks</b>		
<ul style="list-style-type: none"> <li>Minor spills and leaks of non-radioactive chemicals, impacting aquatic ecology and water quality</li> </ul>	<ul style="list-style-type: none"> <li>All chemicals, fuels, lubricants, oils and other potential contaminants will be stored on-site in designated areas in accordance with best practice and PPGs</li> <li>Designated refuelling bays will be used to refuel plant and vehicles</li> <li>Drip trays and bunds will provide protection from spills and leaks</li> <li>Oil and fuel will be stored within impermeable bunds that will provide 110% of the stored volume</li> <li>Spill response kits will be available</li> </ul>	<ul style="list-style-type: none"> <li>Routine control will be enforced through existing site procedures. Any additional requirements will be considered as part of the environmental, health and safety justification produced as part of individual decommissioning project plans</li> </ul>
<b>Traffic and Transport</b>		
No significant adverse environmental impacts identified arising from decommissioning activities.		

### Activities where mitigation may be required but specific measures cannot yet be selected (Condition 3b)

Environmental Impact	Mitigation Measures Under Consideration
<ul style="list-style-type: none"> <li>Migration of existing ground radioactive and/or non-radioactive contamination from the main Sellafield site to Calder Hall</li> </ul>	<ul style="list-style-type: none"> <li>Excavate and segregate contaminated from non-contaminated soils then dispose of to appropriate disposal facilities, subject to the necessary regulatory permissions</li> <li>Monitor in situ if further migration of contamination is unlikely</li> <li>Decontaminate soil if practicable</li> </ul>

### Activities where mitigation may be required but it is not yet possible to identify possible mitigation measures (Condition 3c)

Environmental Impact
<ul style="list-style-type: none"> <li>Additional mitigation measures (or any changes required to those measures listed above) for activities during final site clearance will be based on the technologies available at that time, decommissioning experience and any future environmental assessment deemed necessary.</li> </ul>

## APPENDIX 1 - TRANSPORT MANAGEMENT PLAN

### Objective

As with any construction or demolition project, the decommissioning of Calder Hall will involve a significant number of transport movements, particularly in the interim decommissioning and the final site clearance stages. All decommissioning operations involving transport will be managed so as to minimise the environmental effects of these operations, as far as is reasonably practicable. The principles for achieving this are defined in this initial Transport Management Plan for the interim decommissioning period. This will develop as the detailed arrangements for decommissioning develop and future revisions will include more detail. Implementation will be managed through Management Plans for the individual projects.

Compared to other reactor decommissioning sites, the effects of these movements will be smaller in the interim decommissioning phase due to:

- The limited requirement for new buildings and associated construction traffic;
- The lower number of significant buildings to demolish since Calder Hall does not have dedicated fuel storage ponds or effluent treatment plant;
- The availability of rail transport for movement of low level waste to Drigg;
- The impact on the number of transport movements from the Sellafield Site as a whole is less with Calder Hall being situated on the much larger industrial complex.

### Transport Management Principles

- Low level waste will be transported by rail to the national LLW depository at Drigg;
- HGVs will be required to exit the site through the Sellafield Main Gate and, where appropriate, to follow a preferred trunk road route;
- The numbers of individual transport movements will be minimised as far as is reasonably practicable;
- Employees and contractors will be encouraged to share transport (or use public transport) when travelling to and from the Calder Hall site;
- Sellafield Ltd and their contractors will be required to use and maintain their vehicles in a good standard of condition. This will be monitored by Sellafield Ltd
- When appropriate, vehicles leaving demolition sites will be subject to wheel wash and inspection to ensure that earth and other material is not unduly dispersed;
- On-site roads will be swept as necessary to minimise the spread of material off-site and/or into drains or watercourses. Where appropriate, drains and watercourses will be protected;
- Signage will be provided at site exits to reinforce the contract requirements on vehicle drivers;
- Where practicable, transport distances will be minimised by the use of local disposal sites, recycling companies, etc.;
- Most HGV transport movements will be undertaken during normal working hours;
- In the event of need for an abnormal load to be transported, a specific plan for this movement will be developed.

### Monitoring and Reporting

Implementation of the transport management principles will be monitored throughout the interim decommissioning period and reported through the periodic reviews of the Environmental Management Plan.

**APPENDIX 2 - CONSENT TO DECOMMISSION AND ATTACHED CONDITIONS****1. ANNEX 7 Consent and conditions**

Decommissioning Project Consent No.1

June 2005

**NUCLEAR REACTORS (ENVIRONMENTAL IMPACT ASSESSMENT FOR  
DECOMMISSIONING) REGULATIONS 1999****CONSENT**

granted under regulation 4(b)  
in accordance with regulation 8(3)  
with conditions attached under regulation 8(4)

**CALDER HALL POWER STATION**

The Health and Safety Executive, for the purposes of regulation 4(b) in accordance with regulation 8(3), hereby grants consent for carrying out the project <sup>3</sup> applied for under regulation 4(a), in particular, to remove all buildings except the reactor buildings, alter the reactor buildings for a period of deferment, retrieve and transfer intermediate level radioactive waste to Sellafield and clear the site, subject to the conditions under regulation 8(4) attached.

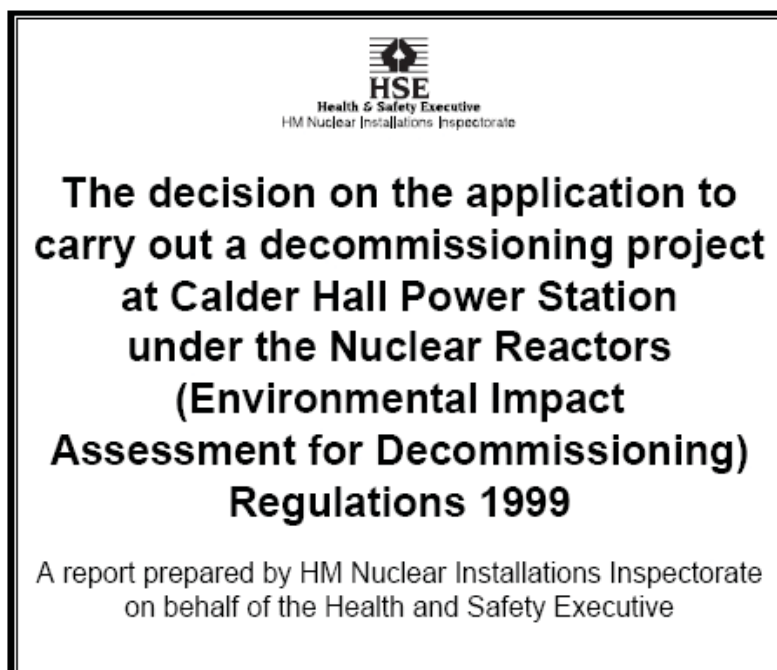
Dated:

For and on behalf of the  
Health and Safety Executive

Signed

Dr A N Hall

A person authorised to act in that behalf



<sup>3</sup> Project as defined in regulation 2

Conditions attached to Decommissioning Project Consent No.1 June 2005

**NUCLEAR REACTORS (ENVIRONMENTAL IMPACT ASSESSMENT FOR DECOMMISSIONING) REGULATIONS 1999 CONDITIONS**

attached under regulation 8(4)  
to Decommissioning Project Consent No. 1 granted under regulation 4(b)

**CALDER HALL POWER STATION**

**Condition 1**

The project shall commence before the expiration of 5 years from the date of this Consent.

**Condition 2**

- (1) The licensee is required to prepare and implement an environmental management plan to cover mitigation measures to prevent, reduce and where possible offset any significant adverse effects on the environment.
- (2) The project shall not be carried out except in accordance with the environmental management plan.

**Condition 3**

Within 90 days of the date of this Consent, with reference to the environmental statement provided under regulation 5(1) and evidence to verify information in the environmental statement, provided under regulation 10(9), the environmental management plan shall:

- a. list the mitigation measures that are already identified in the environmental statement and evidence submitted to verify information in the environmental statement;
- b. list the options to implement work activities where mitigation measures may be required but where selection of an option will only be possible in the future;
- c. list the work activities where mitigation measures may be required but where assessments to identify mitigation measures will only be possible in the future.

**Condition 4**

Subsequent to condition 3, the environmental management plan shall:

4 Project as defined in regulation 2

- a. with reference to condition 3b, identify the mitigation measures for options that have been selected, giving reasons for their selection;
- b. with reference to condition 3c, identify the mitigation measures from assessments carried out, giving reasons for their selection;
- c. describe the effectiveness of the mitigation measures over time;
- d. describe significant changes to the mitigation measures in light of experience, giving reasons for such changes.

**Condition 5**

The licensee is required to:

- a. provide the environmental management plan to the Health and Safety Executive within 90 days of the date of this Consent and every year thereafter, or within such longer time as the Executive may agree;
- b. make the environmental management plan available to the public within 30 days of the plan being sent to the Health and Safety Executive, or within such longer time as the Executive may agree; the plan may replace earlier versions.

**Condition 6**

The licensee is required to provide notice to the Health and Safety Executive of any significant change to a mitigation measure to prevent, reduce and where possible offset any major adverse effects on the environment no less than 30 days before the change is made, or within such shorter time as the Executive may agree. Dated:

For and on behalf of the  
Health and Safety Executive

Signed

K Allars  
A person authorised to act in that behalf





**Sellafield Ltd**

**Sellafield Site**

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