Magnox North

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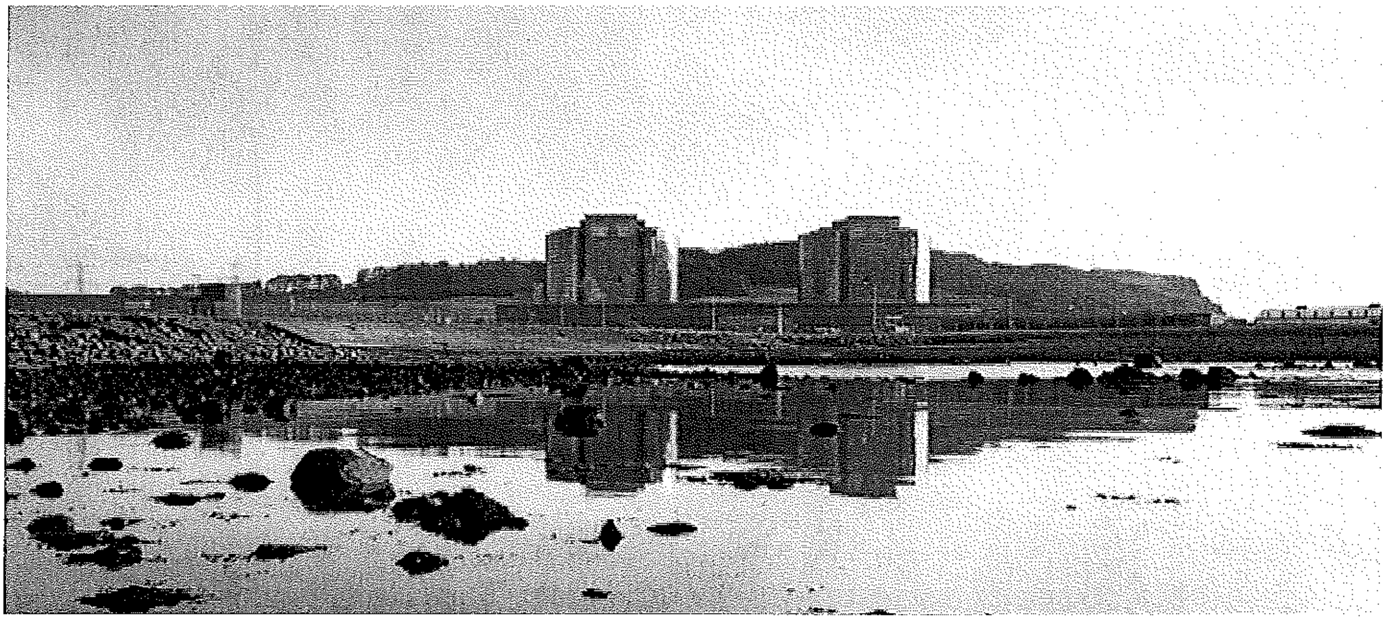
Information in Support of the Application by Magnox North Ltd for Authorisation under RSA93 to Dispose of Radioactive Waste from the Hunterston A Site

HNA/3800/TC/SR/981 – Issue 1 March 2010



Hunterston A Site

STATION REPORT - **HNA/3800/TC/SR/981**
Information in Support of Application by Magnox North Ltd for Authorisation under RSA93 to Dispose of Radioactive Waste from the Hunterston A Site
ISSUE 1

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Information in Support of Application by Magnox North Ltd for Authorisation under RSA93 to Dispose of Radioactive Waste from the Hunterston A Site.

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EXECUTIVE SUMMARY

Magnox North Ltd currently holds authorisations granted under the Radioactive Substances Act 1993 (RSA 93) to dispose of liquid, gaseous and solid low level (LLW) radioactive waste from Hunterston A Site. Magnox North Ltd is applying for a new, 'multi-media' RSA93 authorisation covering all of the identified radioactive waste disposals to the end of the current 'Care and Maintenance Preparations' stage of the decommissioning programme.

Information is presented on matters relating to the disposals of radioactive waste, including anticipated future developments, and as appropriate, past, present and projected performance. This includes Magnox North Ltd's business context and development programmes as described in the Lifetime Plan submitted to the Nuclear Decommissioning Authority (NDA).

It also explains and substantiates the radioactive waste disposal requirements and prospective assessments of their impact.

This application is for the following routes:

Radioactive Waste Type	Disposal Route
Gaseous Waste	Discharge to the atmosphere
Aqueous Waste	Discharge to the Clyde Estuary
Organic Liquid Waste	Transfer to a suitably licensed facility for the purpose of incineration.
Solid Waste:	
Solid Low Level Waste (LLW)	Transfer of solid LLW to a suitably licensed facility for the purpose of disposal.
Solid High Volume Very Low Level Waste (HVVLLW)	Transfer of solid HVVLLW to a suitably licensed land-fill site for the purpose of disposal.
Solid Metallic Low Level Waste	Transfer of segregated metallic LLW to a suitably licensed facility for the purpose of smelting.

The limits in the current authorisations of gaseous and liquid wastes will continue to be required until the 'Care and Maintenance' phase, while volumes of LLW (including HVVLLW) disposals will require to be increased. Authorisation to transfer organic wastes for incineration is required during this period.

Disposals of radioactive waste from Hunterston A Site have had negligible effect on the public and the environment and this situation will continue, with the proposed continuation of the existing limits for discharges. The negligible impacts of increased transport and disposal are outweighed by the reduction in hazard at Hunterston A Site. Likewise, the proposed activity limits to the incineration of combustible waste at a suitably licensed facility will have negligible impact on the public and the environment. Public and environmental impacts at transfer/disposal facilities are substantiated and controlled by their own authorisations.

The overarching requirement to apply and demonstrate Best Practicable Means (BPM) will ensure that disposals are As Low As Reasonably Achievable (ALARA).

1 INTRODUCTION

The current Radioactive Substances Act 1993 (RSA93) (as amended by the Energy Act 2004) authorisations (Reference 1 to 3) to dispose of radioactive waste from Hunterston A Site are held by Magnox Electric Ltd. It is now proposed to amend the RSA93 discharge authorisations of Hunterston A Site and apply for a single new, 'multi-media' authorisation covering all the required radioactive waste streams.

1.1 Purpose

This document provides both Magnox North Ltd's application and technical information in support of application to dispose of radioactive wastes by:

- Discharging gaseous and liquid wastes to the atmosphere and Clyde Estuary respectively;
- Transferring organic liquid wastes to a suitably licensed facility for the purpose of incineration;
- Transferring solid low level radioactive wastes (LLW) to a suitably licensed facility for the purpose of disposal;
- Transferring solid (high volume very low level) radioactive wastes (HVVLLW) to a suitably licensed land-fill site for disposal;
- Transferring segregated metallic wastes to a suitably licensed facility for the purpose of smelting.

This document presents information on matter relating to the disposal of radioactive waste, including information on past disposals for each route, the environmental impact of discharges, the implications of waste disposals from future developments and substantiation for disposal requirements.

1.2 Scope

The scope of this application is for all identified discharges and disposals required to be managed and authorised under an RSA93 authorisation for the Hunterston A Site to the end of the 'Care and Maintenance Preparations' stage of the decommissioning process.

2 THE SITE AND ITS ACTIVITIES

2.1 Operator

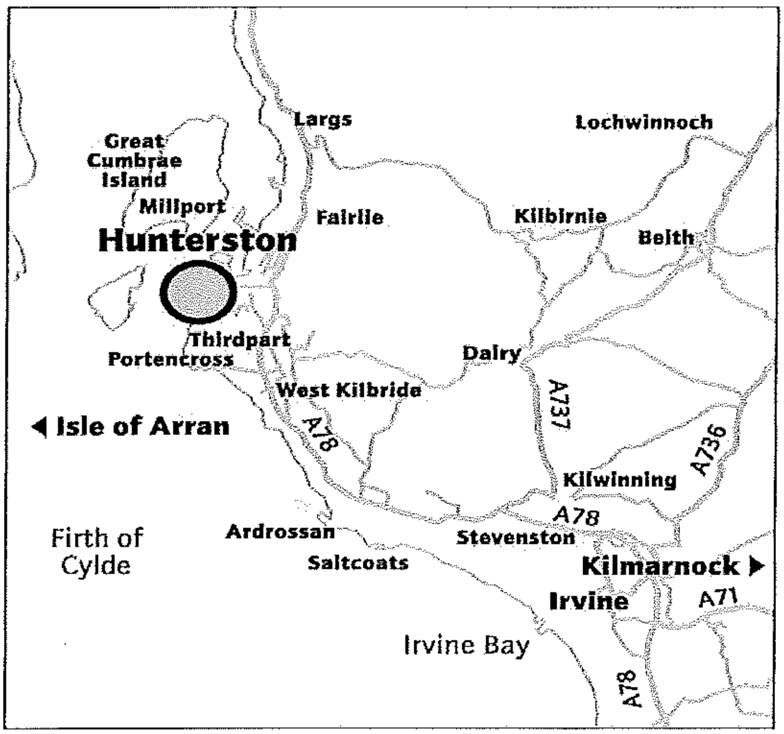
The Hunterston A Site is managed and operated by Magnox North Ltd (MXN). These activities are undertaken for the landholder, the Nuclear Decommissioning Authority (NDA), with which MXN has a contract.

The operation of the nuclear facilities at Hunterston A Site is controlled by conditions attached to the Nuclear Site Licence. The Nuclear Site Licence is issued by the HSE under the Nuclear Installations Act 1965 (as amended) and overseen by the Nuclear Installations Inspectorate (NII). Radiation exposure to employees and other persons is governed by the requirements of the Ionising Radiations Regulations 1999 (IRR99). Discharges of liquid and gaseous radioactivity to the environment and solid radioactive waste transfer and disposal are controlled under the Radioactive Substances Act, 1993 (RSA93). Authorisations issued under the RSA93 are overseen by the Scottish Environment Protection Agency (SEPA). It is a requirement of these authorisations that the Company not only complies with specified limits, but that it also uses BPM to reduce the quantity of radioactivity that it disposes of and discharges from the site. Site security arrangements are regulated by the Office for Civil Nuclear Security (OCNS).

2.2 General Location

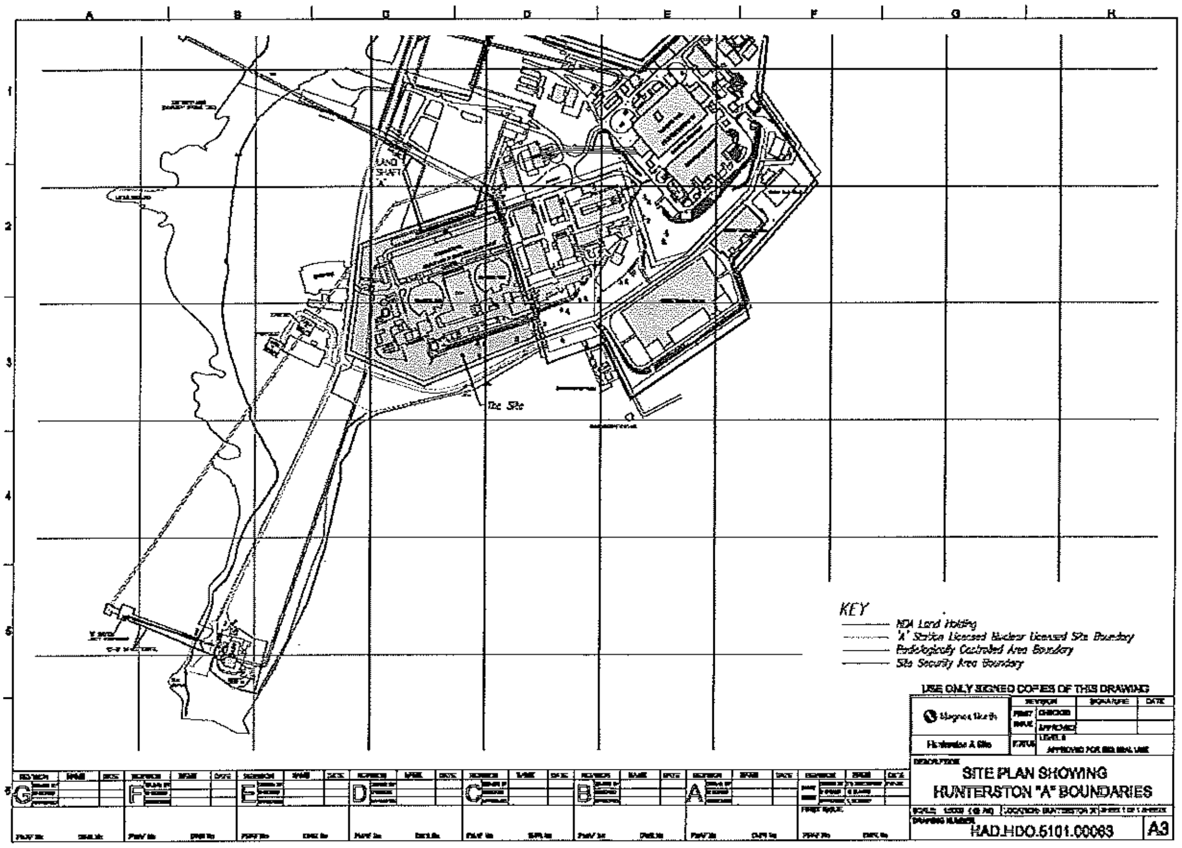
The Hunterston A Site is located on the Hunterston Peninsula in North Ayrshire approximately 5km south west of the village of Fairlie, as shown in Figure 1. The geographical co-ordinates are 55.7N 4.9W, Ordnance Survey Grid Reference NS 182512.

Figure 1 Hunterston A Site Location



Hunterston A Site lies immediately to the south west of the Hunterston B Power Station which is owned and operated by British Energy Generation Ltd (BEGL). The two sites are separate nuclear licensed sites. Figure 2 shows the general site layout.

Figure 2: General site layout.



The Site is approached by a private road of approximately 3km in length from the Hunterston roundabout on the A78 between Fairlie and Seamill. This road services both Hunterston A Site and the BEGL Hunterston B Power Station. The Glasgow to Largs railway line has stations at both West Kilbride and Fairlie. There is a coal loading terminal, operated by Clydeport Operations Ltd, between these stations with a branch line into the main Clydeport site.

2.3 Magnox Plant

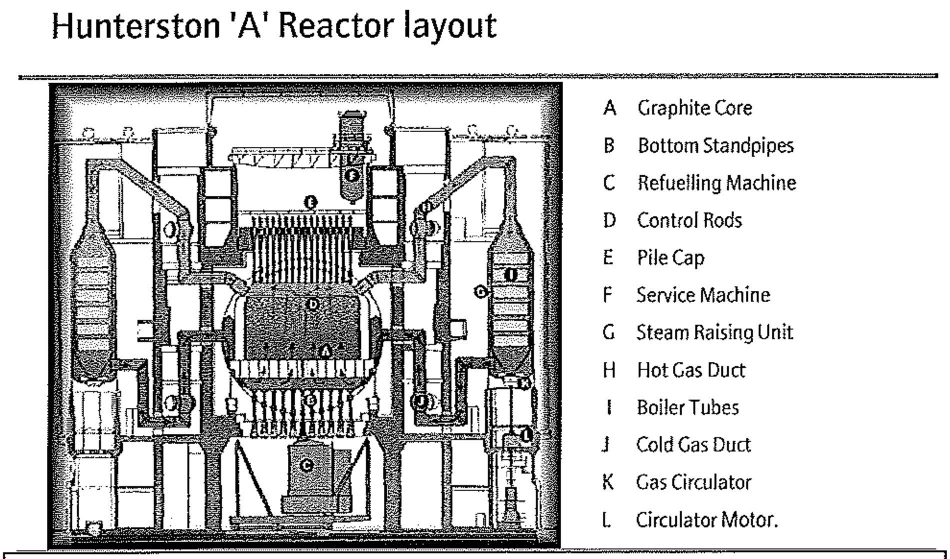
Hunterston A Power Station was one of the first generation of UK commercial nuclear power stations. Planning permission was given by the Minister of Power prior to construction by the South of Scotland Electricity Board (SSEB) to begin in October 1957. Generation commenced in February 1964 and ceased in March 1990. De-fuelling was completed in February 1995 and the site is currently in the process of decommissioning. Table 2.1 below shows the summary programme.

Activity	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
MAETP Testing & Commissioning												
MAETP Caustic Dosing & Sr90 Abatement												
MAETP Operation												
Deplant & Demolish AETP												
Removal of Active Effluent Discharge Line												
Decommission MAETP												
Weather Envelope Construction												
Reactor Temporary Weather Barrier												
Drain & Clean CCP												
Deplant CCP In-Pond, Ventilation & Containment												
Remove Sand from Sand Filters												
Deplant & Demolish CCP Misc & Final Delay Tanks												
Deplant & Demolish CCP Sludge Retention Tanks & Supernatant Tank												
Deplant & Demolish Misc. Sludge Retention Tanks & Supernatant Tank												
Demolish CCP Structures												
CCP Skip Cleaning / Disposal												
Deplant & Demolish Depleted Acid Storage Facility												
Decommission CW and Outfall Systems												
Replacement RCA Stormwater System Phase 1												
Remove Existing RCA Stormwater System												
Removal of Active Drains												
SAWB Retrieval Active Commission												
SAWB Retrieval Operation												
Deplant / Demolish SAWB												
Reactor Deplanting (Phase 3 including CO2 p/work)												
Reactor Deplanting (Phase 4)												
Deplant Pile Cap Cranes & Service Machines												
Demolish Precip. Tower Building												

Deplant & Demolish LLW Transfer Facility												
Deplant & Demolish LLW Processing Facility												
Deplant & Demolish NCAW Facility (1)												
Removal of Decontamination Facility												
Deplant & Demolish Exterior Charge Machine Rails & Turntables												
Deplant & Demolish Exterior Charge Machine Maintenance Facility												
R1 & R2 Circuit Isolation												
RPV & Gas Circ. Safestore Preparations												
Land Quality												
Foreshore Management Remedial Works & Monitoring												
ILW Sludge & Resin Recovery & Processing												
ILW Desiccant Retrieval & Packaging												
Modular Solid ILW Processing Facility												
ILW Store Active Commissioning												
Decommission Existing Sewage System												
Contaminated Oil Disposal												
Decommission Operations & Maintenance												

Hunterston A generated electricity from two Magnox reactors. In a Magnox reactor, heat generated by a controlled chain fission reaction in uranium fuel is transferred by carbon dioxide gas at high pressure and temperature to boilers where it is used to turn water into steam. The steam then powered 6 turbines at Hunterston A each driving an electrical generator.

Figure 3 – Simple schematic of Reactors



During its operational life Hunterston A contributed more than 57 billion units (57 Tera Watt hours (TWh)) of electricity for users in Scotland and was the world's top performing civil nuclear station between 1965 and 1980 (Reference 4).

2.3.1 Site Security

Physical measures that comply with the Government requirements, as specified in the Nuclear Industry Security Regulations (NISR) 2003, are in force at Hunterston A Site. These measures are kept under regular review by the Site Security Officer to ensure their continued effectiveness. The arrangements are audited internally by the Site audit team, and externally by the Office for Civil Nuclear Security (OCNS). In accordance with Government policy, the Company does not disclose details of the security measures which are taken.

2.3.2 Waste Arisings

Waste arisings are generated by the decommissioning of the plant, both through operation and maintenance of equipment and through major project operations. The site will produce radioactive waste in the following forms:

- Solid: From the deplanting and demolition of active facilities on the site, e.g. steel, wood, concrete and spoil.
- Liquid: From the operation and wash down of active plant. Also waste oil from draining of active systems or from the servicing of existing operational plant.
- Gaseous: From the operation of ventilation systems, used to maintain conditions in certain radiation and contamination controlled areas and from reactor vessel ventilation.

2.3.3 Safety

The Health and Safety at Work etc Act 1974 (HSWA) lays responsibilities on the Company to protect the public and workers from all hazards arising from its operations.

The Company recognises the existence of statutory limits for the radiation exposure of individuals as a result of normal operation, and requires that the exposure from normal operation and the risks arising from potential accidents shall be as low as reasonably practicable (ALARP). This approach is in accordance with those principles that the NII has set down in its document "Safety Assessment Principles for Nuclear Plants" (2006); these are derived from recommendations of the International Commission on Radiological Protection which were subsequently implemented by IRR99.

It is important to note that once electricity generation ceased in 1990 there was no further production of radionuclides on the Site once all the fuel was packaged and dispatched to Sellafield. Hence there could be no further transfer of fission products or actinides from any leaking fuel to the materials on the decommissioning site. The alternative pathways for the remaining activity are discharges as liquid or gaseous effluent, solid waste disposal and transfer of combustible wastes (oils and organic sludge) for incineration off-site at an approved facility. The activity remaining on Site reduces further because of radioactive decay.

The decommissioning work programmes that make up the Hunterston LTP include the conditioning of all waste streams giving rise to radioactive discharges for a number of years. Gaseous and liquid discharges, and solid waste disposals, have reduced significantly since the station was operational and are likely to remain at reduced levels until Cartridge Cooling Pond (CCP) cleaning/decontamination programme is completed.

The Company will continue to apply BPM to limit activity discharged from the Site due to decommissioning activities. The radiological impact of the operations to be undertaken on the site is summarised in Section 7.

2.3.4 Storage of Radioactive Materials on Site

A nuclear site licence is in force at Hunterston A Site, and RSA93 effectively exempts the licensee from the requirement for registration for the keeping and use of radioactive materials, and for authorisation to accumulate radioactive waste. These requirements are instead comprehensively covered by the nuclear site licence. The nuclear site licence conditions require the Company to minimise, so far as reasonably practicable, the rate of production and total quantity of radioactive waste accumulated on the site at any time. It also requires the Company to record the radioactive waste accumulated and, where specified by the NII, to obtain approval for the arrangements made to satisfy the licence conditions. To ensure compliance with the site licence, the NII consult with SEPA (who have the overall responsibility for waste management policy in Scotland), on the accumulation, storage and disposal of radioactive waste from the Site.

Note, that all nuclear fuel was removed from Hunterston A Site by 1995. Any hazard to the public and workers from the storage on site of radioactive waste is included within the doses given for the whole installation. Storage facilities and working practices are designed to give confidence that storage of waste will pose no operational, environmental, safety or economic difficulties.

2.3.5 Transport of Radioactive Material to and from Site

Transport for radioactive materials in Scotland is subject to control administered by the Department for Transport (DfT). Such control is based on the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009. A basic principle for these Regulations is that safety is achieved primarily by the use of an appropriate range of package categories each with performance requirements appropriate to the hazard from the permitted contents.

Quality assurance is a requirement at all stages of transport and limits are specified for the levels of radiation from packages and their external surface contamination levels.

Various materials other than radioactive wastes are consigned to and returned from various sites from time to time, including items of plant, instruments, samples and radioactive sources.

3 WASTE MANAGEMENT POLICY, ORGANISATION AND ARRANGEMENTS

3.1 Company Policy

Magnox North Ltd Environment, Health and Safety (EH&S) policy aims, by seeking continuous improvement, to achieve and maintain excellence in EH&S and operational performance.

The policy's primary goal is that no harm should result from its activities and that it will be respected and trusted by its workforce, the public and its stakeholders. In pursuing this it will work in partnership with its employees and contractors at all levels in Magnox North Ltd, and will strive to:

- maintain high standards of nuclear safety
- eliminate injuries and ill-health at work and minimise radiation doses
- prevent incidents, but nevertheless maintain effective emergency arrangements
- prevent pollution and minimise waste and the use of natural resources as part of our contribution to sustainability and environmental improvement
- ensure the safe disposal or storage of radioactive and other waste
- achieve and sustain an excellent safety and environmental culture
- learn the lessons from events, implement corrective actions and seek out and use good practices wherever we may find them
- ensure that our activities, products and services are in compliance with applicable legislation and meet the requirements of good practice and applicable standards of EH&S performance.

In doing this the Company will:

- consult our employees on EH&S matters of mutual interest
- listen to and respond to our customers, shareholder, suppliers and neighbours
- openly report our EH&S performance every year
- work with our regulators, the rest of our industry and our customers and contractors to raise EH&S standards
- inform, instruct, train and develop the people who work for us and ensure that competent EH&S advice is available
- audit the management system which flows from this policy, and set and review EH&S objectives and targets, working within a quality framework
- maintain high standards in the conduct of our operations, in particular by ensuring that they are adequately resourced and carried out by suitably qualified and experienced people and with regard to nuclear safety at all times.

3.2 Overall Arrangements for Environment, Health and Safety

The EH&S Policy statements, along with statutory requirements, are implemented through company procedures forming part of the overall management arrangements to manage all business activities. The SLC procedures include mandatory standards covering key EH&S issues, together with supporting advice and guidance. These ensure consistent standards are applied across all sites. In particular, they ensure that BPM are used to minimise radioactive waste arising and discharges to the environment and ensure that they are at all times below legal limits. This ensures that doses to the public are As Low As Reasonably Achievable (ALARA) and below legal limits.

Site procedures, standards and instructions are in place ensuring compliance with statutory requirements plus company procedures and mandatory standards. In particular, they ensure risks to EH&S are consistently and adequately assessed and controlled, and that protective measures appropriate to the hazard and risk are implemented.

The overall management arrangements have the following key features:

- ***Policy***, the Magnox North Ltd EH&S Policy;
- ***Organisation***, clear definition of responsibilities and the delegation of accountabilities for EH&S and arrangements for provision of specialist advice and consultative committees (set out in Company Manuals);
- ***Planning and Implementation,*** the procedures, standards and instructions to implement the requirements of the EH&S policy including compliance with all relevant statutory requirements. In particular, these ensure BPM are used to minimise radioactive arising and discharges, and that doses to the public are kept ALARA;
- ***Measuring and Reviewing Performance,*** the routine review to confirm the arrangements for EH&S have been adequately implemented;
- ***Audit,*** independent inspection and audit to ensure the effectiveness of the arrangements for EH&S.

Within the overall Company Arrangements Hunterston A have well-established arrangements for the management of EH&S issues. In particular, there are formal arrangements for ensuring compliance with the requirements of the RSA93 Authorisations and NSL for the site. Consequently, the operating processes and procedures will remain unaffected by the proposed authorisation.

3.3 Overall Responsibilities for Environment, Health and Safety

The Board of the Company will assume overall accountability for EH&S performance on the site and for compliance with statutory requirements including the requirements of the Authorisations.

The Site Director has specific responsibility for implementing the Company's EH&S Policy on the site and for ensuring compliance with statutory requirements. The site arrangements and systems control all aspects affecting EH&S performance, including compliance with the Authorisations. This includes the responsibility for ensuring that there is an adequate safety case for all operations that may affect nuclear safety or radioactive discharges. These responsibilities will continue to apply following the proposed transfer.

There are established audit arrangements at the site by which the Site Director can assess the adequacy and effectiveness of the site's arrangements and systems for the management of EH&S matters.

At Hunterston A Site the Site Director is accountable to the Managing Director of Magnox North Ltd for ensuring that there are adequate environmental, health and safety arrangements in place to meet both the licence requirements and the requirements of the Company's Environment, Health and Safety Management System and that these arrangements are complied with. As both a nuclear site licence is in force and disposals from the site are subject to control by a statutory authorising agency, the Site Director is responsible for ensuring compliance with the conditions attached to the licence or authorisation.

The Magnox North Ltd Environment, Health, Safety and Quality (EHS&Q) Director is accountable for advising on the development and promotion of the Company's overall environment, health and safety arrangements and systems including its policies, objectives and targets. On behalf of the Managing Director of Magnox North Ltd, the EHS&Q Director independently verifies through inspection and audits the effective implementation of these arrangements, including those at the site. The Director has access to the Magnox North Executive for the purposes of raising specific issues of environmental, health or safety concerns.

Hunterston A Site will continue to have access to sufficient expertise of the appropriate quality and experience commensurate with its obligations to comply with the Nuclear Site License Conditions, the terms of discharge authorisations and other statutory obligations.

In compliance with Nuclear Site License Conditions, the creation of waste and its disposal and the decommissioning strategy are reviewed and re-assessed periodically and systematically to confirm their validity. The Site Director is responsible for these reviews.

Hunterston A Site also complies with the UK Government policy for International Safeguards for fissile material arising from the sites operations.

Government Policy[1] (Cm2919) is that nuclear facilities should be decommissioned so that eventually the sites should be available for unrestricted alternative use. The consequence of this policy is that all radioactive waste material currently on the Hunterston A Site should be despatched over a period of time to authorised disposal sites. Waste minimisation and volume reduction during decommissioning remain an important part of Company and Site environmental policy, as they were during operation.

This is achieved wherever reasonably practicable by a combination, as appropriate, of:

- minimising waste at source (recycling and preventing material entering radiologically controlled areas);
- monitoring and identifying materials whose radioactivity is below the de-minimis level that can be segregated for free release;
- decontamination for re-use or disposal as non-active scrap;
- volume reduction by dismantling, cutting or compaction to minimise

3.4 Informing the Local Population

The Company is committed to keeping the population near all its nuclear installations informed. In addition to the statutory accountability required under the relevant Acts and regulations/legislation e.g. Freedom of Information Act (2000) and Environmental Information Regulation (1992), the Company seeks to ensure that local people are provided with information about the operational and safety aspects of its nuclear installation. At Hunterston A Site this information is disseminated via:

- The Site's monthly Newsletter, (Hunterston A Site News) which is distributed to staff;
- The Hunterston A Site Stakeholder Group (SSG) which meets at least 3 times a year in an open forum which welcomes the public and media to view and participate in a Questions and Answers session.
- The Site Stakeholder Newsletter (Hunterston A Outlook) which is distributed to Stakeholders every four months.

The Chairman of the Hunterston SSG is voted for by the members and is independent of both Hunterston A and B Sites. The members include both A and B Site Directors, local authority councillors and officers, community councillors, representatives of local emergency services (e.g. police, fire and ambulance/health service) and local organisations and of the NII, SEPA, Food Standards Agency (FSA) and the National Farmers Union.

The SSG Secretariat is provided by the Hunterston A Site and voted for by the SSG members. Other additional 'specialists' attend as requested by the Chairman. Minutes of the meeting are available electronically from the NDA website and Hunterston A website, hard-copies are posted out to local libraries, and the media is invited to attend and report on proceedings and they also receive minutes of previous meetings and full reports in advance of each meeting.

The membership of both A and B Site SSGs are the same but the meetings are separate, but held on the same day, one after the other.

3.5 Emergency Arrangements

Although the aim is to prevent accidents that might have radiological consequences for workers and the public, emergency and/or contingency arrangements are provided at each nuclear power station to respond to such accidents. These arrangements have been in place from the onset of the commercial application of nuclear power in the 1960's. However, to date there has never been the need to invoke the arrangements to protect the public, but the execution of the arrangements is witnessed by the NII on a regular basis. While Hunterston A and Hunterston B were operated by Scottish Nuclear Limited (SNL) the Hunterston A emergency arrangements were supplied by Hunterston B through their emergency teams. However, in June 2005 Hunterston A successfully demonstrated its independent emergency arrangements and is now responsible for their own emergency/contingency response.

It is the nature of any accident that its course cannot be foreseen in every respect, and therefore in drawing up emergency arrangements the plan defines a firm framework that can support a flexible response to a wide range of possible events.

The safety considerations for Hunterston A Site now reflect the reduced risk from the de-fuelled reactors under air storage conditions, and the reducing hazards through continued decommissioning. Safety is no longer dominated by the risk from fuel but by the much lower risks which could arise from the radioactivity contained in the reactor pressure circuit, waste storage facilities, including vaults (SAWB and Reactor vaults), and auxiliary plant due to radioactive contamination or activation.

The Hunterston A safety case, the production and maintenance of which are a requirement of the NSL demonstrated that the risk to the public from Hunterston A decommissioning is tolerable and ALARP.

In addition, in February 2002 Hunterston A submitted a Hazard Identification and Risk Evaluation Assessment Report under the REPPIR (Regulation 6(4)) to the NII which reflects the much reduced risk at the Site during the decommissioning phase.

3.6 The Site's Philosophy of BPEO

The justification for operating Hunterston A Site and hence generating radioactive waste is described briefly in Section 3.8. This section presents a BPEO analysis of the management and disposal of radioactive waste from Hunterston A Site.

3.6.1 General

The Royal Commission on Environmental Pollution defined the BPEO in 1988 as "the outcome of a systematic consultative and decision making procedure, which emphasises the protection and conservation of the environment across the land, air and water. The BPEO procedure establishes, for a given set of objectives, the option that provides the most benefits or least damage to the environment as a whole, at acceptable cost, in the long term as well as in the short term". There is Company guidance on BPEO (Reference 5), part of environmental assessment (Reference 6) and optioneering studies (Reference 7) and Hunterston guidance (Reference 8) on BPEO.

3.6.2 Concentrate and Contain Vs Dilute and Disperse

Magnox North Ltd preferred option for the management of radioactive wastes is to trap radioactive liquid and gaseous radioactivity before it can escape from the plant, where reasonably practicable to do so. This concentrates the trapped activity in solid form (e.g in ion exchange unit resins or HEPA filters), which is then stored safely on site. These solid wastes are then sent for final disposal as soon, as is reasonably practicable. The treated liquid or gaseous effluent containing much reduced concentrations of radioactivity is then discharged to the environment. This is the "concentrate and contain" approach and is consistent with the International Atomic Energy Agency (IAEA) safety fundamental (Principle 2) in Reference 9 and The Department for Environment, Food and Rural Affairs (Defra) statutory guidance in Reference 10 and the UK strategy for discharges in Reference 11.

An alternative approach is to discharge gaseous and liquid radioactivity directly to the environment after minimal treatment. This "dilute and disperse" approach is judged by Magnox North Ltd to be less preferable.

The reasons why "concentrate and contain" was selected by Magnox North Ltd as the best approach include:

- This approach prevents immediate exposure to individuals and the environment in general outside Hunterston A Site.
- Practicable means exist to treat most liquid and gaseous waste streams to reduce the amount of radioactivity in it.
- This approach is consistent with both national and international policy and is consistent with processes used at other UK nuclear establishments.
- This approach is consistent with the objectives of the OSPAR agreement to reduce radioactive discharges to the marine environment.

- The solid waste generated using this approach can be safely stored at Hunterston A Site in purpose built radioactive waste stores, until it is disposed of safely.

The main drawback of the "concentrate and contain" approach is that it increases the risk to the plant operators who handle the waste and to other workers on the site where it is stored.

However, Magnox North Ltd has many years experience in managing radioactive wastes at its power stations. The radioactive waste plant at Hunterston A is also supported by a robust safety case. In addition, all operations involving radioactive waste are carried out using approved procedures. The potential for leaks, spills and escape of radioactive material is reduced by the application of control measures which apply both the "defence in depth" and "abatement at source" principles. In addition, the waste treatment and storage plants at Hunterston A Site are designed to treat and store radioactive waste safely. The risks to workers in the plant who handle radioactive waste and other workers on site have been assessed and are judged to be acceptable.

Another option is to store all liquid and gaseous effluents on site. However, while it may be technically possible to store some liquid effluent on site temporarily, the installed storage capacity is limited. Long term storage of liquid waste would require the building and operation of additional storage facilities and is judged to be not reasonably practicable. Additionally the site licence conditions relating to accumulation, storage, leakage and discharge of radioactive waste would have to be taken into account.

Temporary storage of gaseous effluents on site is not deemed to be practicable. The large volumes of air passing through the stations ventilation systems make any potential storage plant totally unfeasible.

3.7 Justification

The Euratom Directive (96/29/Euratom) lays down the basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation. It requires the justification of "new classes or types of practice"; however, the decommissioning of nuclear power stations is not a new practice (neither in general nor specifically at Hunterston A Site).

In January 1998, prior to the current authorisations being granted a document entitled "The Continued Decommissioning of Hunterston A Site" (Reference 4) was provided to the Scottish Environment Protection Agency (SEPA) in connection with the application for the existing authorisations. The justification for continued decommissioning is given in this section. Changes have occurred between 1997 and 2009, but they do not significantly affect the balance between benefits and detriments due to continued decommissioning of the power station.

The Company believes that the balance of benefits and detriments from decommissioning of Hunterston A Site should be considered in justifying the decommissioning operations at Hunterston A Site.

3.7.1 General

A practice is justified if it can be shown that it provides sufficient benefits that offset the detriments. These benefits and detriments can apply to individual members of the public, or society as a whole and cover social, economic and any other relevant factors.

3.7.2 Benefits

3.7.2.1 Consistency with National Policy

Any organisation wishing to decommission a nuclear facility must ensure that the proposals are consistent with the National Policy. The most recent Government policy on radioactive waste management is set out in "Review of Radioactive Waste Management Policy: Final Conclusions", Cm 2919[1], and was based on;

- "... the same basic principle as apply more generally to the environment policy; and in particular on that of sustainable development."

Specifically it states;

- "radioactive wastes should be managed and disposed of in ways which protect the public, workforce and the environment."

Within this approach Cm 2919 states that;

- "the Government will maintain and continue to develop a policy and regulatory framework which ensures that:
- radioactive wastes are not unnecessarily created;
- such wastes as are created are safely and appropriately managed and treated;
- they are then safely disposed of at appropriate times and in appropriate ways."

Government policy on the decommissioning of nuclear power stations was also set out in Cm 2919 and is summarised in the following statements:

- "the Government believes that, in general, the process of decommissioning nuclear power plants should be undertaken as soon as it is reasonably practicable to so, taking account of all relevant factors."

- "...there are a number of potentially feasible and acceptable decommissioning strategies for nuclear power stations available to the operator".

- "As with all other operations of nuclear site, decommissioning will be undertaken in accordance with conditions attached to the nuclear site licence and subject to Health and Safety Executive (HSE) and Nuclear Installation Inspectorate (NII) controls."

The work will be regulated by the NII, in consultation with the SEPA, Defra and the Scottish Executive, as appropriate.

Cm2919 also includes the following statements:

- "... to ensure that the proposal assure the safety of the site at all times, and that the hazards presented by the plant (or site in the case of nuclear power stations) are reduced in a systematic and progressive manner."

- "To ensure that operators' decommissioning strategies remain soundly based as circumstances change, they will be reviewed quinquennially by HSE, who will consult with the Environment Agencies."

Magnox Electric submitted a quinquennial review (QQR) to the HSE in 2000 and it was reported by the HSE in 2002 as being "appropriate". The information in the QQR has been superseded by Magnox Electric's Decommissioning and Radioactive Waste Management Strategy (Reference 35).

Note, the Decommissioning Strategy states that, "decommissioning strategies will need to take into account relevant developments in UK radioactive waste management policy" and recognises that discharges may have to increase as a result of decommissioning. This is something which is particularly important and is acknowledged in the UK National Strategy for Radioactive Discharges 2001 to 2010.

Note also, in November 2003 public consultation was held on "Modernising the Policy for Decommissioning the UK's Nuclear Facilities". There were some 55 responses to this consultation and a statement was produced in September 2004 on the UK Government and devolved administrations' policy on the decommissioning of nuclear facilities updating and replacing the previous statements in paragraphs 120 to 131 of the Final Conclusions of CM 2919.

The September 2004 statement states that "each operator is expected to produce and maintain a decommissioning strategy and plan for its sites". It also expects the operators to begin "to refine strategies and plans, in consultation with the regulators and stakeholders before they plan to close the facilities" and that strategies should take into account relevant factors including:

- ensuring worker and public safety,
- maintaining site security,
- minimise waste generation and providing for effective and safe management of wastes which are created,

- minimise environmental impacts including re-using and recycling materials whenever possible,
- maintain adequate site stewardship,
- using resources effectively, efficiently and economically,
- providing adequate funding,
- maintaining access to an adequate and relevant skills and knowledge base,
- using existing best practice wherever possible,
- conducting research and development (R&D) to develop necessary skills and best practice,
- consulting appropriate public and stakeholder groups on the options considered and the contents of the strategy.

The process of decommissioning at Hunterston A is judged to be consistent with the National policy for the following reasons:

1. The work carried out through regular monitoring, and the current contaminated land characterisation project, identify areas of the Site that need may need remediation. Work carried out on the NDA decommissioning programme shows that the work is believed to be straight forward and can be carried out safely using existing technology and established radiation safety management techniques;
2. Financial provision is available from the NDA for the decommissioning of the Site;
3. The work identified in the decommissioning programme show that the worker, public and environmental safety of the Site is assured during decommissioning operations;
4. The process to carry out decommissioning is systematic and progressive with robust planning and implementation to reduce the hazard presented by the site;
5. The site safety case is regularly reviewed and updated as required by the Nuclear Site Licence. The NII and SEPA review the documents constituting the safety case and Site operations during regular visits, at formal annual meetings, and are supplied with formally updated Periodic Safety Reviews (PSR) as required. Hunterston A submitted its last PSR to the NII in May 2002. As decommissioning continues at Hunterston A the safety case will be reviewed and updated to cover each new phase of work;
6. The potential radiological hazard to workers and/or members of the public, from continued decommissioning, is addressed via site Engineering, Projects and Health Physics arrangements and staff for each project and is judged to be insignificant;
7. Work will be controlled in accordance with detailed procedures adopting industry "Best Practice" to ensure that safety is not compromised;
8. Best Practicable Environmental Option (BPEO) studies have been carried out which demonstrate that the decommissioning process at Hunterston A is the BPEO (See Section 3.7);

9 Established disposal routes have been identified for each radioactive waste stream. Most of the radioactive waste generated will be solid low level waste (LLW) which will be disposed of to a suitably licensed facility. Small volumes of liquid and gaseous discharges will be made to the environment and small quantities of combustible lightly radioactive waste will be transferred to a suitably licensed facility for incineration. In addition all intermediate level waste (ILW), and any LLW that cannot be disposed of to the licensed facility, will be recovered, treated and stored in an on-site ILW store, as per the Nuclear Site Licence, until a National ILW repository is available.

3.7.2.2 Consistency with Other Policies

The Governments approach to the non-proliferation of nuclear weapons continues to be as set out in Cm 2860:

- "... (the Government) has consistently supported the Treaty on the Non-Proliferation of Nuclear Weapons which came into force in 1970. The Treaty now has over 170 States party to it..." (over 180 states are now party to the Treaty).

- "In the United Kingdom, nuclear fuels in power stations and other civil nuclear material are subject to the Euratom Treaty and the Safeguards Agreement between Britain, Euratom and the International Atomic Energy Agency. The agreements require the United Kingdom to ensure that the material is properly accounted for, and to accept verification and inspection by the Safeguards Directorate of the European Commission and the International Atomic Energy Agency. Further the Government and the nuclear industry is committed to maintaining the present high standards of physical security at nuclear power stations".

It is Government policy not to transfer plutonium originating on civil nuclear power stations to weapons use.

The Article 37 submission made to the European Commission (EC) concerning Hunterston A in March 2002 received a favourable review from the EC.

In July 2002 the White Paper - Cm 5552, "Managing the Nuclear Legacy" was issued outlining the Government's approach to radically change the arrangements for the nuclear clean up funded by the taxpayer. The white paper sets out the arrangements to ensure that the clean up is done safely, securely, cost effectively and in a ways which protect the environment for the benefits of current and future generations in an open and transparent way. This paved the way for the formation of the Nuclear Decommissioning Authority (NDA) in April 2005 under the Energy Act 2004, to own and manage the decommissioning of the civil nuclear legacy. The NDA issued decommissioning strategy and strategic environmental assessment for consultation in 2005 which it issued in March 2006.

The policy has now been adopted and may have a profound impact on the management of civil nuclear facilities, through a defined programme for shutdown and accelerated decommissioning, by open competition, for the management of licensed nuclear sites. In addition the NDA documents address a proposal for a national strategy, and facilities, for Low Level radioactive Waste (LLW), Intermediate Level radioactive Waste (ILW) and High Level radioactive Waste (HLW) disposal. The NDA strategy, and the Committee on Radioactive Waste Management (CoRWM) report issued in July 2006, should pave the way for the development and operation of a national ILW repository. The programme date for the availability of the national ILW repository, and transfer of ILW from Hunterston A, is between 2040 and 2050 according to the Site's current Lifetime Plan (LTP).

The formation of the NDA has resulted in an enhanced focus on financial management and accountability, plus project delivery, without compromising health, safety and environmental standards and compliance. The development of the LTP improves and clarifies the decommissioning costs and programme for the Site and make them visible to all stakeholders. Implementing the LTP will have an effect on emissions and disposals, especially if programme acceleration is achieved.

The costs of decommissioning, plus the potential to reduce these costs and/or accelerate decommissioning are covered in the Hunterston A Site LTP. Opportunities to improve the processing and managing of waste can be found in the Hunterston A Integrated Waste Strategy (IWS) and Technical Baseline and Research and Development (TBuRD) documents.

3.7.2.3 Sustainable Development

The principle of sustainable development is that where practicable to deal with radioactive material in a manner that protects human health and the environment now and in the future without imposing undue burdens on future generations.

The principle is embodied in the national policy and the decommissioning policies of British Nuclear Group Ltd and Magnox North Ltd. Previous and current RSA93 authorisation monthly and annual reports show that Hunterston A has not exceeded any of its limits, and in general solid LLW disposals, and gaseous and liquid discharges are significantly below the specified limits. Ongoing, and planned, decommissioning demonstrate that the technology and expertise is readily available to support the continued decommissioning of Hunterston A. The Company is always striving to develop innovations that will improve the delivery of decommissioning at its sites, including Hunterston A. It is therefore considered to be practicable to continue decommissioning Hunterston A now, dealing with radioactive waste according to National and Company policy, and leaving the residual radioactive waste in a suitably packaged, passive form for final disposal and site clearance. Hence continued decommissioning is in accordance with sustainable development.

3.7.2.4 Reducing the Risk to the Public

If left untended following cessation of electricity generation a nuclear power station, like many other industrial facilities, could pose a hazard to future generations as the condition of plant, equipment and containment deteriorate. The Company ensures the liabilities are managed in a safe manner to meet its responsibilities to future generations.

Government policy on decommissioning and radioactive waste management is set out in 3.7.2.1 above. The main feature of this policy is that decommissioning will take place with the aim of returning the Site to other use as soon as reasonably practicable. Against this background, a wide range of decommissioning options have been examined, leading to the development of strategies which provide an optimum balance between public safety, safety of the workforce, detriment to the environment and expenditure. The work programme for the continuing decommissioning has been presented to the NDA (as the owner of the liabilities), NII (as the Regulatory body responsible for controlling safety of operations on the Site) and SEPA (as the Regulatory body responsible for authorising discharges of radioactive material from the Site). Public access to the individual projects detailed volumes and overall decommissioning programmes (LTP) for each civil nuclear site, including Hunterston A, is readily available through the NDA and Company websites.

3.7.2.5 Employment Effects

The number of permanent staff employed at Hunterston A Site is lower than when the station was operating and will continue to reduce as decommissioning continues. This is detailed in the Site's LTP. However, many extra personnel are needed to perform the various decommissioning tasks. Such extra personnel normally include Company employees from other locations, employees of various contractors (and sub-contractors) who carry out much of the work in question and temporary (contract or agency) personnel working either for the Company or its contractors. The continued decommissioning of Hunterston A Site is expected to provide significant levels of employment for a number of years. During this time expenditure associated with this employment will be a benefit to the local and national economy.

Any acceleration of the decommissioning process, either through Company initiatives, changes of technology or working practices, or the reduction in decommissioning timescales as a result of NDA policy, will affect the level of employment and expenditure. However, short term increases in staff numbers and costs should be offset by earlier completion of decommissioning.

3.7.2.6 Visual Amenity

Any operating Magnox Power Station, by virtue of its scale, cannot easily be hidden from view, either from the immediate surroundings or from more distant locations. Hunterston A is to some extent hidden from view from the east by Goldenberry Hill, but is generally visible from the west. The progressive removal and/or size reduction of buildings on the Site reduces the impact. The original large turbine hall has been demolished, but an interim ILW store has been built over its foundations. The ILW store and the two reactor building will be weather proofed with suitable cladding (agreed by the local community and via statutory consultees through the local planning process) and remain visible until final dismantling and clearance. Appropriate landscaping will also significantly improve the visual impact of the decommissioned Site area.

3.7.2.7 Potential for Land Re-use

It is Magnox North Ltd policy to decontaminate and decommission the Hunterston A Site to enable it to be de-licensed at the earliest opportunity thus permitting the land to be developed for commercial and/or other uses.

3.7.3 Detriments

Several potential detriments of the continued decommissioning of Hunterston A site are discussed in this section. These potential detriments need to be balanced against the benefits already accrued from the electricity previously generated by Hunterston A and the benefits of continued decommissioning described above.

3.7.3.1 Decommissioning Operations

Potential environmental detriment arising out of decommissioning work may be radiological or non-radiological. This document demonstrates that the potential radiological detriment is small. Consideration of the non-radiological detriment reveals it to be associated with the dismantling and demolishing of structures made of conventional materials such as brick, concrete and fabricated metal. All such work is done under conventional environment and safety regulations as specified in Company and/or Site arrangements.

The Company has planned it so these works are, and will continue to be, carried out in accordance with accepted good practice, and within all appropriate environmental and safety regulations as specified in Company and/or Site arrangements, to reduce the environmental detriment to acceptably low levels.

3.7.3.2 Spent Fuel Management

All irradiated nuclear fuel was removed from the reactor cores and CCP and dispatched to Sellafield between 1992 and 1995

Operation at Sellafield licensed sites are subject to strict regulatory inspection and control which ensures that any detriment arising on those sites is given due consideration. These considerations are outside the scope of this document.

3.7.3.3 Air Quality

Major plant items such as auxiliary boilers and diesel generators, which had produced airborne emissions during operation, are no longer operating. Domestic hot water is now produced using electrical heating. There are two small, modern and efficient diesels available at site for emergency standby requirements for electrical systems in the event of loss of grid supply. These are tested for short periods regularly, and if needed would only operate until electrical supplies are re-instated, hence their impact is trivial compared to the original diesel generators.

Given the restricted and reducing usage of remaining plant, emissions to the atmosphere will have no quantifiable impact on air quality. Emissions from general traffic requirements and the small number of on-site vehicles will only be a small fraction of the total emissions.

Radiological gaseous discharges are discussed in detail in Section 4 and in general nuclide activity levels are shown to reduce.

3.7.3.4 Aquatic Ecology

The liquid effluents arising from Hunterston A Site are discharged to the Clyde estuary. Prior to discharge, the effluent streams are treated and monitored as appropriate to satisfy regulatory requirements.

All the radionuclides discharged fall below the thresholds known to cause adverse effects to marine life. Current liquid discharges are very low and much lower than when the station was operational. However, due to certain stages in the planned decommissioning of the site, the liquid discharges are likely to rise. However, BPM will be used to ensure that liquid effluent discharges are minimised. As decommissioning continues the RSA authorisation will have to be modified, and the impact on the aquatic ecology re-assessed.

3.7.3.5 Surface Drains

Land drainage from the station discharges to the Clyde estuary. Potential sources of contamination, such as oil and chemical storage tanks/plant, are bunded to prevent spillage from entering watercourses.

The Hunterston A Site contingency arrangements cover minor chemical/oil spillage, and equipment is available to tackle any on-site minor chemical incidents. Only the CCP skip cleaning acid constitutes a sufficient volume of hazardous chemicals, or oils, stored on site to give a potential major chemical incident. However, Hunterston is not subject to the Control of Major Accident Hazards (COMAH) regulations.

3.7.3.6 Noise

Over its operating life there were few complaints about the noise from Hunterston A Site. During decommissioning work, especially new build or demolition, care is taken to ensure that noise is not a nuisance and does not give rise to public complaint or breach of regulations.

The site has hearing protection zones which are regularly monitored and staff, contractors and visitors must comply with specified ear protection requirements. Site and contractor staff monitors other work that is likely to cause high noise levels and control measures specified to protect immediate work personnel and people entering the work area.

3.7.3.7 Transport

The relation of the Hunterston A Site to the transport system infrastructure is shown in Section 2, Figure 1.

The environmental impacts from the transport of goods and personnel to and from the site will be very small. Although there may be periods of increased transport requirements, due to the decommissioning activities programme, these will be short term and as such there should not adversely effect the environment in the longer term. The existing local road network has sufficient capacity to meet current traffic flows of staff and contractors using vehicles to reach the site, and any short term peaks.

3.7.3.8 Climate

The decommissioning of Hunterston A Site will have no significant effects on the climate. Hunterston A Site is aware of the ongoing research into climate change and the potential impact to the Site in the medium to longer term. Both the interim on-site ILW store and foreshore armouring work has been designed to address the potential worst case sea levels over its lifetime.

3.7.3.9 Radiological Safety

The decommissioning operations at Hunterston A Site will give rise to radiation dose uptakes to workers. In addition, discharges of radioactive materials to the environment may give rise to small dose uptakes to members of the public. These issues are discussed below.

3.7.3.10 Worker Dose

Workers carrying out operations to decommission Hunterston A Site may potentially be exposed to radioactive material and may incur radiation dose uptakes. Such hazards may be mainly external due to radionuclides such as Iron 55, Cobalt 60, Caesium 137 and Strontium 90.

However, all radiation at Hunterston A Site, including work associated with future decommissioning, is controlled and appropriate measures are taken to ensure that protection and safety are optimised. This ensures that the magnitude of individual doses, the number of people exposed and the likelihood of incurring exposure are kept as low as reasonably practicable (ALARP).

The magnitude of individual doses and the likelihood of incurring exposures are very low.

Studies have been carried out for major decommissioning projects which demonstrate that the chosen decommissioning option will minimise as far as reasonably practicable the dose to the workers, general public and impact on the environment, hence it is the BPEO and engineering solution for that project. The criterion of "safety", which includes consideration of workers radiological safety, was included in these studies. Similarly, BPM studies have been done for projects to determine how its impact on the environment is minimised.

For these reasons, the potential detriments of the workers incurring radiation dose uptakes during decommissioning operations is not judged to be significant.

3.7.3.11 Public Doses

Solid LLW and HVVLLW, generated from decommissioning Hunterston A Site, will be disposed of safely to licensed facilities. Only very small quantities of gaseous and liquid radioactive waste may arise. Solid and liquid ILW will be recovered, processed, conditioned, packaged and retained in a purpose built on-site ILW store until it can be transferred for final disposal at a suitable national ILW repository. The disposal of ILW is not considered in the application being made to SEPA and simply included here for completeness.

The public may be exposed to radiation as a result of discharges of radioactive materials in gaseous or liquid form from the decommissioning activities at Hunterston A Site, more detail is provided in Sections 4 and 7 of this document.

Discharges of gaseous and liquid radioactive waste are controlled in accordance with authorisations granted by SEPA. These ensure that doses to the most exposed members of the public (the critical group) in the vicinity of Hunterston A Site are and will continue to be, very low and below applicable dose constraints. The authorisations set discharge limits that must not be exceeded, although in reality BPM will be employed to ensure that discharges are minimised such that actual discharges are well below relevant limits.

Verification of compliance with the discharge authorisations is obtained by monitoring at the point of the discharge complemented by monitoring of the environment.

Section 7 has assessed the maximum dose uptake to the critical group from the discharge of gaseous and liquid discharges from Hunterston A Site. The assessed maximum dose uptakes are well below the relevant dose constraints. Again it is emphasised that in reality BPM will be employed to ensure that discharges are minimised such that actual discharges are well below relevant limits.

The BPEO and BPM studies discussed above for Worker Dose also include consideration of public radiological safety and minimisation of impacts on the environment.

For these reasons, the potential detriment of dose uptakes by the public during decommissioning operations is not judged to be significant.

3.7.3.12 Exposure to Other Toxic Substances

Workers carrying out decommissioning at Hunterston A Site may be exposed to other non-radioactive toxic substances.

Given the age of the plant, and the type of decommissioning activities undertaken, small quantities of toxic substances such as asbestos and lead have been encountered. However, all work during previous operation and de-fuelling, and during decommissioning were controlled in accordance with relevant legislation and with Company safety procedures. These procedures are updated in light of changing legislation and best practice and will continue to be used in future decommissioning. This will ensure that toxic substances are dealt with safely and that appropriate measures are taken to ensure that protection and safety of the workforce are optimised.

For these reasons, the potential detriment of exposure of workers to non-radioactive toxic substances during decommissioning operations is not judged to be significant.

3.7.3.13 Conventional Safety

The Company records, reports and benchmarks its conventional safety using the UK Reporting of Injuries, Diseases and Dangerous Occurrences Regulation (RIDDOR) requirements and those of US Occupational Safety & Health Administration (OSHA) system. RIDDOR gives the Reportable Injury Frequency Rate (per 100,000 hr worked), covering injuries including those leading to people being absent from work for more than 3 days. Since 1988 the Company has been reporting the OSHA Day Away Case Rate (DACR) (per 200,000 hr worked) for absences of more than 1 day and Total Recordable Incident Rate (TRIR) which records not only lost-time injuries but also those that do not result in absence from work.

Hunterston A Site reports its safety statistics via the Company Annual Environment, Health and Safety (EH&S) reports which are readily available on the British Nuclear Group Ltd website. At December 2008 Hunterston A Site had the enviable safety records of a TRIR of only 0.33 and had in the recent past exceeded 76 months without a lost work day accident, with only one LTA in 6 years and 4 months.

In addition Hunterston A Site has a Loss Control reporting system to record and report events, accidents, near misses or deficiencies in safety culture and actively participates in the both the Company Behavioural Safety and Human Performance programmes. These are proactive approaches to safety and can be considered to have contributed to the current safety record.

Annual improvement in EH&S are developed by Site personnel and presented in the Hunterston A Safety and Environmental Enhancement Plans (SEEP). These plans have been available across the company since 1996/97 but have been in the common SEEP format for decommissioning sites since 2003.

To show commitment to safety and safety culture performance and improvement, Hunterston A Site achieved audit certification in the International Safety Rating System (ISRS) Version 7 Level 7 in July 2007. In March 2008 the site also achieved (Occupational Health and Safety Assessment Series) OHSAS 18001:2007 certification.

3.7.3.14 Cost

On the subject of financial provision for decommissioning the Government concluded in Cm 2919;

"... that it should continue to be for industry to make its own provisioning arrangements."

The cost of decommissioning has risen significantly in the last decade. With this in mind the Government has modified the arrangements for the management of civil nuclear liabilities with the formation of the NDA. Financial estimates, monitoring and accountability are now much more rigorous. All civil nuclear decommissioning sites, including Hunterston A Site, now produce detailed volumes for individual projects, covering 3 years in detail, and produce long term programmes (LTP) through to final dismantling and site clearance.

The BPEO studies carried out for major decommissioning projects also consider the "cost" of the proposed options. This is discussed further in Section 3.7.

For these reasons, the potential detriment of the costs incurred during decommissioning are not judged to be significant.

3.7.4 Conclusion

There are benefits and detriments associated with the continued decommissioning operations at Hunterston A Site. It is deemed that the benefits of continuing to carry out the decommissioning work outweigh the detriments, therefore the practice is justified.

The Euratom Directive acknowledges that the justification of classes of practice may be reviewed if new and important information about the efficacy or consequences is acquired. The Company is not aware of any such information.

4 WASTE DISPOSAL REQUIREMENTS

4.1 Waste Characteristics & Arisings

This section briefly describes the production mechanisms for those radionuclides of potential radiological significance in considering discharge authorisations.

4.1.1 The Production of Radioactive Nuclides in Hunterston A Site Reactors

Heat was generated in the nuclear reactors by the process of nuclear fission, i.e. the splitting of heavy nuclides releasing energy and producing light, short lived nuclides known as "fission products" from long lived nuclides such as uranium. In addition the neutron flux which mediated the process also converted stable nuclides into radioactive nuclides known as "activation products".

The design of Magnox fuel ensured that virtually all the fission products arising in the fuel were contained within it and were transported off site to British Nuclear Group Ltd Sellafield for reprocessing, or long-term storage, during operation or in defuelling. Only a tiny proportion of the fission products escaped from the fuel through imperfections in the fuel cladding. Uranium also occurred as contamination on the surface of the fuel and as an impurity in the graphite moderator. Fission in the small quantity of uranium that is outside the fuel releases fission products into the reactor coolant.

Apart from undergoing fission, uranium also absorbed neutrons to produce heavier elements, some of which are alpha-emitters.

All components within the reactor were exposed to neutrons, giving rise to activation products. Although most activation products were bound into the solid components, some were in the form of radioactive gases or particulates and were released from solid components by dissolution or abrasion.

Any waste, whether solid, liquid or gas that is contaminated with radionuclides is, with certain exceptions, defined as radioactive waste whose disposal is regulated by the RSA93.

Radionuclides that are present in waste in significant quantities, or which have the potential for influencing public radiation doses are addressed in detail below.

4.1.1.1 Carbon 14

During operation there were four major production routes for Carbon 14 (C-14, ^{14}C) in Magnox reactors. These were neutron activation of Oxygen 17 (O-17, ^{17}O) and Nitrogen 14 (N-14, ^{14}N) in the coolant gas, and neutron activation of Carbon 13 (C-13, ^{13}C) and Nitrogen 14 in the graphite moderator. Nitrogen was present as in impurity in the reactor coolant and in the graphite moderator, and the N-14 isotope is the principle nuclide in natural Nitrogen. C-13 and O-17 are two of the less abundant nuclides in natural carbon and Oxygen.

During operation the rate of production of C-14 in the coolant and moderator was dependent on reactor power. Since C-14 has a very long half life (5730 years) the quantity in the moderator was proportional to the cumulative power produced by the reactor, hence was expected to increase linearly with time at power.

At Hunterston A Site, as with other similar design of reactors, graphite corrosion released C-14 from the moderator to the coolant. This is believed to have been the greatest source of C-14 in the coolant during operation. As the level of C-14 in the moderator increased the quantity entering the coolant would have increased. In addition, as the oxidation of the graphite progressed, the micro porosity of the graphite would have increased allowing a larger rate of C-14 exchange between the moderator and the coolant. Since graphite corrosion could limit the operational life of the reactor the operators tried to minimise graphite corrosion and the quantities of C-14 entering the coolant.

During decommissioning no more C-14 is being generated but a large inventory remains within the graphite. A possible mechanism for its continued transfer into the reactor vessel atmosphere is diffusion of the gas from the pores of the graphite. Other mechanisms are only possible in accident situations such as fire or earthquakes, or during work such as core dismantling during the Final Site Clearance (FSC) phase of decommissioning. These are not considered in this document. C-14 is a consideration in solid LLW, gaseous discharges and in oil and sludge disposal.

4.1.1.2 Tritium

During operation, the major source of Tritium (H-3, ^{3}H) in the reactors was neutron activation of Lithium present as an impurity in the graphite moderator, from where it was released into the reactor coolant. Some Tritium, produced by ternary fission in the fuel, may have permeated through the fuel cladding into the coolant gas. Tritium has a half life of about 12 years which means it remains significant during decommissioning although it is not of great radiological significance. The level of Tritium in the vessel atmosphere increased with relative humidity due to the molecular exchange of Hydrogen ions and in these conditions the Tritium was present mainly in Tritiated water.

Tritiated water also remains associated with stored sludges and wet wastes as well as solid LLW, gaseous and liquid discharges. Tritium is also a consideration in the transfer and disposal of radioactively contaminated oils and sewage sludge.

4.1.1.3 Particulate Radioactivity

Each Magnox reactor gas circuit contains small quantities of particles, produced by oxidation of the metallic heat exchanger components and other surfaces, activated in the core and deposited in regions of the gas circuit where the gas velocity was low. Changes in the coolant gas velocity could re-suspend some of the particulate which may then have been released within reactor coolant. The nuclide of most radiological significance in this particulate is Cobalt 60 (Co-60, ^{60}Co) which has a half life of 5.3 years. The Co-60 is of interest in solid LLW disposal, gaseous discharges, contaminated waste oils and dried sewage sludge.

4.1.1.4 Caesium 137

Caesium 137 (Cs-137, ^{137}Cs) is a fission product with a half life of 30 years. During operation it was produced within the uranium metal fuel bar and retained by the Magnox cladding of the fuel elements. Provided the cladding remained intact no Cs-137 was released from the fuel to the reactor circuit. At Hunterston A, fuel elements which developed leaks in the cladding while in the reactors were rare.

Small quantities of the uranium were present as contamination on the surface of manufactured fuel elements and consequently, during irradiation, small quantities of fission products were produced on the outside surfaces of the elements. Traces of fission products including Cs-137 remain within the core and gas circuit. When fuel elements were discharged into the CCP the predominant source of contamination arose from the corrosion of the fuel elements. The half life of Cs-137 means that it continues to be present with significant activities during decommissioning. There is likely to be Cs-137 in the radioactively contaminated oil and sludge for incineration.

4.1.1.5 Strontium 90 and Yttrium 90

Strontium 90 (Sr-90, ^{90}Sr) is a fission product produced in the same manner as Cs-137. It has a half life of 29.1 years which means that it continues to be present in significant quantities during decommissioning. Its daughter product Yttrium 90 (Yt-90, ^{90}Yt), which has a half life of 64 hours is in equilibrium with the Sr-90. Sr-90 and Yt-90, in common with Cs-137, are likely to be present in the skip cleaning and CCP recovery work.

4.1.1.6 Other Radionuclides

Radionuclides other than those listed above will be present in liquid and gaseous effluents but their concentrations and radiological significance are less than the radionuclides discussed. It should be noted that in assessing the total discharge and resulting radiation exposure, a much wider range of radionuclides was considered.

4.1.2 Current Disposal Limits

The current disposal limits are shown below in Tables 4.1[a], [b] and [c] for gaseous, liquid and solid wastes respectively.

Table 4.1 Current Disposal Limits

[a] Gaseous Emissions

This covers the disposal of gaseous radioactive waste to the atmosphere.

Authorisation Certificate Number: RSA/W/21044
Issue Date: 3 August 2000

Radionuclide	Limit in 12 consecutive months
Tritium	20 GBq
Carbon 14	2 GBq
Beta Particulate	60 MBq

[b] Liquid Discharges

This covers the disposal of liquid radioactive waste to the Firth of Clyde.

Authorisation Certificate Number: RSA/W/21043
Issue Date: 3 August 2000

Radionuclide	Limit in 12 consecutive months
Tritium	0.7 TBq
Plutonium (Pu-241)	1 TBq
Total alpha activity	0.04 TBq
Total beta activity (excluding H-3 and Pu-241)	0.6 TBq

[c] Solid Disposals

Authorisation Certificate Number: RSA/W/21042
Issue Date: 3 August 2000

This covers the disposal of solid low level radioactive waste (LLW).

Radionuclide	Limit in 12 consecutive months
Uranium	1 GBq
Radium (Ra-226)/Thorium (Th-232)	0.2 GBq
Carbon (C-14)	4 GBq
Iodine (I-129)	0.1 GBq
Tritium (H-3)	25 GBq
Cobalt (Co-60)	75 GBq
Total Alpha emitting nuclides	10 GBq
All other radionuclides	800 GBq
Volume	600 m^3

4.2 Gaseous Radioactive Waste Discharges

4.2.1 Past and Present Sources of Gaseous Wastes

When generation ceased there was no further creation of radionuclides on Site and after the fuel was packaged and despatched there could be no further transfer of fission products or actinides from the fuel to the materials on the decommissioning site. The alternative paths for the remaining activity are discharges as liquid or gaseous effluent and storage and disposal as packaged waste. The activity remaining on Site reduces further because of radioactive decay.

Discharges from the operating reactors constituted by far the most significant sources of gaseous effluent during operation. This source ceased by the end of de-fuelling.

The current and future gaseous waste arisings come from the following main sources:

- Suspension of radioactive gases, mists and dusts in the atmosphere from the decommissioning work involving processes such as cutting, heating or other disturbance of radioactive material
- Suspension of "loose" activity from contamination areas, as a result of normal work activities
- Degassing of Carbon Dioxide (CO_2) trapped in the pores of the graphite moderator

These sources are examined in later parts of this section and assessment made of gaseous discharges from them.

4.2.2 Current Gaseous Discharge Limits

The current RSA93 authorisation certificate for the discharge of gaseous radioactive waste (RSA/W/21044) was issued by SEPA on the 3 August 2000. This requires the Licensee to use BPM to reduce the activity in all gaseous discharges. It also specifies the limits on the total activity of particular radionuclides, or groups of radionuclides, that may be discharged during any period of 12 consecutive calendar months. The limits currently applicable to Hunterston A are:

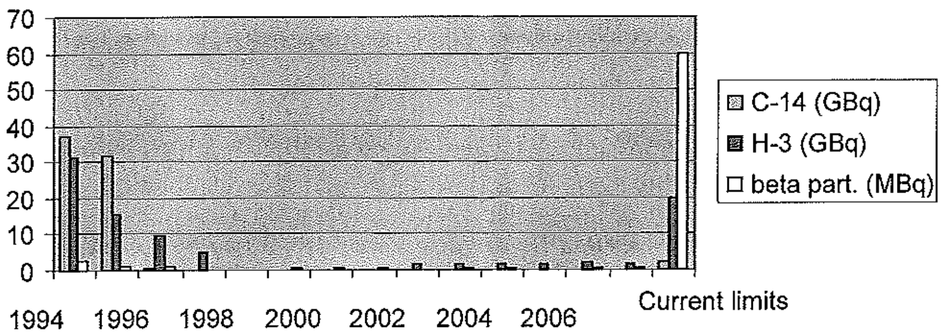
Table 4.2 Current Gaseous Discharge Limits

Radionuclide	Limit (in 12 Consecutive Months)
Tritium	20 GBq
Carbon 14	2 GBq
Beta Particulate	60 MBq

4.2.3 Recent Gaseous Waste Discharge History

Appendix C presents the annual gaseous discharge activities from 1994 to 2007, and the monthly gaseous discharge activities from August 2000 to December 2007. Figure 4.1 summarises the annual discharges from 1994 to 2007 against the current discharge authorisation limits, taken from the data in Table A3.1 of Appendix C.

Figure 4.1 Gaseous Discharge Activity 1994 to 2007



The Company produces annual monitoring of the environment reports that present data on discharges from Magnox sites (e.g. Reference 18). It can be seen from Reference 18, and Figure 4.1, that the gaseous discharges of Tritium and Carbon-14 from Hunterston A are significantly lower than they were during generation, and are on par with other Magnox decommissioning sites.

Discharges of beta activity associated with particulate matter have fallen significantly since the end of generation as the main source for this was discharges of activated particulate matter via the thermal shield cooling system and this is no longer needed or operated. Reference 18 shows that beta particulate activity in gaseous discharges from 2000 to 2005 from Hunterston A are significantly lower than during generation, and are at the lower end of the discharge range for Magnox decommissioning sites.

4.2.4 Radionuclide Specific Consideration for Gaseous Waste

4.2.4.1 Tritium

The quantity of Tritium available for discharge was fixed by the integrated effect of reactor power on the graphite moderator and ternary fission of fuel during operation. It was estimated in Reference 19 that there were 20TBq in the Hunterston A reactor cores in 1997. Since the reactors are no longer operating no further Tritium can be produced. Consequently, routine annual discharges for Hunterston A dropped from 1047 GBq in 1989, to 9.6 GBq in 1996 to 1.61GBq in 2005.

The radiological impact of the gaseous discharge of Tritium at the current limit of 20GBq/y is estimated to be small at 0.003 micro Sieverts/y (µSv/y). This is about 4 orders of magnitude lower than the 20 µSv quoted in Cm 2919, below which "regulators should not seek to secure further reductions in exposure to members of the public". It should be noted that the annual discharges of Tritium are about an order of magnitude below the current limit (Table 4.2 above).

4.2.4.2 Carbon 14

The quantity of C-14 available for discharge was fixed by the integrated reactor power on the graphite moderator. It was estimated in Reference 19 that there was 80TBq C-14 remaining in the Hunterston A reactor cores in 1997. Since the reactors are no longer operating no further C-14 can be produced. Consequently, routine annual discharges dropped from 303 GBq in 1989, to 0.7 GBq in 1996 to 0.114 GBq in 2005.

The primary mechanism for transfer of C-14 to the gas phase in operation was radiolytic oxidation of the graphite moderator by the CO_2 coolant while the reactors were at power. Until the end of de-fuelling in 1995 (when each reactor still contained CO_2) C-14 was still released. The reactors are now de-fuelled and sealed in air at atmospheric pressure. During the periodic purging of the reactors during early decommissioning, to reduce the moisture content within Reactor Pressure Vessels (RPVs), very minor releases of C-14 occurred due to exchange with the natural CO_2 content of air. This was reduced even further when the reactors were isolated from their boiler circuits and regular purging was no longer required.

The radiological impact of the discharge of C-14 at the current limit of 2 GBq/y would be small at 0.015 μSv/y. This is about 3 orders of magnitude lower than the 20 μSv quoted in Cm 2919, below which "regulators should not seek to secure further reductions in exposure to members of the public". Also, there is no potential for further increase in the source of C-14, as there is no longer a significant mechanism for its transfer to the gas phase.

4.2.4.3 Short Lived Nuclides

The nuclides Ar-41 and S-35 are short lived with half lives of 1.83hr and 87.5 days respectively. They were produced during reactor operation, but due to the long period of radioactive decay since the shutdown they are no longer detectable. They have not been reported since 1992, do not appear in the current authorisation and will not be included in future authorisation applications.

4.2.5 Contingency Plans for Foreseeable Events

The consequences of unplanned but foreseeable events causing gaseous discharges during decommissioning are much less than equivalent foreseeable events when the power station was operational since the inventory is grossly reduced and has decayed significantly since the end of defuelling.

It is possible that short term increases in discharges may occur due to impaired performance of HEPA filters or containment. Control of work, together with monitoring, testing and maintenance of the outlets, will minimise the likelihood of such events and ensure that any such events will not result in a significant increase in annual discharges.

4.2.6 Assessment of Future Gaseous Radioactive Waste Discharges

The key projects for the completion of the current phase of decommissioning can be summarised as shown in Table 2.1.

The main ongoing discharges arise from the routine extract ventilation of contamination areas. The main decommissioning activities potentially giving rise to additional discharges are those associated with the decontamination and decommissioning of the CCP and associated plant, CCP skips and the fuel route plant/areas.

- decontamination and decommissioning of the CCP and associated plant,
- processing of CCP fuel storage skips,
- recovery and encapsulation of solid ILW from the SAWB,
- recovery and encapsulation of ILW sludge from CCP & AETP tanks.

In this section the main potential sources of gaseous effluent are examined and an assessment made of the likely activity arisings. Although the actual techniques used in the work may not completely match those assumed, the assessment is representative of the arisings from the planned work. Any substantive changes in technique would be subject to BPEO and BPM assessments and would not be expected to cause a significant increase in radioactive discharges.

4.2.6.1 Pressure Vessel Purging

The majority of the residual radioactivity remaining on the Site is contained within the two steel RPVs and the reinforced concrete shielding. The RPVs are separated from their associated boilers and are maintained in air at ambient temperature and pressure. Although purging of the vessels to remove residual moisture has now effectively ceased the system to allow purging still exists and could be used should the need arise. Each vessel is nominally sealed at the discharge valve but there are a number of minor penetrations which have not been sealed, hence the RPVs tend to follow local fluctuations in pressure.

The estimated annual discharge, as a result of RPV atmosphere changes via these minor penetrations is minor in comparison with the routine discharge from adjacent areas.

4.2.6.2 Routine Ventilation of Contamination Areas

Established contamination areas currently vent to atmosphere via installed ventilation plants which draw the air from the areas through HEPA filters prior to discharge via approved discharge outlets. This practice will continue but at a reduced scale until the loose contamination is removed and filtered extract ventilation systems are no longer required. Appendix C presents the data for the reported discharges from 1994 to 2007. The activities undertaken during the current authorisation (2000 to date) are considered to be indicative of those expected for the future decommissioning projects outlined in Table 2.1. Hence it is deemed appropriate to use the gaseous discharge activities from 2000 to 2007 as the bases for estimating the gaseous arisings from the future decommissioning programme shown in Table 2.1.

Future discharges have been assessed by adding 3 standard deviations to the mean of the monthly discharges from August 2000 to January 2007. This method was adopted to allow for normal fluctuations in discharges and includes over 99% of potential future discharges. This results in maximum monthly gaseous discharges of 0.033 GBq of C-14, 0.310 GBq of Tritium and 0.129 MBq of Beta particulate. A scaling factor of 2 on these estimated discharges was assumed to apply to potential discharges during future decommissioning activities. This was to allow for potential acceleration of decommissioning activities (i.e. bringing forward activities from later in the programme into the period of the new authorisation) and/or innovation projects. Assuming the factor of 2 results in maximum annual discharges of 0.792 GBq of C-14, 7.44 GBq of Tritium and 3.096 MBq of Beta particulate.

4.2.6.3 Decontamination and Decommissioning of the CCP

Reducing the contamination levels of the CCP walls and floor involves the removal of a surface layer once the pond has been emptied and drained. Even with potential minimisation of airborne activity by keeping the surfaces and dusts wet airborne activities are likely to be high, particularly if a dry decontamination technique is used. If practicable, containment will be provided to localise high airborne contamination to areas close to the work and reduce the airborne contamination within the main pond building to below the level at which respiratory protective equipment would be required by personnel in the area. Where this is not practicable appropriate respiratory protective equipment will be specified in Health Physics documents required for the work.

A pessimistic assessment of the potential airborne activity levels can be made by assuming a continuous 2 Bq/m^3 specific Beta activity for the CCP east, west and north wall discharge points. Based on the throughput of the CCP ventilation plant and the efficiency of its filtration system a maximum monthly discharge of 0.0784 MBq, and therefore a maximum annual activity 1.882 MBq (assuming the decommissioning factor of 2) is calculated (see Table A3.3 in Appendix C).

4.2.7 Potential Perturbations in Gaseous Waste Discharges

Two elements have been identified that could affect the actual discharges. The first comprises the statistical variation in routine discharges discussed earlier and are already included. The second is unforeseen work activities and changes to work circumstances. Given the development of individual project plans and overall project programme (LTP) it is not believed that significant new activities will arise. However, any change in work practices will include measures to use BPM to control gaseous discharges and within the limits proposed in this report.

4.2.8 Proposed New Limits for Future Gaseous Waste Discharges

The proposed future discharge limits for any 12 consecutive months have been derived from consideration of recent discharge levels at Hunterston A Site and an assessment of discharges from the programme of future decommissioning work in individual projects and overall Site programme.

Although discharges in recent years have been well below authorised levels, some of the future operations are expected to give rise to significant quantities of gaseous effluent. From assessments described earlier in this section, the maximum estimated discharge in any 12 month period is expected to be 0.15 GBq for C-14, 1.64 GBq for Tritium and 41 MBq beta particulate. However, this is subject to further review which may include the need to increase the estimated figures. To allow for these changes both in estimates and programme a certain amount of 'headroom' is required. Therefore, it is considered that the current authorised limits should be employed as part of the new authorisation as shown in Table 4.3.

Table 4.3 Proposed New Gaseous Discharge Limits

Radionuclide or Group of Radionuclides	Proposed Annual Limit	Proposed Weekly Advisory Level	Proposed Quarterly Notification Level
Tritium (H-3)	20 GBq	TBC	10 GBq
Carbon 14 (C-14)	2 GBq	TBC	1 GBq
Beta-emitting radionuclides associated with particulate matter	60 MBq	TBC	30 MBq

This will provide sufficient headroom to allow for potential perturbations and enable decommissioning to Care and Maintenance (C&M) to be completed in accordance with the proposed programmes and agreement with the Regulators. Actual gaseous discharges will be minimised and suitably controlled by using available plant.

The stacks that will discharge the activity discussed above will be those listed below, in Table 4.4:

Table 4.4 Discharge stacks to be used under new authorisation

Discharge Point	Origin	Discharge height (m)	Grid Ref. (EASTING)	Grid Ref. (NORTHING)
Reactor 1 roof east	Reactor 1 vessel purge. East Blimp ventilation Fuel Separation ventilation.	62 62 67	218115 218118 218117	651220 651215 651211
Reactor 2 roof west	Reactor 2 vessel purge. West Blimp ventilation Fuel Separation ventilation.	62 62 67	218193 218195 218197	651246 651242 651237
CCP west wall	CCP Enclosure area ventilation	21	218134	651211
CCP east wall (1)	CCP Fuel Handling Area ventilation	18	218162	651251
CCP east wall (2)	CCP Decommissioning project 1	18	218170	651246
CCP east wall (3)	CCP Decommissioning project 2	18	218175	651237
CCP north wall (1)	Loading Bay facility ventilation	18	218160	651270
CCP north wall (2)	B Bay dewatering ventilation	18	218165	651275
Solid Active Waste Building West	Bunker room & resin storage plant ventilation	23	218120	651170
LLW Processing Facility NE	LLWPF ventilation	8	218207	651205
FE Skip Refurbishing Plant Roof	Skip refurbishing plant ventilation	23	218121	651177
NCWPF 1	LLW ISO loading facility (CCP)	18	218193	651210
NCWPF 2	LLW ISO loading facility (Reactor 1)	26	218125	651196
MSRT Containment - Tent	Facilitate decommissioning (temporary)	6	218205	651190
MSRT Containment - Tank	Facilitate decommissioning (temporary)	6	218205	651190
MAETP	MAETP maintenance vent system	12	218236	651170
CCP north west Wall	West Blockhouse Motor Room – portable vent plant workshop	18	218130	651230
SAWB Removal Facility	Bunker emptying operations	19	218190	651190
Solid ILW Encapsulation	Boxed ILW encapsulation plant	21	218210	651320
ILW Sludge Encap	CCP ILW Sludge encapsulation operations	18	218170	651150
AETP south wall	AETP Decommissioning operations	4	218220	651167
AETP delay tanks	Delay tank decommissioning	18	218142	651142
ILW Store west wall	ILW store operations	18	218030	651260
LLWPF north wall	LLWPF operations	8	218207	651205
MRT Tank	MRT decommissioning	4	218230	651170
LLWPF west wall	Active Sample Prep Facility operations	7	218192	651192
HP Baseroom	Chemistry Lab fume hood extract	7	218084	651052
Reactor 1 west wall	Decontamination Facility	26	218073	651187
Various	Mobile Extract Unit	TBC	TBC	TBC
Various	Mobile Extract Unit	TBC	TBC	TBC
Various	Mobile Extract Unit	TBC	TBC	TBC
Various	Mobile Extract Unit	TBC	TBC	TBC
Various	Mobile Extract Unit	TBC	TBC	TBC
Various	Mobile Extract Unit	TBC	TBC	TBC

'Minor' stack management:

Certain activities will require minor temporary stacks and ventilation systems to be utilised. This will be when mobile extract systems will be employed. Where possible, Hunterston A Site will try to standardise the configuration of the sites mobile extract units. Prior to use assessments of the discharges will be made and, where applicable, notified to SEPA. All mobile units required are specified in the list above, however the specification of these units is still to be developed. Once this is finalised, the Regulator will be informed and the list above can be fully populated.

4.3 Liquid Radioactive Waste Discharges

Throughout the operational life of Hunterston A Site, and since cessation of generation in March 1990, radioactive liquid effluents have been discharged into the Firth of Clyde within limits specified in authorisations under RSA. Liquid discharges from Hunterston A Site are made via the Hunterston B Station circulating water outfall pipe.

This section gives a description of the sources of liquid effluents and the treatment plants, plus past and expected future sources of liquid effluent.

4.3.1 Sources of Radioactive Liquid Effluent

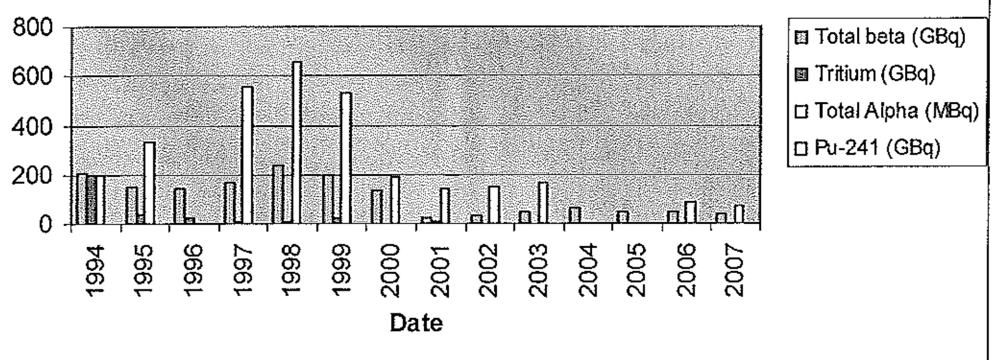
There are two main sources of radioactive liquid effluent from Hunterston A Site:

- Purge water from the CCP, and
- Miscellaneous waste water arising from the operations in the radiological controlled areas of the Site.

Monthly discharges of radioactivity from the site from August 2000 to December 2007 are listed in Table A4.2 of Appendix D.

Figure 4.2 summarises the annual liquid discharges from 1994 to 2007 against current authorisation limits taken from the data in Table A4.1 of Appendix D.

Figure 4.2 Summary of Annual Liquid Discharge Activities from Hunterston A (1994-2007)



Figures 4.2 and A4.1 to A4.3 in Appendix D show that the liquid discharges during the period of the current authorisation are considerably smaller than the specified limits.

Currently the CCP remains full of water, containing radioactivity in solution, and contains miscellaneous plant items, which are radioactively contaminated. In addition, some sludge remains in the pond with the result that the water still contains levels of radioactivity. This will continue to contribute to the radioactive content of the liquid effluent arisings until the pond is emptied and pond cleaning and sealing operations are completed.

The monthly discharge reports supplied to SEPA show that discharges from the CCP have significantly decreased since Pond purging was stopped in 2002. Miscellaneous waste water discharges are made as required (e.g. 1 or 2 times a month with waste volumes typically 30 to 40m^3). These variable levels are likely to continue depending on the operations being performed. There has also been routine monthly discharges from the active drains system and decommissioning activities in the CCP (e.g. pond de-sludging and pond furniture manoeuvring and/or removal), but no routine purging of the CCP since 2002.

In terms of radioactive content, the major radioactive liquid effluents over the remaining period of Care & Maintenance Preparation (C&M P) are expected to be those arising from CCP 'dewatering', and during the retrieval and packaging of stored waste, namely:

- Spent ion exchange (IX) resin currently stored in Active Resin Storage Vault (ARSV) number 1;
- Sludge currently in the CCP, Pond Purge Sump and Miscellaneous Sump;
- Sludge originating from the CCP but now stored in the CCP Sludge Retention Tanks;

(these three work streams are referred to collectively, as 'Wet ILW Recovery' in section 4.5)

A further source of radioactive liquid effluent arises from the continuing treatment of pond water and its final treatment during emptying of the pond.

The radioactive liquid effluent arisings from the above operations are discussed, and forward projections presented.

4.3.2 Contingency Plans for Foreseeable Events

The consequences of unplanned but foreseeable events causing liquid discharges during decommissioning, are much less than equivalent foreseeable events when the power station was operational since the inventory is grossly reduced and has decayed significantly since the end of defuelling.

It is possible that short term increases in discharges may occur due to impaired performance of filters, though this will be less likely once the MAETP is online. Control of work, plus maintenance and testing of plant, together with sampling and analysis of the RDT tank contents prior to release will minimise the likelihood of such events and ensure that any such events will not significantly increase annual discharges.

4.3.3 Assessment of Future Liquid Radioactive Waste Discharges

As discussed above the two sources of radioactive liquid effluent from Hunterston A are broadly: CCP dewatering plus miscellaneous waste water arising from operations within Radiological Controlled Areas of the Site. Over the next few years, to the end of the C&MP period, additional contributions to these wastes will arise from the decommissioning programme outlined in Table 2.1, such as pond and fuel route clean-up, skip cleaning and disposal, plus the recovery and treatment of wet radioactive wastes.

As a basis for substantiation of requirements for liquid waste discharge over the remainder of the C&MP period this section presents the results of an assessment done to predict the radioactive liquid waste arisings. These are based on current experience and on estimates of the volume and radioactive content of arisings from the individual projects and Site LTP. These are discussed in terms of future requirements for authorisation.

4.3.3.1 Discharge History

Data on the monthly liquid effluent activity for the period August 2000 to December 2007 is presented in Table A4.2 of Appendix D. Figure 4.2 shows how the annual liquid discharge volume varies between 1994 and 2007, taken from the data in Table A4.3 (b) from Appendix D.

This figure shows that the volumes of liquid effluent discharges were decreasing from 1994 to 2007. Since 2000 the CCP discharge volume and the miscellaneous discharge volume has been reasonably constant. As the decommissioning programme outlined in Table 2.1 progresses and with the potential for accelerated decommissioning, particularly the de-watering, decontamination and decommissioning of the CCP, it is likely that liquid effluent discharges will increase for a period of time.

Annual discharge reports for other sites from 2002 to 2004 show the liquid discharges for Magnox sites (Reference 18). In general Hunterston A Site liquid discharge activities are significantly lower than operational Magnox stations and on par with other Magnox decommissioning sites.

There would therefore appear to be scope to reduce the limits imposed on liquid discharges in the current authorisations, however, the de-watering of the CCP will require the discharge figures to remain as they are in the current authorisation.

4.3.3.2 Future Discharges – Pond and Miscellaneous Wastes

As with the gaseous discharges it is assumed that recent liquid discharges are indicative of the decommissioning process at Hunterston A Site and future discharges have been assessed by adding 3 standard deviations to the mean of the monthly discharges from August 2000 to December 2007 (Appendix D). This method assumes a Gaussian distribution for routine discharges, minor fluctuations and peak discharges covering over 99% of predicted future discharges. This approach, however, is only applicable to the periods when CCP de-watering is not being undertaken.

Therefore, using the data in Appendix D it is possible to generate maximum volumes and activities and compare them with the current limits as shown in the following table (though again this does not take into account the period when the CCP will be dewatered):

Table 4.5 Estimated maximum annual liquid discharge volumes and activity (disregarding CCP de-watering).

Source	Mean + 3 Standard Deviation estimates of monthly liquid effluent discharge over the period 2000 - 2007				
	Volume (m3)	Total Beta (GBq)	Tritium (GBq)	Total Alpha (MBq)	Total Pu-241 (GBq)
Total Monthly discharge*	371.9	19.16	0.94	61.61	0.23
Total 12 month discharge	4,462.8	229.9	11.38	739.3	2.76
Total 12 month discharge with decommissioning factor of 2	8,925.6	459.8	22.56	1478.6	5.52
Current Limit	Not specified	600	700	40,000	1000

* Total of CCP and Miscellaneous discharge volumes and activities.

The remainder of this section presents supporting assessments of activity based on individual project programmes for key activities likely to generate significant liquid discharges. It should be noted that project programmes should be reasonably accurate for 1 to 3 years, but after that there is scope for deviation.

4.3.3.3 Future Discharges – Modular Active Effluent Treatment Plant

The discharge volumes and activity of the CCP and Miscellaneous waste streams, up until C&M, will vary according to the programme in Table 2.1. Baseline discharges (the site's routine discharges not including CCP de-watering) will remain essentially constant throughout the C&MP, both before and after the point at which the MAETP replaces the current AETP, but will fluctuate as individual projects progress. Once the MAETP is operational the activity in the liquid effluent discharges should reduce, due to the improved abatement plant, though the 'baseline' routine discharges are of low activity prior to treatment. The MAETP will have replaced the AETP as the site's effluent treatment plant well before the planned draining and cleaning of the CCP. The MAETP is currently being employed in the circulation of the CCP water, to remove activity from the water in preparation of de-watering. The de-watering of the CCP will result in the activity being discharged in liquid effluent increasing for a period of time, principally through the increase in volume discharged.

The MAETP is designed to filter out the suspended solids in the CCP water and transfer them to sludge holding tanks, polish the remaining water and 'concentrate and contain' the majority of the Cs-137 activity in the CCP water in a small number of IONSIV cartridges. The CCP sludge will be recovered and encapsulated as part of the Wet ILW Sludge retrieval project. The IONSIV cartridges will be retained in the on-site ILW store awaiting final disposal, as mentioned previously.

Ongoing investigations (Reference 20) identify some 30 options for de-watering the CCP using the MAETP. This gives de-watering periods from 1 year to 3.8 years depending on the shift pattern adopted and the number of delay tanks used. Hence the programme to de-water the CCP could be achievable using a number of options. The maximum discharge to the Firth of Clyde of de-watering 6000m^3 of CCP water in a year, assuming a Caesium Removal Unit MAETP SCRU efficiency of 95% and final discharge activity of 25 MBq/m^3 (this figure is a 'target' value – the final discharge figure will be justified as BPM) would give the following activity discharges in a year:

Table 4.6 Comparison of MAETP and Total Liquid Effluent Discharges Against Current Authorisation Limits.

	Total Beta (GBq)	Pu-241 (GBq)	Tritium (GBq)	Total Alpha (GBq)
MAETP Final Discharge (CRU 95% efficient)	82.3	0.36	6.84	0.06
Total Rolling 12 Month discharge with decommissioning factor of 2	459.8	5.52	22.56	1.48
Current Rolling 12 Month Limits	600	1000	700	40

Therefore the estimated final discharges for de-watering in one year are well below the total annual discharge activities, with a decommissioning factor of 2, calculated from historical data above and the current authorisation limits.

This process is consistent with national and Company policy, strategy and recognised best practice. This will continue through to the end of decontamination of the CCP structure. There may also be additional liquid discharges as the MAETP is itself decontaminated and decommissioned, but these have not been accounted for at this stage.

4.3.3.4 Future Discharges – Waste Retrieval Operations

The nature of the operations involved in the retrieval of the resins, sludges and sand waste currently stored in tanks and vaults is such that only broad estimates can be made of the arisings of radioactivity in the effluents from the process. Reference 7 presents a summary of the estimated future activity arisings of liquid discharges from general operations and from waste retrieval campaigns as per the work programme from 1997 to 2004.

Experience shows that it has been difficult to accurately predict how decommissioning activities will actually progress or develop over time. Hence it is also difficult to ensure that estimates of discharges, made in advance of detailed BPEOs and BPMs, accurately predict the level of radioactivity in discharges. Therefore there is always some uncertainty associated with making such predictions.

Figures for the liquid discharges for this waste process are based on the individual projects done to meet the decommissioning programme. These estimates include the benefit of radioactive decay from cessation of generation to completion of the planned work.

4.3.3.5 Proposed Future Limits for Liquid Effluent Discharges

The estimates discussed above show that given the current decommissioning programme and the proposed treatment strategy the peak years for liquid effluent discharges is likely to be when the CCP is de-watered. However, it must be recognised that because of the nature of the waste processing operations there is some uncertainty in the future estimates of discharges and when they will occur.

On this basis the requirements for liquid discharges for the remaining phases of C&MP at Hunterston A are shown in Table 4.7.

Table 4.7 Proposed New Liquid Discharge Limits

Nuclides to which limit applies	Proposed Annual Limit	Proposed Quarterly Notification Level
Tritium (H-3)	0.7 TBq	0.35 TBq
Plutonium 241 (Pu-241)	1.0 TBq	0.5 TBq
Beta emitting radionuclides taken together (excluding H-3 and Pu-241)	0.6 TBq	0.3 TBq
Alpha emitting radionuclides taken together	0.04 TBq	0.02 TBq

Note: No weekly Advisory Level is proposed due to frequency of discharges.

It is believed that the proposed continuation of the current annual limits will provide sufficient headroom to allow for potential perturbations in liquid discharges and enable decommissioning to C&MP to be completed, in accordance with the proposed programmes and agreement with the Regulator. Actual liquid discharges will be minimised and suitably controlled by using available plant.

4.4 Solid Waste Disposals

4.4.1 Origins of Solid Waste

4.4.1.1 High Volume Very Low Level Waste (HVVLLW)

A relatively recent avenue for the disposal of solid waste that falls below the specific activity levels specified for LLW (see below), but exceeds the acceptance criteria for SOLA except materials is the route for the disposal of 'High Volume, Very Low Level' radioactive waste. Recent changes in government policy will result in Nuclear Licensed sites being able to dispose of HVVLLW to suitably licensed land fill sites. This is a route that Hunterston A intends to utilise, as part of this authorisation.

The waste will predominantly be contaminated soil and rubble and the intention is to dispose of the waste to a suitably licensed landfill site or, alternatively, through a suitably licensed facility, who will act as a waste broker, disposing of the waste through other, suitably licensed, facilities.

The quantity and activities involved for this waste disposal route are still being investigated. As are the potential disposal facilities. This work is still ongoing as the change in policy is relatively recent. Using this route to dispose of HVVLLW avoids the unnecessary usage of capacity at the licensed facility, which would have been the destination for this waste prior to the policy change. This would prolong the operational life of this national facility.

4.4.1.2 Low Level Waste (LLW)

Normal operation and maintenance of the plant and equipment associated with site operational and decommissioning activities have generated radioactive LLW. Solid waste arisings are segregated at source into non-radioactive and that which is potentially radioactive. However, all waste arising from work within the Radiological Controlled Area (RCA) and contamination controlled areas is deemed potentially radioactive until confirmed otherwise.

All non-compactable LLW arisings at Hunterston are processed in the appropriate HHISO loading facility and loaded into either a HHISO or THISO. The filling of ISO containers is carefully managed to reduce voidage within the containers as far as practicable together with recognition of other LLW Condition for Acceptance requirements. These ISO containers are periodically sent to a licensed facility for grouting and disposal. Compactable LLW arisings are processed in the LLW Processing Facility (LLWPF), by sorting, shredding and compacting into 200 litre drums, which are then placed in a Full Height ISO (FHISO) container. These containers are periodically sent to a licensed facility for super compaction, grouting and disposal.

4.4.1.3 Intermediate Level Waste (ILW)

Since ILW disposal is outwith the scope of the RSA93 application being made the following is only a brief overview of the position with this waste category, and is simply included here for information and completeness. Further details on this classification of waste, and other potential radioactive wastes beyond the scope of the RSA93 application can be found in the Hunterston A IWS.

Previous refuelling and defuelling operations led to production of some intermediate ILW. This is principally graphite, miscellaneous active components (MAC) and fuel element debris (FED). This material is contained in 5 site storage bunkers within the Solid Active Waste Building (SAWB). The reference plan for LTP 2008 is to retrieve, place all the contents in SAWB bunkers 1 to 5 in Nirex containers and grout the contents. The Nirex containers will be stored in the Site ILW Store until a national ILW repository becomes available (this is currently expected to be some time between 2040 and 2050). The ILW generated in the Final Site Clearance (FSC) phase will be processed via the Waste Management Facility (WMF) and sent to the National ILW Repository for final disposal.

Pond operations also result in the production of some ILW Wet wastes arisings, predominantly sludge and resins where they are currently stored in holding tanks on site. It is intended to encapsulate these wastes in a cementious matrix utilising $3m^3$ Nirex containers (previously referred to as the Wet ILW retrieval project). Preliminary design work and formulation trials have provided conditioning /packing factors that have been utilised in order to calculate the ratio of arisings to packaged volume.

4.4.2 Disposal Routes

All radioactive waste must be disposed of in accordance with the conditions of the RSA93 Certificate of Authorisation and requirements of the Nuclear Site Licence. LLW is disposed of by transfer to a licensed facility. HVVLLW is currently included in the waste sent to the licensed facillity in accordance with Cm 2919 policy on controlled burial for the Nuclear Industry. However, as referred to in section 4.4.4.2, the site intents to divert this waste away from burial. Therefore it is intended to send this waste a suitably authorised land-fill site or another licensed facility for onward disposal.

Segregated metallic LLW or HVVLLW will be sent to a suitably licensed facility for smelting. This could result in the non-radiologically contaminated proportion of the waste being re-used.

All disposal sites are regulated by the Nuclear Installations Inspectorate and/or the Environment Agency. The operators of these facilities impose Conditions of Acceptance with which Hunterston A must comply for waste despatched from site.

4.4.3 Waste Streams

The radionuclide composition within any waste arising is characteristic of the type and location of work being undertaken. Waste is characterised by its radionuclide 'fingerprint' which is specific to particular waste streams. Waste is therefore segregated according to its origin; these waste streams are identified in Table A5.1 of Appendix E, which presents the identified LLW for Hunterston A through to Final Site Clearance, and are consistent with the waste stream data in the UK Radioactive Waste Inventory in Reference 24.

The waste to be disposed of consists of material arising from the removal of plant and process materials which have become radioactively contaminated during operation and also secondary wastes resulting from the continued maintenance and/or decommissioning of the Site.

Reference 23 presents the characterisation of the main LLW streams for the Care & Maintenance Preparation (C&MP) phase of Decommissioning Hunterston A. It provides a description of each specified waste stream plus the raw volume (m^3), estimated weight (tonnes (t)) and activity level (TBq) plus proposed processing and packaging information. The information is updated on a regular basis. The total LLW volumes for the C&MP phase of decommissioning were estimated in Reference 23 as:

Table 4.8 Hunterston A Nirex LLW Identifiers and Volumes for C&MP

Nirex Waste Stream Code	Waste Description	LLW Arisings Volume (m^3)
9J948	Reactor and Auxiliary Building LLW	1831
9J949	Pond and AETP LLW	2331
9J950	Miscellaneous Sludge – AETP Clean up	0
9J931	Miscellaneous Sludge – MSRT 1	0
9J932	Miscellaneous Sludge – MSRT 2	1.6
9J50	Aluminium Skips	500

AETP – Active Effluent Treatment Plant, MSRT – Miscellaneous Sludge Retention Tank

Note 1: the majority of waste stream 9J932 has been disposed of at the time of writing.
Note 2: Contaminated soil is included in waste stream 9J949.

The material for the three main waste streams (9J948, 9J949 and 9J50) have been radio-isotopically fingerprinted as detailed in Table A5.2 to A5.4 in Appendix E. Descriptions of the materials are given below. Volumes of waste quoted are current estimates. Final volumes will depend on the results of treatment carried out to condition the wastes prior to disposal, and in the short term, the extent of decommissioning prior to the C&M phase.

4.4.3.1 Reactor and Auxiliary Buildings (Waste Stream 9J948)

This material consists of plant that has been in direct or secondary contact with the reactor gas stream. Boiler and fuel handling plant, including fuel charge/discharge machines that were previously listed in the later stage disposal in waste streams 9J100 and 9J310 to 9J317 (see Annexe 5 Table A5.1), constitute the largest volume of such material. Some of the material is already stored on Site but the bulk will arise from ongoing decommissioning activities. Some secondary, mainly compactable, waste is also included.

The total quantity of material to be despatched will be dependent on the level of site processing. This stream includes a significant amount of steel. If this is to be dispatched to the licensed facility for burial then initial process and recovery will be undertaken at Site to minimise the volume for disposal. It is presently estimated in the Nirex Inventory for Hunterston (Table A5.1) that when packed for transport this waste stream will have a total volume of approximately 2886m^3.

4.4.3.2 CCP and AETP (Waste Stream 9J949)

This material consists of plant that has been in direct or secondary contact with "wet" systems, in particular plant that may have been in contact with CCP water, and radioactive drain collection systems that are processed through the AETP.

As with the other waste streams some of this material is already in store on site but the bulk will arise from decommissioning activities. Some secondary, mainly compactable, waste is also included.

Contaminated soil disposal has also been added to this waste stream.

It is presently estimated in the Nirex Inventory for Hunterston A (Table A5.1) that this waste stream will have a total volume of approximately 3674m^3 (excluding the aluminium CCP skips) when packed into transport containers.

4.4.4 Analysis of Historical Data and Annual Solid Waste Disposal Requirements

4.4.4.1 Low Level Waste

Waste Volumes and Activities

Examination of records of solid LLW disposals to the LLW repository near Drigg in Cumbria from 1997 to 2006 show that annual transfers have ranged from 19.5 to 539.2 m^3. The annual disposal volumes are shown in Figure 4.3, and were taken from Table A5.5 in Appendix E. The maximum waste volume, in any 12 months over the period analysed was for September 2005 to August 2006. The graph shows the increasing disposals of solid LLW as decommissioning progresses.

The activities of the nuclides specified in the current solid LLW RSA93 Certificate of Authorisation RSA/W/21042 are shown in Figure 4.4.

Figure 4.3 Solid LLW Disposals from 1997 to 2005

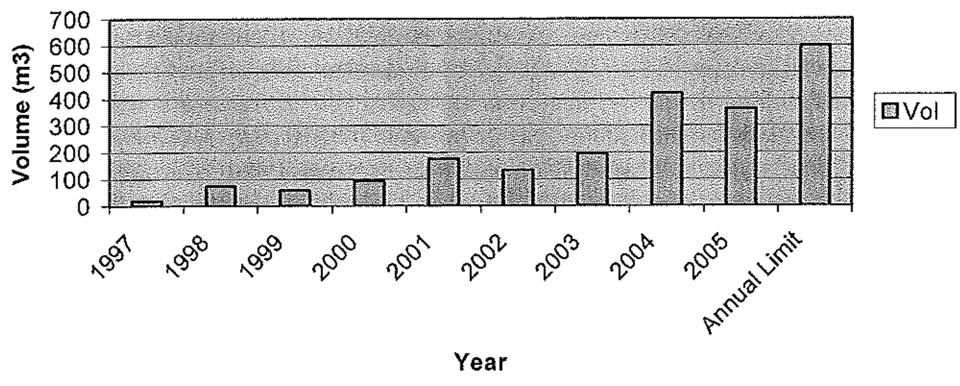
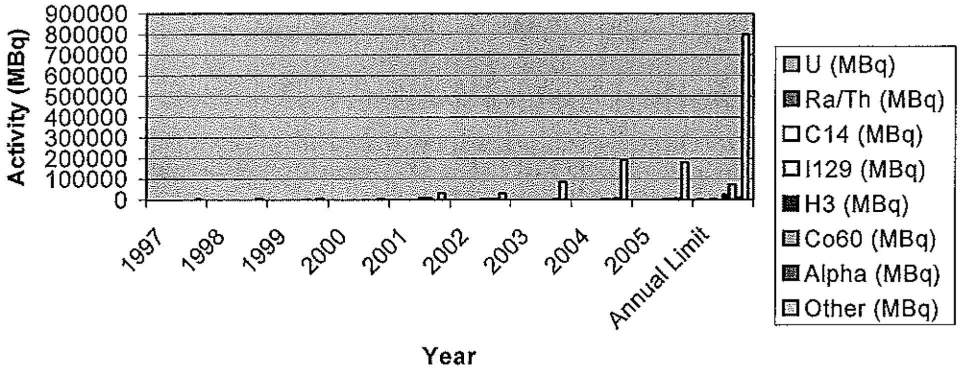
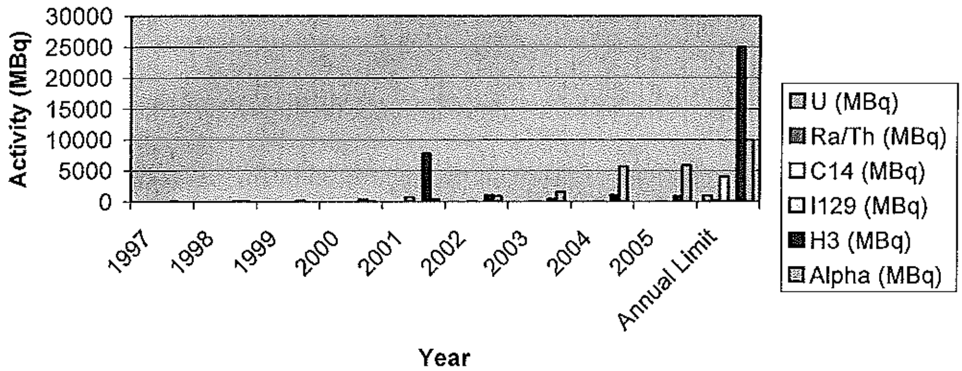


Figure 4.4 Solid LLW Activity from 1997 to 2005



It should be noted that for most of the nuclides specified in the current authorisation the level of activity discharged is significantly lower than the limit specified. In many cases discharges are too small to register within the scale of the graph. Over the period 1997-2005 there were no measurable/recordable levels of Radium(Ra-226, ^{226}Ra)/Thorium (Th-232, ^{232}Th) and Iodine 129 (I-129, ^{129}I), and only very small levels (0.03 to 0.33 MBq) of Uranium (in 2001, 2002 & 2007). The graph is dominated by the Co-60 and Other Beta limits. If these are removed the activities of the other nuclides is clearer, as shown in Figure 4.5.

Figure 4.5 Solid LLW (excluding other & Co60)



The statistical analysis (mean + 3 standard deviations) of the historical disposals predicts a maximum volume of 626m^3. It also predicts the activity of the nuclides specified in the current authorisation certificate would be as shown in Table 4.9.

Table 4.9 Comparison of Estimated Mean + 3 Standard Deviation Nuclide Activities and Current Authorisation Limits

Nuclide	Current Limits in any 12 consecutive months (MBq)	Mean plus 3 Standard Deviation Levels (MBq/y)
Uranium	1,000	0.45
Radium/Thorium	200	0
Other Alpha	10,000	10,383
Carbon 14	4,000	955
Iodine 129	100	0
Tritium	25,000	10,607
Cobalt 60	75,000	7,693
Other Beta	800,000	332,757

4.4.4.1.1Activity Content and Proposed New Limits

The disposal levels in future years can also be estimated from the Hunterston A LTP07 and WAT as shown in Table 4.10.

Table 4.10 Predicted Solid LLW Disposals

	Total Arisings (m^3)	Estimated Disposal (m^3)
2009	83.6	133
2010	557.5	876
2011	761.2	1208
2012	558.9	887
2013	354.3	563
2014	512.6	812
2015	519.6	829
2016	320.9	512
2017	2	

It is estimated from Table 4.18 that ~4443m^3 of LLW will be disposed of between 2007 and end of C&MP (2017). The total waste volume from the Hunterston A LLW Characterisation Document (Reference 23) is estimated as ~4670m^3. As these 2 estimates of total LLW volumes are relatively consistent for the purposes of this document it has been assumed that 4443m^3 of LLW arisings will be disposed of from Hunterston A to the end of C&MP.

The Nirex data in Table A5.1, and Reference 24, gives a packing fraction of ~63% for the final packaged volume for LLW. This is significantly higher than what is currently achieved in packing fractions for HHISO's from Hunterston A. However, there is work ongoing to improve the packing factors that are achieved. Hence, Table 4.18 assumes a target packing factor of 63% giving an average annual volume of ~704.9m^3 and a peak volume of 1208m^3 for the remainder of C&MP. Adopting these as the basis for the future volume limits for LLW disposal is believed to give operational flexibility, allowing for uncertainties in the forward planning within the LTP and the underpinning of waste volumes in the WAT and Nirex Inventory.

Using the data in the Hunterston A LLW Characterisation document and the peak waste arising volume of 761m^3 (for 2011) it is possible estimate the total annual activity for each nuclide specified in the current RSA authorisation for solid LLW, and propose limits for the new RSA authorisation. This information is presented in Table 4.11 below.

Further work will be undertaken to develop the route for segregating metallic LLW suitable for smelting. This is likely to be consigned to a licensed facility in dedicated HHISO containers (still to be agreed) and consigned by the operators of the facility to a third party for smelting and, where applicable, recycling. It is expected that the volume and activity of the waste will be included in the total volume activity limits applied for disposals to the licensed facility. Hunterston A Site will also be investigating other routes for segregated metallic LLW, as current arrangements are at an early stage. All proposals once at a more detailed stage will be fully discussed with the Regulator.

Table 4.11 Comparison of Current and Proposed Solid LLW Disposal Limits

Nuclide	Current Limit (MBq)	Peak Activity (Year 2011) (MBq)	Estimated Mean + 3SDEV Activity (MBq/y)	Proposed New Limit (MBq)
U	1,000	4.231	0.45	500
Ra/Th	200	0.000	0	100
Alpha	10,000	9096.148	10,383	10,000
C-14	4,000	2663.750	955	4,000
I-129	100	0.122	0	50
Tritium	25,000	4351.077	10,607	25,000*
Co-60	75,000	4779.332	7693	75,000
Others	800,000	243249.159	332,757	800,000

*Note: The percentage of tritium in 9J948 increased significantly in the last issue of the WSCD (from 19.7% to 66.5%); therefore it is proposed that the current limit is retained.

The proposed new limit considers the higher of the Peak Activity and the estimated mean + 3 standard deviation activity. Hence the new activity levels, in any 12 consecutive months, for each nuclide is proposed below:

Allowing for some headroom, it is recommended that the Uranium limit is reduced from 1000 MBq to 500 MBq for the new application. This proposed value is believed to be a suitable margin to cover the recovery, processing and disposal of the skips and other solid ILW in any one year, whilst still reducing the limit.

It is proposed to retain the Radium/Thorium and Iodine nuclides but reduce the limits from 200 and 100 MBq respectively to 100 and 50 MBq respectively for the new authorisation application to allow some headroom should these nuclides be found in future analysis of the waste streams.

It is also recommended that the:

- C-14 limit remains at 4000 MBq;
- Co-60 limit remains at 75,000 MBq;
- Other beta nuclides limit remains at 800,000 MBq;
- Alpha limit remains at 10,000 MBq;
- Tritium limit remains at 25,000MBq.

It is not currently the intention to accumulate LLW on Hunterston A site, other than that being prepared for disposal. However, it is recognised that the vault capacity at the licensed facility is scarce and although steps are being taken to increase this capacity there could be a delay in future disposal that would require interim accumulation at site. Similarly, if the plan for a new vault is put out to public inquiry there could be a further delay of 12 to 18 months with associated restrictions. These possible restrictions will have to be discussed with SEPA, and the NII, to agree the way forward to ensure that decommissioning is not disrupted during any LLW embargo.

Therefore, it is proposed that the 12 month limit on solid LLW volumes should remain at $600m^3$.

4.4.4.2 HVVLLW

Although the disposal of HVVLLW from Nuclear Licensed Sites is a relatively recent development, Hunterston A Site recognises that certain projects will generate waste of this type.

It would be best practice to divert this waste away from burial at a licensed facility, prolonging the life of this national facility. However work is still ongoing to determine values and radionuclide activities of the waste concerned. Also, development is still required as to how the consignment of this waste would be carried out.

It is proposed, initially, that no annual volume limit (for waste falling below the HVVLLW specific activity limits) would be applied for, but that HVVLLW volumes would be recorded as a sub-set of the LLW disposals (therefore falling within the specific authorisation limit for LLW). The ratio of HVVLLW to LLW and the proportion of the authorisation limit utilised by either waste from would depend on the decommissioning work being undertaken at the time of the disposal.

Further work is required to refine and develop predictions of waste to be generated. However, it is recognised that this waste route is developing rapidly in the off-site arena and that this report needs to include a proposal in this area.

Licensed disposal facilities are still rare; however the Hunterston proposal is to identify a suitably licensed land-fill facility to take this waste. It should be noted that Energy Solutions Inc. (Magnox North Ltd's parent organisation) is assisting Waste Recycling Group in the development of a suitable license application for its site.

Therefore it is likely that Hunterston A Site will make use of this work. However, other sites may be considered.

Further work on both the waste characteristics and the disposal destinations will be undertaken during the period shortly after the issue of this report. All proposals will be discussed with the Regulator.

4.5 Transfer of Combustible Waste for Incineration

This section concerns the disposal of two types of combustible LLW:

(i) lightly radioactively contaminated oil,
(ii) lightly radioactively contaminated organic sludge.

It is proposed that both of these wastes should be sent for incineration at a suitably licensed facility.

4.5.1 Liquid Combustible Waste

4.5.1.1 Sources of Liquid Combustible Waste

Hunterston A Site no longer uses a significant amount of lubricating oil, and there is a reducing probability that the remaining oil will become contaminated with radioactivity during decommissioning. However, it does have contaminated oil in redundant circulator seal oil and hot main gas valve systems. In addition to the oil itself, maintenance activities on plant/equipment containing oil may give rise to oily solid waste, (rags etc): oily waste is not acceptable for disposal at the suitably licensed facility without encapsulation, thus increasing both the cost and the volume of the waste. Hence, the preferred option for disposal of contaminated waste oil at Hunterston A Site is incineration at a suitable off-site licensed facility.

4.5.1.2 Disposal Route

Hunterston A Site radioactively contaminated waste oils were previously incinerated at Hunterston B Power Station. This has not been possible since 1996/97. Since then no radioactively contaminated circulator seal or hot main gas valve oils have been disposed of from Hunterston A Site, and there is currently no authorisation for the transfer and disposal of radioactively contaminated oil from the Site.

4.5.1.3 Options for Disposal of Liquid Combustible Waste

Site procedures ensure that the arisings of liquid combustible waste requiring disposal as radioactive waste are minimised by ensuring that waste which is not contaminated is kept separate from potentially contaminated waste. After confirmatory checks have been made any non-radioactively contaminated oil can be disposed of as special waste.

In principle, there are a number of possible means of dealing with contaminated liquid combustible waste:

(i) the waste can be incinerated. As Hunterston A Site does not have an incinerator, this would require the liquid combustible waste to be transferred to another location for incineration.

(ii) the waste could be treated chemically to remove the radioactivity in solid form, allowing the oil to be sold for re-use and the remaining radioactive solid radioactive waste to be sent for disposal at a licensed facility.

(iii) the liquid waste could be treated to fix the liquid in a solid matrix, and the resulting waste could be encapsulated and sent for disposal at a licensed facility as solid LLW.

A number of studies, within the Company, have been carried out to determine the best option for dealing with this type of waste. Decontaminating the waste oil to allow it to be re-used is an initially attractive option, since it should lead to an overall reduction in the quantity of radioactive waste requiring disposal and would allow otherwise waste material to be reused. However, most of the radioactivity in the oil is tritium and it would be expected that most of the tritium would be released during processing and discharged to the atmosphere, defeating the purpose of the process. Although it may be technically feasible to "fix" the liquid waste so that it can be encapsulated, it is believed that this would result in a large increase in the total volume of the waste, since a relatively small amount of oil would be included in the encapsulated material. There are also further uncertainties about the long-term retention of the oil in the encapsulated solid matrix.

Previous studies have concluded that incineration of this waste is the best option. At other Magnox power station sites (including those in Magnox South Ltd), liquid combustible waste is either incinerated on site[2], sent for incineration at a neighbouring power station site[3], or sent for incineration at an appropriate industrial waste incineration facility[4]. In each case, other disposal options were considered and incineration was considered to be the best option. A recent study was carried out by the Company to investigate whether the current means of

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[2] Oldbury and Wylfa have authorisations to incinerate liquid organic waste on site.

[3] Magnox South Ltd sites Hinkley Point A and Sizewell A have authorisations to send liquid organic waste to the neighbouring B Station for incineration.

[4] Trawsfynydd and Wylfa have authorisations to send liquid organic waste to the specified contractor for incineration.

disposal of all radioactive waste from Magnox power station sites in England and Wales continue to be the best environmental option. This study included the options for disposal of combustible liquid waste and concluded that incineration was the best option. As liquid combustible waste contains only small quantities of radioactivity, the quantities of radioactivity discharged to the atmosphere during incineration would be small. It is not practicable to extract the oil which is soaked in to the oil pads. Incineration is the best disposal option for these pads. Hunterston A Site therefore intends to transfer the combustible liquid waste to a suitably licensed facility for incineration. Confirmation that the contractor will accept the contaminated waste oil is given in Appendix B. Several other Magnox power station sites have been granted authorisations to transfer similar radioactively contaminated oil wastes to a suitably licensed facility for incineration. In conjunction with the developing IWS at Hunterston A the TBuRD strategy document is also being improved. Both the IWS and TBuRD for the 2008 LTP include discussions of the options currently being considered for the pre-treat of contaminated oils.

4.5.1.4 Activity Determination

Consistent with other Magnox North Ltd sites, representative samples were taken from each system and storage container and a radiochemical analysis was carried out to determine the radionuclide concentrations in the samples. Where appropriate, for radionuclides which were below the limit of detection, theoretical estimates were provided based on knowledge of the potential origins of those radionuclides and the measured concentrations of other radionuclides expected to be associated with them. From these assessments, the quantities present in each waste consignment from the site can be determined.

The inventory of radioactive waste oil is estimated as:

(a) Circulator Seal (CS) (up to $4m^3$) and HMGV (up to $5.5m^3$) hydraulic system oils;
(b) Decommissioning and deplanting of redundant plant (~1 to $2m^3$).

Note that Reference 21 states that no alpha emitters were detected from the series of samples analysed for the report. Also note that any remaining small volumes of miscellaneous contaminated oil, exceeding the SoLA exempt levels, found during remainder of the decommissioning will also be disposed of via this route. Any such oil found that is below the exemption levels will be disposed of as hazardous waste.

Reference 22 presents an analysis of the HMGV oils done in 1997. These results have been decay corrected and were used to generate the average and total activity for the HMGV oil in Table 4.12 assuming $5.5m^3$ of oil.

Table 4.12 HMGV Oil Average Concentration and Total Activity

Nuclide	Average Concentration (Bq/l)	Volume (Litres)	Total Activity (MBq)
Tritium (H-3)	406795.8	5500	2237.38

Carbon 14 (C-14)*	60,000	5500	330
Iron 55 (Fe-55)	129.8	5500	0.71
Cobalt 60 (Co-60)	150.1	5500	0.83
Caesium 137 (Cs -137)	10.2	5500	0.06

*The C-14 concentration is based on a peak activity of 60 Bq/cm^3, from Reference 22.

The decay corrected results were also used to estimate the average and total activity for the oils from the decommissioning and de-planted of redundant plant shown in Table 4.13.

Table 4.13 Average Concentration and Total Activity for Oils from Deplanted Equipment.

Nuclide	Average Concentration (Bq/l)	Volume (Litres)	Total Activity (MBq)
Tritium (H-3)	406795.8	2000	813.59
Carbon 14 (C-14)*	60,000	2000	120
Iron 55 (Fe-55)	129.8	2000	0.26
Cobalt 60 (Co-60)	150.1	2000	0.30
Caesium 137 (Cs -137)	10.2	2000	0.02

*This assumes that there is $2m^3$ of oil from 4 (b) above and that it is all HMGV oil.

To support these decay corrected results on-site liquid scintillation analysis and gamma spectroscopy were done of samples from the HMGV oil systems. This analysis estimated activities lower than the decay corrected results from Reference 22. It is therefore assumed that using the decay corrected activities gives a pessimistic estimation of the average and total activities, hence these were used to estimate the potential future limits.

It is believed that the majority of the Circulator Seal Oil (CSO) was transferred to Hunterston B in 1996. However, Reference 21 estimates that 2.5 to 4.0 m^3 of this oil remains in the associated pipework. This oil was not sampled and analysed with the HMGV oil in 1997, hence there are no values to decay correct. Also, no recent samples have been taken or analysed on site for this oil. Hence it is pessimistically assumed that the radioactive content of the oil is as specified in Reference 21, i.e.

Table 4.14 Circulator Seal Oils

Nuclide	Tritium (H-3)	Carbon 14 (C-14)	Other Nuclides
Estimated total activity MBq	5000	Not Specified Separately	65

The C-14 activity is not specified separately but assumed to be part of the "Other Nuclides" activity.

The majority of the oil is currently held in system tanks and/or the LLW Transfer Facility (LLWTF) awaiting disposal. However, there is likely to be small quantities within pipes, pumps, valves and sumps in these, and other, systems awaiting decommissioning and deplanting.

The results in Tables 4.13 and 4.14 indicate that at least some of the oil may be of sufficiently low activity to be classed as free release. Where practicable the waste oil volume for incineration will be minimised by filtering, conditioning or other treatment identified by specific BPEO and BPM studies for the task prior to the recovery and disposal of the oil. The intent being to sentence as much oil as possible as material for special/hazardous waste disposal or commercial recycling if appropriate. The remaining radioactively contaminated oil will be sent to a suitably licensed facility for incineration. All process and/or secondary radioactive waste will be minimised and arisings sentenced as LLW as appropriate.

However, at the time of recovery and sentencing of the oil it may not be effective or efficient, on cost or operational grounds, to separate the oil into free release and radioactively contaminated oil. Hence pessimistically all the hot main gas valve oil and circulator seal oil in the systems, plus that stored in the LLWTF, may have to be disposed of as LLW.

The decommissioning programme requires that where practicable as much of the LLW is removed from the Site by the end of 2016. The Hunterston A Lifetime Plan (LTP) for 2007/2008 shows that the current accumulation of waste oils will be recovered and disposed of before 2015/2016. The disposal of oil is included in this RSA93 application to ensure that a suitable disposal route is available and to allow early disposal should the opportunity arise.

4.5.2 Solid Combustible Waste

Combustible organic waste solids have arisen during the operation and maintenance of the power station. These are of low activity but do not comply with the conditions of acceptance for the licensed facility, *viz.*

- Dried organic sludge from the existing sewage sludge drying beds;
- Wet organic sludge from the decommissioning and deplanting of the redundant sewage plant.

4.5.2.1 Sources of Solid Combustible Waste

The material for disposal is in the form of fibrous sludge (85% volume) mixed with earth (10% volume) and stone (5% volume), resulting from the bacterial digestion of sewage from the redundant Hunterston A sewage treatment plant. This contains sewage from both Hunterston A and Hunterston B power stations as until recently the Hunterston A plant processed sewage from both stations. Hunterston A and B now have their own separate sewage plants.

Essentially the material content is dominated by moisture (66%) and organic material (22%) and is contaminated predominately by Cs-137 and Co-60. The material also contains traces of "Listed Materials" as defined under the "Control of Pollution (Special Waste) (Amended) Regulations". Detailed results of physical and chemical assay of the material are given in Reference 23. The volume of dried sludge for disposal is estimated as ~50 m^3 (with <1m3 of wet sludge estimated to reside within the sewage plant equipment and pipework) and an estimated weight in excess of 26 tonnes.

Scottish Nuclear Ltd (SNL) undertook investigation of the source of contamination but was unable to identify a single specific cause. It was believed that the cause was contamination carried by airborne spray from the Hunterston A CCP before it was enclosed in 1979. SNL also found, from measurements across the sludge/liquid interface of the sewage plant, that the sludge product is an extremely efficient medium for the concentration of radionuclides. As such, any radioactive material wrongly consigned to the sewage system in the past may have concentrated in the sludge medium.

There may also have been a small contribution to the radioactive content from the fallout from Chinese weapons testing and Chernobyl.

4.5.2.2 Disposal Route

Previously, similar contaminated waste sludge from Hunterston A was incinerated at Hunterston B. This has not been possible since 1996/97. Since then no radioactively contaminated sewage sludge has been disposed of.

There is currently no authorisation for the transfer and disposal of contaminated sewage sludge.

4.5.2.3 Options for Disposal of Solid Combustible Waste

As with other materials, the Site procedures ensure that the arisings of solid combustible waste requiring disposal as radioactive waste are minimised by ensuring that waste which should not be contaminated is kept separate from potentially contaminated waste, so that, after appropriate confirmatory checks have been made, the non-contaminated waste can be dealt with as normal non-radioactive material.

In principle, the possible means of dealing with contaminated solid combustible waste is the same as in section 4.5.1 for liquid combustible waste.

Given the high moisture content and the organic material in the sewage sludge, it cannot meet the Conditions for Acceptance for the licensed facility either in its current state, or conditioned. Although moisture content has been significantly reduced by air drying in 4 sewage beds, this simply increases the relative content of the organic material. Further biodegradation of the organic component, with the attendant production of gas, has the potential to compromise the integrity of the final waste product.

Although it may be technically feasible to "fix" the organic waste so that it can be encapsulated, and sent for disposal as solid LLW, it is believed that this would result in a large increase in the total volume of the waste given that there is an estimated 50m^3 of sludge. There are also uncertainties about the long-term retention of the organic material in the encapsulated solid matrix. Hunterston A therefore intends to transfer the combustible solid waste to a licensed facility for incineration. Confirmation that the contractor will accept the contaminated dried sewage sludge is given in Appendix B.

4.5.2.4 Activity Determination

Representative samples were taken from the sewage plant and radiochemical analysis was carried out by a specialist laboratory in order to determine the radionuclide concentrations in the samples. Where appropriate, for radionuclides which were below the limit of detection, theoretical estimates were provided based on acknowledge of the potential origins of those radionuclides and the measured concentrations of other radionuclides expected to be associated with them. From these assessments, the quantities present in the waste can be determined.

As stated above the inventory of radioactive waste sludge is estimated as:

(a) Dried organic sludge ~50m^3;
(b) Wet organic sludge <1m^3.

On-site analysis results of samples taken from across the sludge beds are summarised Table 4.15 below.

Table 4.15 Peak and Mean Specific Activity of Individual Nuclides in Organic Sludge

	Cs-137 (MBq)	Cs-134 (MBq)	Sb-125 (MBq)	Cr-51 (MBq)	Mn-54 (MBq)	K-40 (MBq)	Am-241 (MBq)	Co-60 (MBq)
Mean	1.58	0.03	0.13	0.21	0.05	2.32	0.07	0.93
Peak	3.93	0.05	0.47	0.82	0.20	5.17	0.17	2.29

The organic sludge samples were not analysed for H-3 or C-14. It is believed that the sludge was contaminated from drains in the Reactor buildings. Hence it is assumed that the specific and total activity of H-3 and C-14 can be estimated using the fingerprints for the Reactor and Auxiliary Building waste stream (Nirex Identifiers 9J948). The H-3 and C-14 activities have been apportioned against the Co-60 activities above and are presented in Tables 4.16 and 4.17 below.

Table 4.16 Estimated Specific Activities of Tritium and Carbon-14

Nuclide	Tritium (Bq/Kg)	Carbon 14 (Bq/Kg)
Mean	52.75	4.93
Peak	128.95	12.06

Table 4.17 Estimated Total Activities of Tritium and Carbon-14

Nuclide	Tritium (MBq)	Carbon 14 (MBq)
Mean	1.37	0.13
Peak	3.35	0.31

The majority of the organic sludge is currently in drying beds on site awaiting disposal. However, there is likely to be small quantities within pipes, pumps, valves, tanks and sumps of the systems awaiting decommissioning and deplanting.

The results in Tables 4.15 to 4.17 indicate that at least some of the organic sludge may be of sufficiently low activity to be classed as free release. Where practicable the organic sludge volume for incineration will be minimised by in-situ monitoring, or bagged and monitored, or by other options identified in specific BPEO and BPM studies for the task, prior to the recovery and disposal of the sludge. The aim will be to sentence as much organic sludge as possible as special/hazardous waste. The remaining radioactively contaminated organic sludge will be sent to a suitably licensed facility for incineration. All process and/or secondary radioactive waste will be minimised and arisings sentenced as LLW as appropriate.

At the time of recovery and sentencing of the organic sludge it may not be effective or efficient, on cost or operational grounds, to separate the sludge into free release and radioactively contaminated material. Hence, pessimistically all the contaminated organic sludge may have to be disposed of as LLW to a suitably licensed facility for incineration.

4.5.2.5 Proposed Limits

Analyses of the current accumulations indicate the presence at very low concentrations (but marginally in excess of the "de minimis" level) of Tritium (H-3), Carbon 14 (C-14) and other nuclides, quantities of alpha and beta in all oils and/or sewage sludge.

Whilst the total quantity of contaminated oil and organic sludge to be disposed of is small (~62.5m^3) and would ideally constitute a "one-off" disposal, the Site would wish to dispose of such material in batches as specified in the decommissioning programme. It is therefore proposed that in order to accommodate this strategy a volume limit for any 12 consecutive months should be up to 62.5m^3 of oil and/or organic sludge, to most effectively utilise the 30m^3 per consignment limit in the Condition for Acceptance of Radioactive Waste. This gives the opportunity to incinerate all the oil and organic sludge waste in a single year.

To allow for present uncertainty, and provide for the timely transfer of waste oils and sludge, the proposed annual limits for incineration are set out in Tables 4.18 and 4.19 below.

Table 4.18 Proposed Radioactive Waste Oil Limits in any 12 Consecutive Months

	Tritium	Carbon 14	Other Nuclides (excluding Alpha)
Annual Limit (MBq)	8050	450	67

Note, Reference 5, states that "No alpha emitters present" in the oils.

Table 4.19 Proposed Radioactive Waste Sludge Limits in any 12 Consecutive Months

	Tritium	Carbon 14	Others Beta and Gamma emitting nuclides	Alpha emitting nuclides
Annual Limit (MBq)	3.35	0.31	6.5	0.1

Note the conditions for acceptance calls for Iodine 123 (I-125) and Iodine 131 (I-131) to be separately specified but neither of these nuclides were identified in the analysis and do not appear in the 9J948 waste stream fingerprint. Hence these are assumed to be negligible.

4.5.2.6 Future Disposal Requirements

The transfer of contaminated oil and sludge from Hunterston A to the suitably licensed facility for incineration is limited both by the volume and activity that the facility can receive. It is also expected that the transfers cannot constitute a "one-off" disposal as there will need to be transfers from current storage vessels and residual oils and sludge encountered as individual plants are deplanted.

Hence it will be necessary to spread the transfer of the oils and sludge over a period of 2 to 3 years. Magnox North Ltd therefore wishes to have flexibility in the types of waste it can send via this disposal route and consequently will apply for all the waste types listed above to be included in the new authorisation. Although Magnox North Ltd wishes to have the operational flexibility to send these types of waste they remain committed to ensuring all waste arisings are minimised by continuing to apply best practicable means to limit the volumes of wastes produced.

The authorisation limits need to reflect this requirement but it is expected that the radioactively contaminated sludge will be disposed of between 2013 and 2015, and the radioactively contaminated oil disposed of between 2015 and 2016 (as shown in the outline programme in Table 2.1). However, consideration could be made to bringing forward the disposal of the contaminated oils to match the sludge disposal.

The waste will be transferred to a suitably licensed facility for incineration by road in full accordance with the requirements of the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009, where appropriate, and any other relevant legislation. The waste will be drummed (i.e. cylindrical ISO container which meets the requirement of Low Specific Activity, Group II (LSA-II)) or appropriately contained.

The waste will be incinerated in an approved incinerator that has a current Certificate of Authorisation. The proposed nuclide limits in the tables above represent only a small fraction of their authorised values.

Any residues from the combustion process will be collected and disposed of at a controlled landfill site in accordance with normal procedures at the works.

5 BPM REVIEW

5.1 BPM Philosophy

It is incumbent on operators within the nuclear industry to ensure that the volumes and radioactive content of waste disposals are minimised. In undertaking to comply with this the operator has to take into account the appropriate political and social factors. The operator has to comply with this requirement by demonstrating that his operations to minimise waste disposals are considered to be BPM.

The Company uses, and will continue to use BPM at Hunterston A Site to:

- minimise the radioactivity in wastes produced,
- minimise the activity of liquid and gaseous wastes discharged to the environment, and
- minimise the volume of radioactive waste disposed of by transfer to other premises.

The Company applies BPM at all Magnox North Sites, including Hunterston A Site, according to a common set of principles, which include:

- BPM is applied to all station procedures that might impact on waste arisings, for example: procedures for waste disposal, control of fuel cooling ponds radioactivity levels and exclusion of unnecessary "waste" from radiation controlled areas;
- BPM is applied to both strategic and day-to-day decisions; the latter is achieved by addressing the impact of operations on waste arisings routinely at operational meetings;
- BPM is considered for the control of waste arisings from projects during the design phase;
- Appropriate ownership is acknowledged for all environmentally sensitive plant and sampling equipment to ensure that the responsibility for maintenance lies with the plant or equipment operators, who are best placed to recognise equipment failure. Maintenance priorities are reflected in operating procedures;
- The site's independent nuclear safety assessment process should include adequate environmental scrutiny to ensure that BPM is applied to plant modifications;
- In addition to the definition of "normal state of plant" conditions, abnormalities in environmentally sensitive plant are addressed in procedures. Where equipment failure requires maintenance, appropriate tagging of the failed equipment is used;

- Experience from other sites is considered in the application of BPM. There are several forums, both Company wide and industry wide, for sharing experience in operations, including the management of radioactive wastes.

  Cm 2919, states that in determining whether a particular approach represents BPM, "the Inspectorate will not require the applicant to incur expenditure, whether in money, time or trouble, which is disproportionate to the benefit likely to be derived". This BPM requirement is also reflected in the current RSA93 authorisations for the Site (References 1, 2 & 3).

  In the subsequent text, the Company has detailed its perceived requirements regarding future disposals of radioactive wastes. Although each radionuclide has been considered against recent historical routine disposal levels the Company has reviewed its arrangements to ensure that BPM continues to be applied bearing in mind the move forward from power generation to preparations for the site's care and maintenance prior to ultimate decommissioning. Each of the three elements in the White Paper were considered as follows:

- Money; the monetary worth of a potential reduction in radiation dose, and hence environmental impact, to the whole population of Europe from a given discharge stream was compared with the cost of activity abatement to achieve that reduction. The Company used a monetary worth of £20,000 per manSv for public dose (proposed for Cost Benefit Analysis (CBA) in Company Reference 29) and recommended by the Health Protection Agency (HPA), formerly the National Radiological Protection Board (NRPB) in RSA93 applications in 2002. However, £100,000 per manSv has been used more recently, i.e. more in line with National Health Service figures of £200,000 and £400,000 for reduction in radon and dental x-ray exposure.
- Time; any abatement has to be to a timescale appropriate to the given process. For example, radionuclides with a short half-life may be allowed to decay prior to disposal.
- Effort; any implications resulting from the undertaking of a potential abatement exercise. For example, the extent of any increase in operator dose compared to the potential reduction in dose to the critical group.

There are Company and Site guidance documents (Reference 15 and 8 respectively) on conducting BPMs that are used when individual BPMs are produced.

As part of the preparation for the submission of the new RSA93 application a review of the BPEO/BPM process at the site was carried out (Reference 12). The review of the process shows that:

- The Company recognises and references Government Policies, Strategies and Legislation/Regulations. The Corporate requirements arising from these are produced as Company Documents that are readily available to all their sites. Hunterston A Site recognises these requirements and includes them in their Site arrangements;
- Company and external BPEO/BPM guidance is readily available at Hunterston A Site, and where practicable is used in BPEO/BPM studies. Site generated guidance on BPEO and BPM is also available;
- A generic BPEO for Magnox Power Stations (Reference 13) was issued in 1998. Company report Reference 14 issued in 2005, showed that the current disposal options for Magnox Stations were compliant with RSA93 requirements and that the overall Company approach to decommissioning continued to represent BPEO for decommissioning Magnox Stations. Whilst these reference Magnox Power Stations in England and Wales, they can in essence be seen to be applicable to Hunterston A. BPEOs exist for individual decommissioning projects ongoing, and/or planned, for the site;
- Individual project BPEOs and BPMs are produced and are issued to SEPA for information, or as requested by SEPA. Sampling of the BPEOs/BPMs show that they are consistent with the general requirements for such studies. The current RSA93 authorisations (from 2000), and the proposed new RSA93 "multi-media" authorisation, require that BPM is applied to all discharges/disposals made from the site. Substantiation documents, the adoption of industry standard equipment and practices, plus Site arrangements ensure this is the case.

5.2 Minimisation of Gaseous Waste Arisings

Significant radionuclide generation is no longer possible at Hunterston A Site, so minimisation no longer needs to cover the production of radionuclides. However, minimisation of releases of radioactive gases, mists and dusts is still required. For the potentially most significant source, the reactor cores, this is accomplished by containment offered by the sealed RPVs. Minimisation of the air suspension of activity from routine operations in contamination controlled areas is achieved by using approved working practices and by decontaminating to reduce the levels of loose surface activity that could become airborne if disturbed.

For decommissioning projects work the activities are planned to use BPM to minimise gaseous effluent arisings. Local areas giving rise to significant airborne activity will be contained and, where appropriate ventilated using a local filtered extraction unit. BPM options will be assessed where the airborne activity arising from the work can be reduced by sealing or wetting surfaces, or removing loose activity. Decisions on the minimisation techniques need to be holistic and take into account the solid waste filters and liquid effluent that may arise together with the effects on workers dose and costs.

5.2.1 Application of BPM for Gaseous Wastes

The current Hunterston A Site Certificate of Authorisation (RSA/W/21044, Reference 3) for the disposal of gaseous waste requires that the Company "shall use best practicable means to reduce the activity in all of the waste subject to disposal under the terms of this authorisation". The BPM is "that level of management and engineering control that minimises, as far as practicable, the release of radioactivity to the environment whilst taking account of a wider range of factors, including cost-effectiveness, technological status, operational safety, and social and environmental factors". The Certificate of Authorisation also states that SEPA, in determining whether a particular aspect of a proposal represents the best practicable means "will not require the Company to incur expenditure whether of money, time or trouble which is disproportionate to the benefit likely to be derived".

Practical examples of how BPM is applied to atmospheric discharges of radioactivity at Hunterston A Site are:

- discharge routes and filtration treatment are agreed with the Regulators,
- discharge routes will generally use multi-stage HEPA filtration (e.g. 2 stages with 1 pre-filter and 1 HEPA filter),
- discharges are small quantities of activity diluted in very large volumes of air,
- consideration is given to changing from continuous running of discharge routes to duty/standby arrangements. This reduces the discharge volume whilst maintaining adequate air changes to satisfy radiological requirements and saves energy,
- management procedures and working arrangements will minimise the generation of gaseous discharges, e.g. packaging and processing material at the point of work and avoiding dust raising activities,
- gaseous discharges will be monitored and reported to SEPA to demonstrate that the processes ensure that the discharge limits are not exceeded.

The impact is therefore small and helps reduce discharges. The procedures in place to protect personnel working in contaminated areas also minimise the levels of contamination available to be entrained in the ventilation systems.

The reported gaseous discharges during decommissioning to date are much reduced from those arising during operation and defuelling, and the collective doses from them are so small that the use of further abatement plant, even if it were feasible, would not be justified. Hence it is considered that BPM is therefore being used to treat gaseous effluent.

Gaseous discharge figures are routinely reviewed to ensure and demonstrate that BPM is being applied both from specific project and site-wide perspectives. Further work will be carried out to demonstrate that the stack sampling methods employed are also BPM.

5.3 Application of BPM for Liquid Wastes

The current Hunterston A Certificate of Authorisation (RSA/W/21043) for the disposal of liquid waste requires that the Company "shall use best practicable means to reduce the activity in all of the waste subject to disposal under the terms of this authorisation". The BPM is "that level of management and engineering control that minimises, as far as practicable, the release of radioactivity to the environment whilst taking account of a wider range of factors, including cost-effectiveness, technological status, operational safety, and social and environmental factors". The Certificate of Authorisation also states that SEPA, in determining whether a particular aspect of a proposal represents the best practicable means "will not require the Company to incur expenditure whether of money, time or trouble which is disproportionate to the benefit likely to be derived".

With the very low radiological impact of discharges at the current and proposed levels of authorisation, the requirement to use BPM in considered to be met by:

- particulate removal by filtration followed by discharge of filtered effluent to the environment;
- operation of the treatment plant and control of discharges in accordance with Site procedures;
- liquid effluent is sampled and analysed to ensure that discharges comply with the RSA93 authorisation requirements;
- pre-conditioning of liquid effluent, or wash through of tanks and systems, are reviewed to ensure that new, or secondary, waste that could arise are assessed and minimised if the process is to be taken forward and relevant operating instructions will be modified to reflect the changed or new processes;
- assessment is made of any proposed modification, trial or test process that is likely to generate liquid effluent to ensure that it matches the final requirements and does not introduce unnecessary secondary waste;
- BPM/BPEO assessments are done for replacement and modification of plant and processes.

5.4 Volume Minimisation of Solid Waste

The Company has an Environment, Health and Safety Policy which, for waste operations, states that it "will strive to prevent pollution and minimise waste and the use of natural resources as part of our contribution to sustainability and environmental improvement". In compliance, Hunterston A pays particular regard to waste minimisation through staff training, its operating procedures and volume reduction processes and/or initiatives.

Procedures are in place to restrict the amount of material taken into areas where LLW is or may be created, or by the reuse of items wherever possible. Staff are trained to minimise the amount of potentially redundant packaging taken into radiation and contaminated controlled areas and to reuse items and tools within the RCA.

The volume of all LLW produced is reduced in a number of ways. For example by minimising the waste classified as LLW by monitoring and segregating wastes to ensure as much as possible is sentenced as "free release". Where practicable, LLW can be processed as compactable waste for shredding and/or low force compaction on Site. It may also be possible to identify LLW that could be sent for incineration rather than surface disposal. In all cases where waste has to be handled careful consideration is given to the consequent operator radiation exposure.

Where appropriate, decontamination techniques are used to reduce waste by cleaning items for reuse or disposal as non-radioactive scrap. Such techniques could be used to reduce the levels on an item to bring it into a lower category. However, it is recognised that decontamination produces secondary wastes that can be chemically and radioactively unacceptable as LLW and could result in an increase in the total mass or volume of waste requiring disposal. This, together with operator dose implications, must be taken into account before such techniques are applied.

Some large items may be cut up so that they fit into drums or transport containers. Cutting of contaminated items is undertaken in a contamination controlled area under controlled conditions with suitable provision for the collection of swarf, dust or other particulate. The application of ALARP may limit the cutting of heavily contaminated items.

Consigning LLW is an expensive process and hence there is a financial incentive to dispose of as much waste as possible as free release. All staff are aware of this and are encouraged, through Site procedures, to take account of solid LLW disposal requirements in designing and planning their projects.

The Site strategy is consistent with the Nuclear Site Licence and RSA93 requirements to process and dispose of solid LLW as soon as possible rather than accumulating the waste on site.

Where contaminated waste materials exceed the SOLA exemption activity levels, but satisfy the HVLLW levels the intention is to segregate this material for disposal at a suitably licensed facility or for transfer to another licensed facility, where the site operator will act as a waste broker and dispose of the waste through a suitably licensed third party.

Where metallic LLW suitable for smelting is identified during the decommissioning process, the intention (under this authorisation) will be to attempt decontamination on the site and, if unsuccessful segregate the waste to be sent for onward transfer for smelting and (where applicable) re-use.

The above are therefore believed to demonstrate the Hunterston A adopts BPM to dispose of solid LLW generated during decommissioning.

6. ASSESSMENT TECHNIQUES

6.1 Gaseous Radioactive Waste Discharges

6.1.1 Treatment Plant and Sampling of Gaseous Wastes

The Hunterston A Site gaseous discharge points are presented in the following table:

Table 6.1 Summary of Current Gaseous Discharge Points

Discharge Point	Origin and Nature	Monitored
Reactor 1 roof east	Reactor 1 purge	yes
	Reactor 1 Fuel Separation ventilation	yes
Reactor 2 roof west	Reactor 2 purge	yes
	Reactor 2 Fuel Separation ventilation	yes
CCP west wall	CCP enclosure area ventilation	yes
CCP east wall	CCP handling area ventilation	yes
CCP north wall	Temporary ISO loading facility ventilation	yes
Solid Active Waste Building West	Bunker room & resin storage plant ventilation	yes
LLW Processing Facility NE	LLWPF ventilation	yes
FE Skip Refurbishing Plant Roof	Skip refurbishing plant ventilation	yes
NCWPF 2	ISO loading facility	yes
MSRT Containment - Tent	Facilitate decommissioning (temporary)	yes
MSRT Containment - Tank	Facilitate decommissioning (temporary)	yes
CCP north west Wall	West Blockhouse Motor Room – portable vent plant workshop	yes

See Reference 16.

These systems include High Efficiency Particulate Air (HEPA) filters and sampling devices. The filter testing methods (sample method, frequency and subsequent assessment methods) are as defined in site arrangements. Work involving airborne radioactivity is ventilated according to an industry code of practice (Reference 17). Mobile extract units fitted with HEPA filters are used to filter air from non-routine work areas where there is no permanent ventilation system and there is a potential for significant airborne contamination to arise. Operation of such equipment is subject to agreed levels of maintenance and monitoring.

Other ventilation systems exist but serve areas of lesser radiological significance. The discharges from these unmonitored outlets do not have a significant impact on the total gaseous discharges and are not expected to exceed 1% of the current authorised discharge limits. It is assumed that any ventilation system that is in place, or likely to be in place, for 3 months or more should be classed as permanent, monitored and notified to SEPA.

6.1.2 Arrangements for the Control and Monitoring of Gaseous Discharges

The Site Director, or his nominated deputy, is ultimately responsible for the compliance with the Nuclear Site Licence and RSA discharge authorisation. The key responsibilities and the nominated person(s) are specified in the Site's Management Control Procedures (MCPs).

The contamination controls and procedures affecting the gaseous waste arisings and the sampling provide a means for day to day control of discharges.

The operations are conducted within strict management system combining the MCPs referenced above. The Site's quality management system and environmental management arrangements are subject to regular internal and external audits. They are based on BS EN ISO 9001:2000 and BS EN ISO 14001:2004 respectively.

6.2 Liquid Radioactive Waste Discharges

6.2.1 Treatment Plants for Liquid Effluent

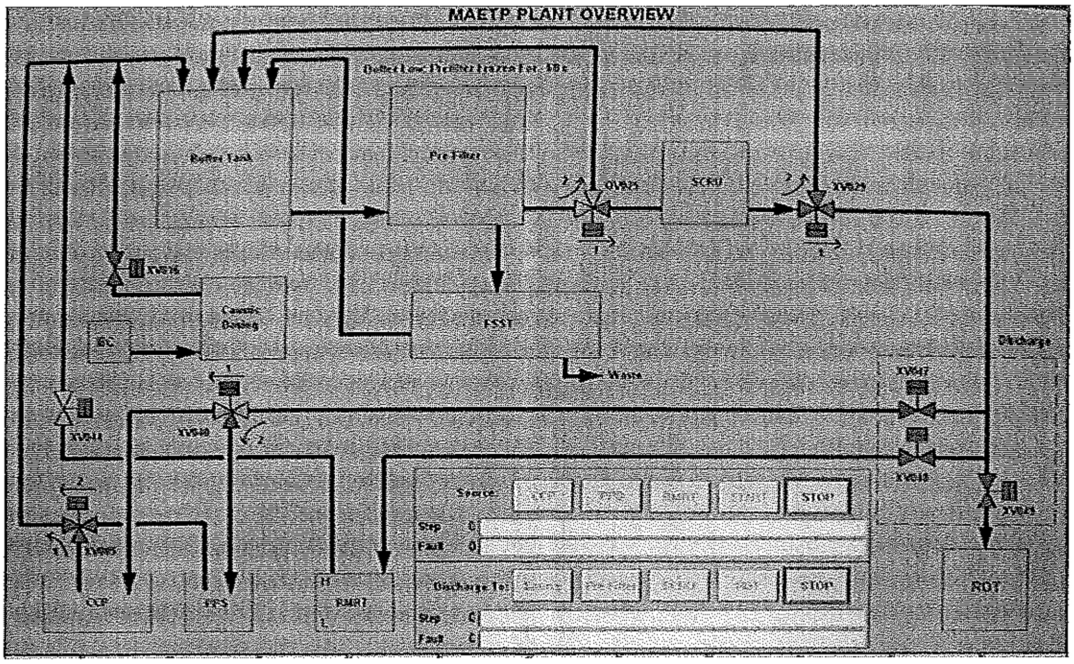
The historical (and current at time of writing) Active Effluent Treatment Plant (AETP) processes effluent through sand pressure filters, removing suspended radioactive particulate matter from the active liquids. No soluble abatement measures are available using this plant. The original AETP has two waste streams: the CCP stream and the Miscellaneous stream.

A suitable alternative plant, the Modular Active Effluent Plant (MAETP) has been designed, built and tested off-site. Between 2006 and 2008 it was installed on-site; then in-actively and actively commissioned. The decontamination and decommissioning of the current AETP, plus the operation and decontamination & decommissioning of the new MAETP will generate radioactive liquid effluent. Table 2.1 shows the expected programme dates for replacement of the AETP and the operation of the MAETP.

The MAETP consists of both particulate and soluble activity abatement treatment systems. Particulate activity abatement is achieved through the operation of a 'FILTOR' radial depth media filter. This unit removes particulate material suspended in the effluent flow. It also has the facility to be able to constantly clean the media in the filter, therefore prolonging the useful life of the filter media. The soluble activity abatement is achieved by passing the effluent though Submersible Caesium Removal Units (SCRU), containing 'IONSIV' ion-exchange cartridges which will remove the bulk of the soluble Cs-137 and Sr-90 activity in the effluent (along with other more minor contaminants). The SCRU units are stored underwater to provide shielding for the plant operators and the IONSIV cartridges will become Intermediate Level Waste at the end of their operational lives. A schematic of the MAETP is shown in Figure 6.1 (below).

In the upgraded system, several of the current waste water tanks will be replaced with a Replacement Miscellaneous Receiving Tank (RMRT). In addition, various final delay tanks have already been replaced by a Replacement Delay Tank (RDT). Miscellaneous waste water from drains, showers or sinks etc. from radiation/contamination controlled areas is collected, treated by the AETP (MAETP in the future) and pumped to the RDT to be discharged to the Firth of Clyde. Waste water from the CCP building, the Pond Purge Sump (PPS) and the RMRT will also be treated via these routes. Water from CCP can currently be re-circulated through the MAETP system (and back to the CCP), for decontamination, to remove both the suspended and soluble activity, but not for discharge. Once CCP water activities have been reduced to a predetermined level, and other decommissioning activities completed, the CCP water will pumped to the RDT for final discharge (once agreed by SEPA) – this will constitute CCP de-watering.

Figure 6.1 Schematic of MAETP System



6.2.1.1 AETP (Miscellaneous Stream)

The Miscellaneous Receiving Tank (MRT) No. 1 receives effluent from the Charge Machine Maintenance Building (CMMB) and the Miscellaneous Sump. Effluent in the Misc. Sump comes from a variety of sources including: reactor buildings, pond building, SAWB, Health Physics Baseroom, Low Level Waste Processing Facility (LLWPF) and Skip Refurbishment Plant (SRP). MRT 1 is batch discharged via No. 2 Misc. sand filter to the RDT.

6.2.1.2 AETP (CCP Stream)

Prior to the operation of the Pond Water Treatment Plant (PWTP) this plant was used to process all purge flow from the CCP. Effluent from the CCP Purge Sump was routed to a Precipitator Tower for settling and the supernatant transferred, via the two CCP sand filters, to the CCP Delay Tanks. The settled sludge was transferred to the CCP Sludge Retention Tanks. Backwash from the CCP sand filters was passed to a CCP backwash Receiving Tank where, after settling, the supernatant was returned to the CCP purge sump, and the sludge pumped to the CCP Sludge Retention Tanks. Supernatant from these tanks was also returned for treatment via the CCP Purge Sump.

During the period of the current authorisation this plant has only been used for the processing of backwash from the PWTP sand filters. Backwashing is still done as and when required. The Precipitator Tower has been deplanted and removed from site; the CCP Delay Tanks have been moth-balled.

6.2.1.3 PWTP

During de-fuelling and early decommissioning the pond water quality was maintained by a purge flow of demineralised water, with chemical dosing, the effluent from the pond being passed to the CCP Pond Delay Tanks via two PWTP sand filters.

During operation two Caesium Removal Units (CRUs), containing ion exchange material, were available for use when required to maintain Caesium levels in the pond within agreed limits. The CRUs were only used for a very short period in the 1980's then taken out of service when the levels of Caesium in the pond fell to a point where the CRU operation was not necessary.

The original CRU systems, although still in place, is over 20 years old, the availability of the resin and potential plant modification and operational issues means that it does not present a suitable alternative to the MAETP.

6.2.1.4 Modifications to the Liquid Effluent Treatment Plant

As a result of the changed demands on the effluent treatment plants following de-fuelling, and to provide optimum performance during decommissioning, various modifications were made to the AETP and its mode of operation. The modifications carried out to ensure that all radioactive liquid effluent streams were subject to filtration to minimise discharges and that suitable procedures for isolation, sampling and approval for discharge of liquid effluent batches were followed to comply with RSA/W/21043.

The AETP, in its modified form will continue to operate and interface with the RDT (currently in operation) and the RMRT (currently in commissioning stage). Once the MAETP is adopted as the active effluent treatment plant for the site the RMRT and RDT will interface with it rather than the AETP. A staged withdrawal and management system will then be implemented, to ensure that the AETP is correctly monitored and maintained (if necessary) until it can be fully decommissioned.

The decontamination and decommissioning of both the current plant, and newly installed plant/systems, is to be completed following the programme shown in Table 2.1.

6.2.1.5 Monitoring and Discharge from Replacement Delay Tank

Discharge of active liquid effluent occurs only via the RDT. Batches of effluent collected in the RDT are isolated (once the tank is full); the tank is re-circulated for a set period of time (to homogenise the contents) and sampled. Analysis of the contents is carried out in accordance with site procedures and on approval; the contents of the tank are discharged, via the Hunterston B cooling water outfall, to the Firth of Clyde, on an ebbing tide. This is a manual operation carried out by Hunterston A Operations staff in liaison with the Hunterston B Operations staff at optimum tide conditions. Current arrangements state that optimum discharge conditions are from one hour after high tide to one before low tide. Under the new authorisation procedures will adjusted to start the discharge one hour after high tide and end the discharge four hours after the high tide. During discharge the effluent is continuously sampled by means of a volume proportional sampler. The results from the analysis (of the post-discharge sample) are used to determine the radioactive discharge in accordance with the terms of the authorisation. These figures are used to collate the monthly liquid discharge reports for SEPA.

The operations are conducted within a strict management system combining the various relevant site MCPs. The Site's quality management system and environmental management arrangements are subject to regular internal and external audits. They are based on BS EN ISO 9001:2000 and BS EN ISO 14001:2004 respectively.

6.3 Solid Radioactive Waste Disposals

6.3.1 Activity Determination

In order to overcome the inherent difficulties in providing detailed data concerning the radionuclide content of solid waste, the concept and use of "fingerprints" is employed at Hunterston A. Activity "fingerprints" have been established for each of the representative low level waste streams produced on the site (see tables A5.2 to 5.4 in Appendix E, and Reference 23). The approach assumes that the radionuclide inventory of the waste can be assessed from measurement of gamma emitting radionuclides and knowledge of the ratios of these to other non-gamma emitting radionuclides. As compactable LLW is segregated into individual waste streams only one "fingerprint" is applicable per drum. This enables the determination of radioactivity to be assessed from measurements of certain gamma activities within the waste. Appropriate fingerprints for the waste streams have been determined in agreement with the management of the licensed facility.

For large items, i.e. those that are too large to be drummed, the activity is assessed from direct measurements of surface contamination or from a comparison of dose rates at various distances. Knowledge of dose rates, contamination probe measurements, gamma spectrometry of swabs, dimensions and weight of the object, the origin of the waste and the appropriate fingerprint are employed to determine isotopic activities that are not measured directly. The most suitable measurement techniques are discussed with a suitably qualified expert prior to the characterisation exercise to ensure that the activity assessment utilises 'best practicable means'.

Non-compactable wastes are monitored at source, bagged and transferred to designated loading areas for loading into HHISOs. Records are kept of where the waste came from, its monitoring results and which HHISO it was loaded into according to site arrangements.

The proposed new limits for annual discharges were determined by reviewing the recent LLW history and looking at the forward decommissioning programme. Using the same approach as used for gaseous and liquid discharges the mean plus three standard deviations were calculated for the waste volume and activity. In addition the annual waste volume from 2007 to the end of C&MP was taken from the LTP07 detailed volumes via the Waste Accountancy Template (WAT) from the IWS. This was used, in conjunction with the Hunterston A LLW Characterisation document (Reference 23), to estimate the peak activity per nuclide for each year. The maximum values from this method and the mean plus 3 standard deviation results were used to estimate the proposed new limits for solid LLW, as detailed in Section 4.

7 ENVIRONMENTAL IMPACT ASSESSMENT

7.1 Location

The Hunterston A Site is situated in the District of North Ayrshire Scotland.

The Hunterston peninsula is bounded by the A78 trunk road to the east and includes Goldenberry Hill to the south of the Site. To the east there is a low bridge running north/south parallel to the A78 and forming a visual barrier and watershed with the inland area which, to the east of the road rises steeply to the terraces of the Renfrew Scarp. The Burn Gill rises in Goldenberry Hill and flows to the east before turning north to flow into the Clyde estuary.

Approximately 0.75km north east is Hunterston House, which is the nearest residence. Immediately north of the BEGL Hunterston B power station there is an area of low-lying ground which is used as pasture. Beyond this at 1.5 km is a facility, built on reclaimed land, which was used for the construction of oil and gas production rigs. This land is currently essentially unused. Further to the north is the deep water jetty operated by Clydeport Operations Ltd for handling coal and bulk cargoes.

To the south and south east the Site is bounded by Goldenberry Farm and the Hunterston Estate, whilst the small settlement at Portencross lies approximately 2.5km down the coast on the peninsula. A public footpath to Portencross runs via the station access road along the NSL boundary and down to the coast.

To the east and north west across the Clyde estuary lie the islands of Little Cumbrae and Great Cumbrae. The town of Millport is located in a south facing bay at the south end of Great Cumbrae. A ferry runs between Largs and Great Cumbrae.

7.2 Existing Land Ownership

The Nuclear Decommissioning Authority (NDA) owns land comprising some 36 hectares (15 hectares of which are within the Nuclear Site License boundary) at Hunterston 'A'. The access from the A78 to the northernmost limit of the Hunterston A site is owned by BEGL with access rights granted to Magnox Electric Ltd or its successors, whilst the remainder of the road is owned by Magnox Electric Ltd with access rights to the cooling water inlet jetty granted to BEGL.

7.3 Designated Areas

The regional designated areas for Ayrshire, Inverclyde, Argyll & Bute and Renfrewshire, are summarised in the following table:

Local Authority	No. SSSI	No. SAC	No. SPA	No. Ramsar	No. HGDL	No. NSA	No. NP	No. CP	No. LNR	No. NNR
Argyll & Bute	116	26	16	8	19	7	0	0	1	8
E. Ayrshire	16	1	1	0	3	0	0	1	0	0
Inverclyde	4	0	0	0	2	0	0	0	1	0
N. Ayrshire	28	3	1	0	3	1	0	2	1	1
Renfrewshire	7	0	1	0	1	0	0	3	2	0
S.Ayrshire	31	1	1	0	8	0	0	1	0	0

SSSI - Site of Special Scientific Interest, SAC – Special Areas of Conservation, SPA – Special Protection Area, Ramsar – Wetlands of International Importance, HGDL – Historic Gardens and Designated Landscapes, NSA- National Scenic Areas, CP- Country Parks, NP - National Parks, LNR – Local Nature Reserves, National Nature Reserves. The data is taken from the Scottish Natural Heritage (SNH) Facts and Figures 2003/2004

Note, only those of particular importance to Hunterston A Site are discussed below.

There are no designated areas within the perimeter of the Hunterston A site. There are however a number of SSSIs within 10 km of Hunterston A. These are described in the North Coast and Cumbrae Area Local Plan.

Close to the site is Portencross Coast SSSI comprising the coastline running past the site from Fairlie to the pier at Portencross, which incorporate the Southannan and Hunterston sands. The majority of the site consists of coastline mudflats with mainland incursion at Goldenberry Hill which includes a transition to wooded cliffs. The intertidal areas are of great regional importance for wildfowl and waders as one of only three such areas between Stranraer and Greenock. Hunterston sands also support a diverse flora of salt marsh species.

There are two SSSIs on Great Cumbrae Island. Ballochmartin Bay is the most varied rocky coast on Cumbrae and a notable site for otters. It, and Kames Bay at Millport, have been intensively studied and are important teaching sites for the study of intertidal marine biology.

Within 10km of the power station there are also eleven mainland and seven island Wildlife Sites. Designated by the Scottish Wildlife Trust and included within the Local Plan for the purposes of their conservation and protection.

Horse Isle, a rocky outcrop in the coastal waters about 2 km west of Ardrossan and 10km south of the Hunterston 'A' site is designated as a National Nature Reserve.

7.4 Land Use and Development Constraints

The landscape around the site is rural. Agriculture is the principal land use on the Hunterston Peninsula. The dominant agricultural activity is grazing of cattle (for milk and beef) and sheep, but some barley and potatoes are grown.

There is commercial fishing and crustacean collection undertaken in the area from Campbeltown to Ayr, and there are also a number of fish farms and shellfish farms on the west coast of Scotland.

There will be no adverse change to the impacts of ongoing discharges on these areas as a result of the proposed new limits which are in general lower than the current limits.

7.5 Environmental Monitoring

7.5.1 Environmental Monitoring Programme

Magnox North Ltd carries out an extensive programme of environmental monitoring around its nuclear sites in order to assess the quantities of wastes released to the environment and demonstrate compliance with the authorisations issued under the RSA93. The monitoring programme at Hunterston A was in place during the operation of the station and decommissioning to date, and will continue to completion of FSC. In addition, an extensive independent programme of environmental monitoring is carried out, with data published by the Centre for Environment, Fisheries and Agriculture Sciences (CEFAS) on behalf of the Environment Agency, Environment & Heritage Service, Food Standards Agency and SEPA in annual Radiation in Food and the Environment (RIFE) reports (e.g. Reference 26).

Measurements, such as gross beta activity and gamma spectrometry of environmental samples, taken from within the site boundary, are undertaken in the site's own laboratories. Radiochemical analysis and gamma spectrometry for environmental samples, from beyond the site boundary, are undertaken by BEGL Hunterston B on behalf of Hunterston A. No change in these arrangements will be undertaken without the agreement of the Regulator, however it is expected that the site will need to develop certain aspects of the 'district survey' program to meet the requirements of the 'multi-media' authorization. Further work is required to identify and develop the necessary changes.

The data given in the tables in the following sections are taken from the Company Annual Reports of Discharges and Monitoring of the Environment (e.g. Reference 18) and supplemented with data from the routine reports to SEPA in compliance with the Aerial and Marine Discharge Authorisations.

7.5.2 Terrestrial Environmental Monitoring

7.5.2.1 Milk Radioactivity Concentrations

Over the period of the current gaseous discharge authorisation milk samples from up to 6 farms, within 6 km of Hunterston A, have been analysed quarterly for Tritium and Caesium 137, although the latter will decay significantly in the period post generation and therefore will become inappropriate for future measurement. These measurements are supplemented by the more detailed radiochemical analysis of quarterly bulked samples from up to 2 farms within 3km of Hunterston A (inner zone) and up to 4 farms within 3 and 6km (outer zone).

The mean annual activities in inner and outer zone farms for these radionuclides over the last 8 years are shown in Tables 7.1 and 7.2. For most of the period of interest the Tritium concentrations in milk from the inner and outer zone farms are essentially the same and have remained constant at less than 20 Bq/l. The levels of Carbon-14, Sulphur 35 and Strontium 90 in milk are no longer relevant for Hunterston A and are not included in Table 7.1 and 7.2.

The Caesium-137 milk concentrations, from the inner and outer zone farms, are not significantly different and show a general decreasing trend over the period. Comparatively high concentrations of Caesium-137 were measured between 1986 and 1990, which may well have been associated with the Chernobyl reactor incident in mid 1986.

Table 7.1 Average Activities in Inner Farm Milk (0-3 km from Hunterston) from Hunterston B surveys

Year	12 Tritium (Bq/l)	Caesium-137 (Bq/l)
2000	<20	0.22
2001	<20	0.12
2002	<20	0.05
2003	<20	0.07
2004	<20	0.07
2005	<20	0.11
2006	<20	0.13
2007	<20	0.10

Table 7.2 Average Activities in Outer Farm Milk (3-6 km from Hunterston) from Hunterston B surveys

Year	13 Tritium (Bq/l)	Caesium-137 (Bq/l)
2000	<20	0.12
2001	<20	0.26
2002	<20	0.13
2003	<20	0.14
2004	<20	0.19
2005	<20	0.12
2006	<20	0.11
2007	<20	0.10

Note, environmental monitoring done by Hunterston B covers both stations and provides information on the level of Sulphur-35 and Iodine-131 in monthly milk samples. However, since these are short half-life nuclides, and it is a long time since Hunterston A generated power, they could not originate from Hunterston A, and so are not reported here.

7.5.2.2 Green Vegetable Radioactivity Concentrations

Locally grown grass is taken from the inner and outer milk farms for Hunterston. These samples are currently analysed for Sulphur-35 and Caesium 137. However, as explained in Section 7.5.2.1 the former is no longer relevant for Hunterston A post generation due to its relatively short half-life. As with milk samples this analysis is part of programmed quarterly surveys. Annual average activity levels for the identified radionuclides for locally grown grass are given in Table 7.3.

Table 7.3 Activities Reported in Local Grass from Farms

14 Year	Caesium-137 (Bq/kg dry weight)
2001(Inner)	5.1
2001(Outer)	1.9
2002(Inner)	0.69
2002(Outer)	1.5
2003(Inner)	0.28
2003(Outer)	0.36
2004(Inner)	1.1
2004(Outer)	0.8
2005*1	0.32
2006*2	0.29
2007*3	0.23

Taken from Table 38, 39 or 41 of "Discharge and Monitoring of the Environment in the UK" Company annual reports from 2001 to 2004.
Note *1: Data taken from RIFE 11
Note *2: Data taken from RIFE 12
Note *3: Data taken from RIFE 13 (Refs 26 -28)

Table 7.3 shows that the Cs137 has reduced significantly since 2001 and appears to be leveling out below 1Bq/kg.

7.5.2.3 Terrestrial Pathways Doses

The annual critical group doses in recent years for the milk, green vegetables, other pathways and totals as reported in the Company Annual Discharges and Monitoring of the Environment reports (e.g. Reference 18), are shown in Tables 7.4 and 7.5. Over this period the annual critical group dose for the milk pathway has ranged from 0.3 to 25μSv for an infant, 0.3 to 5.2 μSv for a child, and 0.1 to 2.9 μSv for an adult, based on milk from the inner zone farms.

Assessed annual doses for the local vegetable pathway have been less variable when compared with the milk pathway and for an adult have ranged from less than 0.4 to 1.4 μSv. Annual doses for this pathway for an infant and child were essentially the same at 0.1 to 0.4 μSv and 0.2 to 0.5 μSv respectively, hence generally lower than that for adults.

Table 7.4 Critical Group Doses (μSv) for Milk and Vegetable Pathways as Reported in the Company Annual Reports of Radioactive Discharges and Monitoring of the Environment

1.1.1.1.1.1	Milk			Green Vegetable		
	Infant	Child	Adult	Infant	Child	Adult
2001	25	-	2.9	-	-	0.57
2002	0.33-24	0.078-5.2	2.1-2.2	0.41	0.48	1.0
2003	0.80	0.42	0.49	0.086	0.16	0.44
2004	0.67	0.34	0.09	0.26	0.5	1.4

Table 7.5 Critical Group Doses (μSv) for Other Terrestrial Pathways as Reported in the Company Annual Reports of Radioactive Discharges and Monitoring of the Environment

1.1.1.1.1.1	Other pathways			Total		
	Infant	Child	Adult	Infant	Child	Adult
2001	-	-	0.3	-	-	3.8
2002	2.4	0.57	0.33	0.33-26	0.078-6.2	2.1-3.6
2003	0.089	0.058	0.093	0.89-0.97	0.58-0.64	0.93-1.0
2004	0.093	0.083	0.14	0.93-1.0	0.83-0.9	1.4-1.6

These results were taken from tables 46 to 53 of annual reports.

The measured critical group total annual dose for an infant, child and adult for all terrestrial dose pathways has ranged from 0.3 to 26 μSv, 0.1 to 6.2 μSv and 0.9 to 3.8 μSv respectively.

7.5.2.4 Comparison of Terrestrial Pathway Doses by Modelling & Environmental Monitoring

In 1997 and 2002 the consequences of gaseous discharges on the environment, plus UK and European population were modelled centrally by the Company for the RSA93 authorisation (Reference 19, 21 and 29) and for the Hunterston A Article 37 submissions (Reference 30) respectively. The Company also models the consequences retrospectively (Reference 25) in the vicinity of all Magnox sites. These models were based on Company computer programs, specified in the references, and/or proprietary computer programs such as PC-CREAM.

It is Hunterston A's intention to develop its own PC-CREAM model to predict the consequences of gaseous discharges. However, a model is not yet available and as such a comparison cannot be made of monitored and reported terrestrial pathway doses and models other than those already reported in the above references.

7.5.3 Marine Environmental Monitoring

7.5.3.1 Seafood Radioactivity Concentrations

Samples of lobster, prawn, winkle and fish (cod, plaice and mixed species) obtained from local fisherman, on a quarterly basis, when available, have been analysed for total beta and Caesium-137 activities. The annual average seafood activities from 2000 to 2007 are given in Tables 7.6 and 7.7. No particular trends for Strontium-90 activity in seafoods are evident with Hunterston A discharges. Both Caesium-134 and Caesium-137 seafood concentrations have decreased significantly since the 1980s, following a steady decrease in both Hunterston A and Hunterston B caesium-137 discharges (e.g. Reference 18). Hunterston B discharges are up to 5 magnitudes higher than those for Hunterston A (Reference 26). Also, the results do not take into account possible contribution from Hunterston B, Sellafield, Dounreay and Ministry of Defence (MOD) establishments to activities in the Firth of Clyde.

Table 7.6 Activities Reported in Fish and Lobsters/Prawns

Year	Fish		Lobster/Prawn	
	Total Beta (Bq/g wet weight)	Caesium-137 (Bq/g wet weight)	Total Beta (Bq/g wet weight)	Caesium-137 (Bq/g wet weight)
2000	0.084	0.0013	0.05	0.001
2001	0.08	0.002	0.074	0.001
2002	N/R	N/R	N/R	N/R
2003	0.091	0.002	0.034	0.001
2004	0.088	0.001	0.102	0.001
2005	0.090	0.001	0.005	0.000
2006	0.096	0.002	0.083	0.001
2007	0.100	0.001	0.089	0.001

N/R – Not Recorded.

Table 7.7 Activities Reported in Winkles

Year	Total Beta (Bq/g wet weight)	Caesium-137 (Bq/g wet weight)
2000	0.016	0.001
2001	0.019	0.001
2002	0.044	0.001
2003	0.076	0.003
2004	0.145	0.001
2005	0.078	0.005
2006	0.112	0.001
2007	0.200	0.001

These results were taken from the quarterly reported values for Hunterston A from the Hunterston B environmental monitoring.

7.5.3.2 Indicator Radioactivity Concentrations

Samples of seaweed from up to 12 locations are taken quarterly. Total beta and gamma analysis is undertaken and reported. There are no sediment samples taken for Hunterston A Site, but are recorded for Hunterston B Power Station. The annual average activities in seaweed over the last 5 years are given in Table 7.8. Caesium-137 activities in seaweed are shown to be generally constant over this period. Hunterston A Site Caesium discharges have generally decreased over this period. Also, this does not take into account contributions from Hunterston B Power Station, Sellafield, Dounreay and MOD discharges in the Firth of Clyde.

Periodic movements of foreshore silts within the Firth of Clyde may also be factor contributing to variation in the sediment activity concentrations reported by Hunterston B.

Table 7.8 Average Activities in Seaweed from Quarterly Reports

Year	Total Beta (Bq/g wet weight)	Caesium-137 (Bq/g wet weight)
2000	0.1718	0.0017
2001	0.1727	0.0011
2002	0.1878	0.0012
2003	0.2255	0.0012
2004	0.2185	0.0012
2005	0.1927	0.0010
2006	0.1877	0.0012
2007	0.1365	0.0223

7.5.3.3 Foreshore Gamma Dose Rates

Gamma dose rates are measured at three vicinities close to the Site on a quarterly basis. These are reported to SEPA. The annual average gamma dose rates, based on the quarterly reported data to SEPA, inclusive of the natural background (0.060 μGy/h Table 44 Reference 18), are given in Table 7.9.

In recent years there has been little change in foreshore dose rates at these locations and averaged at around 0.09 μGy/h, hence only slightly higher than natural background.

Table 7.9 Beach Gamma Dose Rates

Year	External Gamma Average Dose Rate (µGy/h)		
	Little Brigurd	Burnfoot	Ardneil Bay
2000	0.095	0.088	0.095
2001	0.327	0.340	0.350
2002	0.085	0.09	0.088
2003	0.093	0.085	0.088
2004	0.093	0.085	0.085
2005	0.093	0.093	0.085
2006	0.090	0.100	0.090
2007	0.090	0.090	0.085

7.5.3.4 Marine Pathway Dose

The measured annual critical group doses for the consumption of seafood and the external doses from aquatic discharges are reported in the Company Annual Reports on Discharges and Monitoring of the Environment (Reference 18) from 2001 to 2004 are shown in Table 7.10. Over this period the doses from the consumption of seafood, and other pathways, have been generally stable and in the range 0.1 to 8.4 µSv. The Hunterston A Site external exposure figures between 2001 and 2003 include a contribution for exposure over mud and sand from Hunterston B Power Station.

The 2004 annual report differentiates between 3.2 µSv for external exposure for Hunterston A and 31 µSv for the exposure over sand and mud for Hunterston B. These exposures, however, do appear to be stable at 30 µSv overall.

Table 7.10 Marine Pathway Annual Critical Adult Group Doses from the consumption of seafood by pathway and External Exposure (µSv)

Year	Fish	Crustaceans	Molluscs	Other Pathways	Total	External Exposure from aquatic discharges
2001	3.5-4.9	0.4-2.7	0.072	0.4-0.8	4.3-8.4	22*
2002	0.47-2.8	0.75	0.056-0.14	0.37	1.3-4.0	29*
2003	<2	<0.9	<0.06	0.27	<3	29*
2004	0.4-2.0	<0.86	<0.079	0.29	0.4-3.2	3.2

* This is a measure of Hunterston A & B external exposures

7.6 Public Radiation Exposure Limits

The International Commission for Radiological Protection (ICRP) is the international body which recommends radiation dose limits. ICRP bases its recommendations on dose limitation for workers (persons occupationally exposed to ionising radiation) and for the general public upon its assessment of the relationship between dose and the risk of harm to the person. The underlying principle is that all radiation doses should be reduced to a level that is As Low As Reasonably Achievable (ALARA), economic and social factors being taken into account, and below the recommended dose limits. In the UK, ALARP is considered to be effectively synonymous with ALARA.

For the management of radioactive wastes, Government dose objectives were given in the "Review of Radioactive Waste Management Policy: Final Conclusions" (Cm 2919) now reflected in the Ionising Radiations Regulations 1999. These specify that:

> "....the dose to members of the public....from all manmade sources of radioactivity other than medical exposure....should be limited to 1 mSv in a year."

In Cm 2919 the Government accepted the additional application of:

> "....a maximum constraint value of 0.3 $mSv.y^{-1}$ when determining applications for discharge authorisations from a single new source, defined as 'a facility, or group of facilities, which can be optimised as an integral whole in terms of radioactive waste disposals'."

The Government also accepted in Cm 2919 HPA advice that:

> "....in general, it should be possible for existing facilities to be operated within a dose constraint of 0.3 $mSv.y^{-1}$. However, it (HPA) recognized that in some cases a realistic assessment of doses might suggest that the facility could not be operated within this figure. In these cases it (HPA) believed that the operator must demonstrate that the doses resulting from the continued operation of the facility were as low as reasonably achievable and within dose limits."

This was included in "The Radioactive Substances (Basic Safety Standards) (Scotland) Direction 2000".

As will be seen from sections 7.6.1 and 7.6.2 the total dose to any member of the public from the gaseous and liquid discharges at the Hunterston A is estimated as 5.57 µSv/y for the current limits and 0.98 µSv/y for the proposed limits, hence significantly lower than the maximum dose constraint of 0.3 mSv/y that would apply to a new single source.

7.6.1 Calculated Individual Doses due to Aerial Discharges

In Section 4 it was argued that, although BPM would continue to be used to minimise radioactive discharges from the site, there would be a continuing requirement for aerial discharges. Table 4.3 gave the estimated annual discharge limits. For convenience these requirements are reproduced in Table 7.11.

The annual doses to the most exposed group of individuals in the vicinity of Hunterston A resulting from annual discharges at these levels have been derived from the dose assessments for indicative annual discharges.

The doses to the members of the critical groups from the gaseous discharges at the limits proposed by the Company for the authorisations are estimated to be 0.258 µSv/y for the current authorisation and also for the proposed new authorisation. See Table 7.11 for the individual and total doses from gaseous discharges.

Table 7.11 Annual Adult Critical Group Dose for Gaseous Discharges at Current Limits (RSA/W/21044) and at proposed new limits

Nuclide	Annual Discharge Limit	Dose, µSv/y
Carbon 14	2 GBq	0.015
Tritium (H-3)	20 GBq	0.003
Beta Particulate	60 MBq	0.24
Total Dose		0.258

This assumes that the gaseous discharge fingerprint is unchanged and apportioning the doses for the changes in activity.

The basis of the dose calculations is described in Appendix E. Collective dose estimates for gaseous discharges for the UK and European populations are given in section 7.6.3.

7.6.2 Calculated Individual Doses due to Aqueous Discharges

In Section 4 it was argued that, although BPM would continue to be used to minimise radioactive discharges from the site, there would be a continuing requirement for aqueous discharges. Table 4.5 gave the estimated annual discharge limits. The basis for the dose calculations is described in Appendix E.

The doses to the members of the critical groups from the liquid discharges at the limits proposed by the Company for the authorisations are estimated to be 5.41 µSv/y for the current authorisation and also for the proposed new authorisation. See Table 7.12 for the individual and total doses from liquid discharges. It should be noted that the radioactivity in the Firth of Clyde is dominated by activity from Sellafield, Dounreay and Hunterston B.

Table 7.12 Annual Adult Critical Group Dose for Liquid Discharges at Current Limits (RSA/W/21043) and at Proposed New Limits

Nuclide	Annual Discharge Limit	Dose, µSv/y
Tritium (H-3)	700 GBq	0.000061
Pu-241	1000 GBq	1.93
Total Alpha	40 GBq	2.71
Total Beta	600 GBq	0.77
Total Dose		5.41

This assumes that the liquid effluent fingerprint is the same and apportioning the doses for the changes in activity.

Collective dose estimates for liquid discharges for the UK and European populations are given in section 7.6.4.

7.6.3 Calculated Collective Doses due to Aerial Discharges

Collective doses are calculated based on discharges at the proposed limit and truncated at 500 years. The calculated Collective Dose of the UK population is 8.45×10^{-4} man-Sv from gaseous discharges for the current authorisation and also for the proposed new authorisation (see Table 7.13). The corresponding figures for the European population are 4.96×10^{-3} man-Sv from gaseous discharges for the current authorisation and also for the proposed new authorisation (see Table 7.14).

Table 7.13 Calculated Collective Doses (man-Sv) to UK Population from one year's Aerial Discharges at Proposed Limits

Nuclide	Current Limits (also the Proposed New Limits)	
	Discharge	Dose man-Sv
Carbon 14	2 GBq	4.8E-4
Tritium (H-3)	20 GBq	16.6E-6
Beta Particulate	60 MBq	3.48E-4
Total Dose		8.45E-4

(using dose factors from Reference 25).

Table 7.14 Calculated Collective Doses (man-Sv) to European Population from one year's Aerial Discharges at Proposed Limits

Nuclide	Current Limits (also the Proposed New Limits)	
	Discharge	Dose man-Sv
Carbon 14	2 GBq	4.40E-3
Tritium (H-3)	20 GBq	4.20E-5
Beta Particulate	60 MBq	5.16E-4
Total Dose		4.96E-3

(using dose factors from Reference 25).

7.6.4 Calculated Collective Doses due to Aqueous Discharges

Collective doses are calculated based on discharges at the proposed limit and truncated at 500 years. The calculated Collective Dose of the UK population is 1.08 x 10^{-2} man-Sv from liquid discharges for the current authorisation and also for the proposed new authorisation (see table 7.15). The corresponding figures for the European population are 3.73 x 10^{-2} man-Sv from liquid discharges for the current authorisation and also for the proposed new authorisation (see Table 7.16).

Table 7.15 Calculated Collective Doses (man-Sv) to UK Population from one year's Aqueous Discharges at Proposed Limits

Nuclide	Current Limits (also the Proposed New Limits)	
	Discharge	Dose man-Sv
Tritium (H-3)	700 GBq	0.308E-6
Pu-241	1000 GBq	2.8E-3
Total Alpha	40 GBq	7.6E-3
Total Beta	600 GBq	3.9E-4
Total Dose		1.08E-2

(using dose factors from Reference 25).

Table 7.16 Calculated Collective Doses (man-Sv) to European Population from one year's Aqueous Discharges at Proposed Limits

Nuclide	Current Limits (also the Proposed New Limits)	
	Discharge	Dose man-Sv
Tritium (H-3)	700 GBq	1.4E-6
Pu-241	1000 GBq	7.5E-3
Total Alpha	40 GBq	2.88E-2
Total Beta	600 GBq	1.02E-3
Total Dose		3.73E-2

(using dose factors from Reference 25)

7.6.5 Environmental Impact and Transport Issues

The doses to members of the public from all operations involved in the collection, packaging and transport of LLW from Hunterston A are indiscernible from natural background radiation.

The solid LLW will be transported to a suitably licensed facility by road in full compliance with the requirements of the applicable Transport Regulations.

Due to the low external dose rates from the transport packages the envisaged radiological impact from the transport is estimated to be very low. The Transport Index will not exceed 10 and is expected in most cases to be much lower than this value.

In addition, the Health Protection Agency (formerly the National Radiological Protection Board) studies for the Department for Transport states: "Doses to members of the public from the transport of radioactive material tends to be very low. Estimates of maximum individual doses are less that 20 μSv per year." This is estimated on the basis that "individual annual dose to a member of the public living in a building 5m from a set of traffic lights, where a lorry carrying a maximum load of technetium generators and radioisotopes pass each week is less that 20 μSv. This is likely to be the maximum individual dose arising from the road transport of radioactive materials. These maximum estimates do no take account of building shielding and continuous occupancy is assumed. The actual doses are likely to be at least an order of magnitude lower."

Transport of radioactive material therefore gives rise to very small doses and waste is only a small proportion of the material transported. For Hunterston A HHISOs with "standard" LLW the contact dose rate at the surface of the HHISO is nominally 2 μSv/hr and will drop to less than 2 μSv/hr with distance from the containers. The surface contact dose rate ranges from less than 2 μSv/hr to a maximum of 350 μSv/hr at the side of a container and a maximum of 500 μSv/hr at the base of a container. The maximum dose rate drops to 85 μSv/hr at 1m, and 30 μSv/hr at 2m (i.e. less that 1/3 of the maximum of 100 μSv/hr at 2m from the Company Radiological Safety Rules). It is estimated that the dose to an individual from passing a consignment of LLW from Hunterston A will be less than 1.7μSv assuming the 100 μSv/hr dose rate at 2m and a minute transit time past the ISO transporter.

Notwithstanding these arguments it is against Government policy to store LLW that has an identified and approved disposal route.

The environmental impact of the disposal of waste by the following three shall be assessed by the RSA93 authorisations for the facilities receiving the waste:

- Incineration of organic wastes at
- HVVLLW disposal at a suitable land fill site.
- Smelting of segregated metallic LLW

8 CONCLUSIONS

Following closure of the reactors the site has moved into the 'Care & Maintenance Preparation' phase of decommissioning the site's facilities. This document shows that:

- The small detriment arising from the decommissioning of nuclear power stations must be set against the benefits to UK society of minimising the risk to the public, the employment provided by decommissioning work, the improvement in visual amenity and the eventual de-licensing of power station sites and the release of their land for alternative use.
- Strategies have been developed for decommissioning Hunterston A in accordance with current and developing Government Policy (e.g. Cm 2919, Cm 2860, Cm 5552 plus the NDA strategy which majors on reduction in liability). A wide range of decommissioning options have been examined leading to the development of strategies which provide a balance between public safety, safety of the workforce, detriment to the environment and costs. The current Company strategy is the deferred Safestore; however, this may change when the recently approved NDA strategy is addressed in the Hunterston A LTP.
- The removal of irradiated fuel from the Hunterston A reactors and its dispatch to Sellafield reduced the on-site radioactivity by about 99% of that during electricity generation.
- Decommissioning work is being carried out in accordance with the requirements of approved safety cases.
- Programmed work includes the processing of operational ILW as appropriate into a passive form that will be stored in an on-site interim ILW store, awaiting final disposal in accordance with Government Policy. The LTP is agreed with the NII, SEPA and the NDA and are readily available on Company and NDA websites.
- Decommissioning work will produce quantities of liquid and gaseous radioactive waste which require to be discharged to the Clyde estuary or atmosphere respectively; solid LLW that requires to be transferred to a suitably licensed facility for long term storage, and combustible waste that requires to be transferred to an off-site incinerator for disposal. These discharges will be within authorisation limits proposed in the RSA93 application to SEPA.
- In making these discharges the Company will undertake BPEO studies to confirm appropriateness of the processes and equipment used to complete decommissioning projects and maintain the practice of adopting BPM to minimise the impact of the discharges and
- Careful dose management will maintain radiation exposures to the workforce and public at levels which can be shown to be ALARP and within regulatory limits.

Future aerial and liquid discharges and solid waste disposals have been determined from the proposed work programmes and the site's Lifetime Plan (LTP) for the reactors and other site facilities. The required waste discharge and disposal limits are given in the relevant document section. The best practicable environmental option (BPEO) for the safestore decommissioning strategy and best practicable means (BPM) for minimising radioactive discharges and waste disposals are discussed and radiological assessments of the gaseous and liquid discharges, at the required annual limits, have been made for the most exposed members of the public. The resulting radiation doses are less than the statutory annual dose limit of 1 mSv and the recommended annual Source Constraint of 0.3 mSv. A review of the terrestrial and marine dose pathways, assessed from radioactive analysis of environmental samples, have shown a general downward trend in recent years, reflecting the reduced annual gaseous discharges from site and liquid discharges from other previously British Nuclear Group Ltd sites and Magnox North Ltd sites.

See table 8.1 (below) for summary of proposed disposal routes:

Table 8.1 Proposed disposal routes.

Radioactive Waste Type	Disposal Route
Gaseous Waste	Discharge to the atmosphere
Aqueous Waste	Discharge to the Clyde Estuary
Organic Liquid Waste	Transfer to a suitably licensed facility for the purpose of incineration.
Solid Waste:	
Solid Low Level Waste (LLW)	Transfer of solid LLW to a suitably licensed facility for the purpose of disposal.
Solid High Volume Very Low Level Waste (HVVLLW)	Transfer of solid HVVLLW to a suitably licensed land-fill site for the purpose of disposal.
Solid Metallic Low Level Waste	Transfer of segregated metallic LLW to a suitably licensed facility for the purpose of smelting.

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GLOSSARY OF TECHNICAL TERMS

Activation products
Activation products are radionuclides produced by the interaction of neutrons with stable nuclides, for instance, cobalt-60 which is an isotope of cobalt.

Alpha activity
Radionuclides that decay by emitting an *alpha* particle. The latter consists of two protons and two neutrons.

ALARA (As Low as Reasonably Achievable)
Radiological doses from a source of exposure are *ALARA* when they are consistent with the relevant dose or target standard and have been reduced to a level that represents a balance between radiological and other factors, including social and economic factors. The level of protection may then be said to be optimised. In the UK the term ALARP, As Low as Reasonably Practicable, is used which is effectively synonymous with ALARA.

Authorisation
Authorisations are permission given by regulatory authority under the Radioactive Substances Act or Environmental Protection Act to dispose of respectively radioactive and non-radioactive waste, subject to conditions.

Becquerel (Bq)
The *Becquerel* is the internationally approved unit of radioactivity. A radionuclide decaying at a rate of one transition per second has an activity of 1 Bq. In practice this unit is so small that multiples of the unit are commonly used.

Beta-Particulates
Beta-Particulates are small particles of solid material containing radioactive isotopes that emit beta particles when they decay. A beta particle is an electron or positron.

BPEO (Best Practicable Environmental Option)
BPEO is a concept developed by the Royal Commission on Environmental Pollution. It implies that decisions on waste management have been based on an assessment of alternative options evaluated on the basis of factors such as the occupational and environmental impacts, the costs and social implications.

BPM (Best Practicable Means)
Within a particular waste management option, the *BPM* is that level of management and engineering control that minimises as far as practicable, the release of radioactivity to the environment whilst taking account of a wider range of factors including cost-effectiveness, technological status, operational safety, and social and environmental factors.

CEFAS
The Centre for Environment, Fisheries and Agriculture Science is a scientific research and advisory centre for fisheries management and environmental protection. It is an Agency of the UK Government's Department for Environment, Food and Rural Affairs (Defra). It was formed in 1997 from the Fisheries Research Laboratory of MAFF and its Lowestoft laboratory carries out habit surveys and monitoring of radioactivity in the environment on behalf of the Food Standards Agency.

Collective Dose
Collective Dose is the quantity obtained by summing the individual doses of the people in a population. It is measures in units of man-Sieverts.

Contamination Controlled Areas
Contaminated controlled areas are parts of the site's facilities where radiological conditions require protection against inhalation or ingestion of radioactive material.

Critical Group
The concept of the *Critical Group* is used to predict the maximum dose that a member of the local population could receive from exposure to a source of radioactivity. A series of conservative assumptions are made to describe the life-style of the critical group, including location, habits and diet. In practice, the conservative nature of these assumptions often means that it is unlikely that the critical group corresponds to any real member of the local population.

Dose
Dose is a measure of radiation received. In this document it is used primarily to mean the 'effective dose' received by members of critical groups. Effective dose is defined below:

Dose constraint
Dose constraint is a restriction on annual dose to an individual from a single source, applied at the design and planning stage of any activity in order to ensure that when aggregated with doses from all sources, excluding natural background and medical procedures, the dose limit is not exceeded.

Dose limit
For the purpose of discharge authorisations, the UK has (since 1986) applied a *dose limit* of 1 mSv (1000 μSv) per annum to members of the public from all man-made sources of radiation (other than medical exposure). This limit is now incorporated into UK law in the Basic Safety Standards Directive.

Effective dose
Effective dose is the sum of the equivalent doses in all tissues and organs of the body from internal and external radiation multiplied by the tissue weighting factor (e.g. skin = 0.01, thyroid = 0.05, red bone marrow = 0.12, gonads = 0.20). It allows the various equivalent doses in the body to be represented by a single number giving a broad indication of the detriment to the health of an individual from exposure to ionising radiation, regardless of the energy and type of radiation. For comparison with dose limits, the term takes on a specific meaning.

Fingerprint
The contaminated controlled areas, and wastes, have a characteristic mixture of radionuclides. These *fingerprints* define the radionuclides present and the ratio between the quantities of each radionuclide

Fission Product
Nuclear fission is the process in which a nucleus of an atom splits into two or smaller fragments (nuclei) and neutrons and energy is released. The isotopes produced, which are often unstable, are called *fission products*. Examples as Caesium 137 and Strontium 90.

Giga Becquerel (GBq)
The *GBq* is a thousand million times larger (10^9) than a Becquerel.

Graphite Moderator
The *graphite moderator* is the central part of the reactor system in which the graphite assembly slows down neutrons to allow the nuclear chain reaction to proceed. The nuclear fuel is inserted into the moderator and the fuel and moderator together form the reactor core.

Gray (Gy)
Gray is the SI unit of absorbed dose. This is the mean energy imparted by ionising radiation to matter in a given volume divided by the mass of the matter. Dose rates measured in the environment are usually expressed in the units of µGy, a millionth of a Gray.

Half-life
Half life is the time for the radioactivity of a radionuclide to decrease by radioactive decay to one half of its initial value. Half-lives range from fractions of a second to millions of years. The effective half-life in the human body of a quantity of ingested radioactivity is a function of the radioactive half-life and biokinetic behaviour.

Health Protection Agency (HPA)
HPA was formerly the National Radiological Protection Board. An independent statutory body set up by the Radiological Protection Act 1970 to advance the acquisition of knowledge about the protection of mankind from radiation hazards and to provide information and advice on matters relating to radiological protection and radiation hazards.

High Volume Very Low Level Waste (HVVLLW)
HVVLLW is solid waste with radioactivity concentrations not exceeding 4MBq/tonne for all radionuclides apart from Tritium, for which the concentration limit is 40 MBq/tonne.

Individual Dose
Individual dose distinguishes the radiation exposure of a single individual from the collective dose of the population.

Intermediate Level Waste (ILW)
ILW is waste with radioactivity levels exceeding the upper boundaries for low level waste and which requires special handling facilities or systems.

Ion-Exchange Units
Ion exchange units contain material which can remove soluble ions from water.

International Commission on Radiological Protection – (ICRP)
ICRP is an independent group of experts founded in 1928 which provides guidance on principles and criteria in the field of radiological protection. The recommendations are not legally binding, but are generally followed by the UK in legislation.

Ionising Radiation Regulations 1999 (IRR99)
The *IRR99* under the Health and safety at Work Act 1974 in part implement the European Basic Safety Standards Directive of 1996.

Low Level Waste (LLW)
LLW is waste containing levels of radioactivity greater than those acceptable for dustbin disposal but not exceeding 4 GBq per tonne of alpha-emitting radionuclides or 12 GBq per tonne of beta-emitting radionuclides.

Magnox
Magnox is a magnesium/aluminium alloy that is used in the manufacture of the canister for uranium fuel metal ('Magnox fuel') used in a type of nuclear reactor ('Magnox reactor').

Man Sievert (man-Sv)
The *man-Sievert* is the unit of collective effective dose, Collective dose is the quantity obtained by summing the individual doses of all the people in the population

Mega Becquerel (MGq)
The *MBq* is a million times larger (10^6) than a Becquerel. As an example, typically 200kg of super phosphate garden fertiliser contains 1 MBq of radioactivity from natural sources.

Micro Sievert
The *micro Sievert* (μSv) is one-millionth (10^{-6}) of a Sv. As an example, a typical chest X-ray gives a dose of about 20 μSv, and a flight in a jet aeroplane from the UK to Spain gives a dose of 10 μSv.

Milli Sievert (mSv)

The *mSv* is one-thousandth (10^{-3}) of a Sv.

Natural Background Radiation
Everyone is exposed to *natural background radiation* which includes cosmic rays from outer space; gamma rays from the ground, floor and walls; and radon gas seeping from the rocks and soil.

NII (Nuclear Installations Inspectorate)
The *NII* is part of the Health and Safety Executive. It is responsible for enforcing legislation relating to nuclear safety under the Nuclear Installations Act 1965.

Nuclear Fuel
The *nuclear fuel* in a Magnox reactor consists of metallic natural uranium sealed in Magnox alloy cans to form fuel elements.

Radiation
Radiation, in this context, refers to ionising radiation; this radiation may consist of subatomic particles or electromagnetic waves with sufficient energy to break chemical bonds.

Radioactivity
Radioactivity is the spontaneous disintegration of atomic nuclei. Radioactive substances or radiation they emit (e.g. alpha particles, beta particles, gamma rays). The rate of decay, measured in the standard international (SI) units, Becquerels (Bq) or their multiples or sub-multiples.

Radioactive Decay
Radioactive decay is the process whereby some atoms may change, usually by emitting ionising radiation, and eventually become non-radioactive. There are many naturally occurring materials that undergo radioactive decay, in addition to those that may be produced by man.

Radioactive Substances Act (RSA) 1960, 1993
RSA is the statutory legislation to control the keeping and use of radioactive substances and the accumulation discharge or disposal of radioactive waste.

Radioactive waste
Radioactive waste is material that contains radioactivity above the appropriate levels specified in the Radioactive Substances Act 1993 and which meets the definition of waste given in the Act.

Radionuclide
A *radionuclide* is a radioactive isotope of an element.

Ramsar
Ramsar is an inter-government treaty which provided the framework for national action and international co-operation for the conservation and use of wetlands and their resources, signed in Ramsar, Iran, 1971.

Sievert (Sv)
The *Sv* is the internationally approved unit of effective dose equivalent and is a measure of the degree of exposure to ionising radiation. It takes account of the harmfulness of different types of radiation. Frequently this unit is too large so that in practice fractions of the unit are commonly used.

Substances of Low Activity (SoLA)
The *SoLA* Exemption Order applies to solid waste that is insoluble in water and with radioactivity concentrations of less than 0.4 Bq/gram. SoLA also covers organic liquids containing C-14 and H-3 at concentrations of less than 4 Bq/litre.

Stack
A *stack* is a chimney through which gaseous discharges are directed. The discharge point is usually some way above the adjacent building and ground level and ensures that the discharges are dispersed effectively in the air.

Tera Becquerel (TBq)
The *TBq* is a million million times larger (10^{12}) than a Becquerel.

LIST OF ABBREVIATIONS AND ACRONYMS

AETP	Active Effluent Treatment Plant
ALARA	As Low As Reasonably Achievable
ALARP	As Low As Reasonably Practicable
BEGL	British Energy Generation Ltd
BNFL	British Nuclear Fuels plc
BNG	British Nuclear Group
BPEO	Best Practicable Environmental Option
BPM	Best Practicable Means
CCP	Cartridge Cooling Pond
Cm	Command – Government policy and other high level documents
C&M	Care and Maintenance (a quiescent decommissioning phase, 2017 to 2080)
C&MP	Care and Maintenance Preparation (decommissioning phase prior to C&M, up to 2016)
CP	Country Parks
DACR	Day Away Case Rate (OSHA statistic for industrial safety)
EC	European Commission
EH&S	Environment, Health and Safety
EHS&Q	Environment, Health, Safety and Quality
Euratom	European Atomic Energy Community
FSC	Final Site Clearance (decommissioning phase after C&M to de-license the Site, 2081 to 2090)
(g)	Gram, unit of mass
HEPA	High Efficiency Particulate Air
HGDL	Historic Gardens and Designated Landscapes
HSE	Health and Safety Executive
HSWA	Health and Safety at Work etc Act 1974
ISO	International Standards Organisation
IWS	Integrated Waste Strategy document in support of the LTP
(Kg)	Kilogram, 1000 grams
(l)	Litre, unit of liquid volume
LNR	Local Nature Reserves
LTP	Lifetime Plan, produced by each decommissioning site for the NDA
MAETP	Modular AETP
MAFF	Ministry of Agriculture Fisheries and Food
NDA	Nuclear Decommissioning Authority
NISR	Nuclear Industry Security Regulations 2003
Nirex	Nuclear Industry Radioactive waste Executive
NNR	National Nature Reserves
NP	National Parks
NSA	National Scenic Areas
OCNS	Office of Civil Nuclear Security
OSHA	United States Occupational Safety and Health Administration standard
OSPAR	Oslo and Paris Commission for the Protection of the Marine Environment of the North East Atlantic
PSR	Periodic Safety Review
QQR	Quinquennial Review

RDT	Replacement Delay Tank
REPPIR	Radiation Emergency Preparedness and Public Information Regulations 2001
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulation, 1995
RIFE	Radiation in Food and the Environment reports produced annually
RMRT	Replacement Miscellaneous Receiving Tank
RUP	Reference Unit Power, terminology used by WANO for power output of operating reactor
SAC	Special Area of Conservation
SEEP	Safety and Environmental Enhancement Plan
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage
SoLA	Substances of Low Activity
SPA	Special Protection Area
SSEB	South of Scotland Electricity Board
SSG	Site Stakeholder Group
SSSI	Site of Special Scientific Interest
TBuRD	Technical Baseline and Research and Development document in support of the LTP
TRIR	Total Recordable Injury Rate (OSHA statistic for industrial safety)
TWh	Tera Watt hours measure of electrical output for and operating reactor
UK	United Kingdom
UKEHSM	UK Environment, Health and Safety Manual (BNG Reference documents)
US	United States
WANO	World Association of Nuclear Operators
WAT	Waste Accountancy Template document in support of IWS

APPENDIX A - PRINCIPAL RADIONUCLIDES

Americium-241 (^{241}Am or Am-241)

Americium-241 is an activation product with a half-life of 432.75 years. Major decay is by alpha and gamma emission. It is found as contamination in the organic sludge of the current Site sewage treatment plant.

Argon-41 (^{41}Ar or Ar-41)

Argon-41 is a radioactive isotope of the chemically inert element argon. It is produced in an operating Magnox reactor from the neutron irradiation of air, and is present as a gas. Half-life of Argon is 1.8hours.

Carbon-14 (^{14}C or C-14)

Carbon-14 emits low energy beta radiation with a half-life of 5700 years. It occurs naturally in the environment, being produced by the action of cosmic rays on nitrogen in the upper atmosphere.

There are two production mechanisms for Carbon-14 in a nuclear reactor:-

- neutron irradiation of carbon, nitrogen and oxygen in the Carbon Dioxide (CO_2) coolant;
- neutron irradiation of carbon and nitrogen in the graphite.

As nuclear reactors age during operation, an increasing proportion of Carbon-14 comes from irradiation of the graphite moderator and the process of radiolytic corrosion releases Carbon-14 into the coolant. This is an accelerating process as the concentration of Carbon-14 in the graphite increases with core irradiation, and the rate of corrosion also increases slowly. Carbon-14 discharges therefore increased during operation. The majority of Carbon-14 produced in the coolant, or released to the coolant from the graphite, was discharged to atmosphere with the carbon dioxide coolant (mainly as $^{14}CO_2$). Residual amounts of Carbon-14 are still present within the reactor vessels at Hunterston A and it remains a limiting radionuclide for gaseous discharges and as particulate contamination in solid LLW, waste oils and sludge from the existing Site sewage treatment plant.

Although some Carbon-14 was present in liquid discharges during operation the quantity was small and Carbon-14 is not a significant radionuclide for liquid discharges during decommissioning.

Caesium-137 (^{137}Cs or Cs-137)

Caesium-137 is a fission product with a half-life of 30.17 years. Major decay is by beta emission. It was significant in discharges during normal operation and, like other fission products; small quantities were produced within the reactor. It is still found as contamination in the waste oils and sludge from the current Site sewage treatment plant.

Cobalt-60 (^{60}C0 or Co-60)
Cobalt-60 emits both beta and gamma radiation with a half-life of 5.27 years. Cobalt-60 is an activation product formed within various reactor components by the irradiation of cobalt, which is a common constituent of steels. Fuel components were the principal source and these account for the presence of Cobalt-60 in pond water. Cobalt-60 is also likely to be present in solid LLW the particulate contamination found in the waste oil.

Iron-55 (^{55}Fe or Fe-55)
Iron-55 is an activation product with a half-life of 2.735 years. Major decay is by electron capture (EC) and gamma emission. It was not significant in discharges during normal operation but, like other activation products, small quantities were produced within the reactor and is still found as contamination in the waste oils.

Iodine-129 (^{129}I or I-129)
Iodine-129 emits both beta and gamma radiation with a half-life of 1.569×10^7 years. It is a fission product and was not significant in discharges during normal operation. Like other fission products, small quantities were produced from uranium contamination within the reactor and there is also the possibility of occasional quantities of Iodine-129 in solid LLW.

Manganese-54 (^{54}Mn or Mn-54)
Manganese–54 is an activation product with a half-life of 312.3 days. Major decay is by electron capture (EC) and gamma emission. It was not significant in discharges during normal operation but, like other activation products, small quantities were produced within the reactor and it is found as contamination in the organic sludge of the current Site sewage treatment plant.

Plutonium -241 (^{241}Pu or Pu-241)
Plutonium-241 emits alpha and beta radiation with a half-life of 14.41 years. It is an activation product and was not significant in discharges during normal operation. Like other activation products, small quantities were produced from uranium contamination within the reactor and remains a significant radionuclide in pond water discharges.

Tritium (^{3}H or H-3)
Tritium is a radioactive isotope of hydrogen, emitting very low energy beta radiation with a half-life of 12.3 years. Small quantities occur naturally in the environment, being produced by the action of cosmic rays on the upper atmosphere.

The main source of tritium in Magnox power stations were ternary fission within the fuel, a process in which a heavy nucleus such as uranium splits into two large fragments plus a tritium nucleus. No practicable options were found for preventing tritium from leaving the fuel and entering the coolant during operation of the reactors. Another source of tritium in decommissioning is from neutron irradiation of lithium impurities in the graphite.

Over 99% of the tritium in the reactor coolant was removed as water vapour in the coolant dryers and then discharged to sea during operation. A small proportion was discharged to atmosphere with CO_2 coolant.

Beta emitting radionuclides associated with Particulate Matter
Radioactive particulate matter can become airborne in any area where radioactive materials are handled. It also occurs in atmospheric discharges of the reactor vessels. Most of the activity associated with particulate currently consists of activation products. Filtration on discharge routes to atmosphere minimises emissions.

Other beta activity
The other beta activity present in various forms of radioactive waste comprises both fission products and activation products. The fuel elements were the principal source of the beta activity in pond water and hence the activity that is discharged to sea.

Other beta-emitting radionuclides that are sometimes detected (or would be expected) in waste generated at a de-fuelled/decommissioning Magnox power station include: ^{45}Ca, ^{54}Mn, ^{55}Fe, ^{58}Co, ^{59}Ni, ^{65}Zn, ^{90}Sr, ^{90}Y, ^{106}Ru, ^{110m}Ag, ^{125}Sb, ^{129}I, $^{134,137}Cs$, ^{144}Ce, ^{147}Pm, $^{152,154,155}Eu$, ^{241}Pu

Measurements at Hunterston A and at other decommissioning Magnox power stations show that the majority of "other beta activity" discharged consists of ^{45}Ca, ^{54}Mn, ^{55}Fe, ^{90}Sr and ^{137}Cs

Alpha activity
The alpha activity consists of uranium and radionuclides arising from the activation of uranium (neptunium, plutonium, americium & curium). The fuel elements were the principal source of the alpha activity in pond water and hence the activity that is discharged to sea.

Other gaseous activity
In addition to the radionuclides discussed above, there are some other radionuclides that are discharged in gaseous form. These discharges are all of low radiological significance because they are discharged in small quantities, have short half-lives or are chemically inert.

APPENDIX B CONFIRMATION CONTRACTOR WILL ACCEPT COMBUSTIBLE WASTE FROM HUNTERSTON A` SITE FOR INCINERATION

VEOLIA
ENVIRONMENTAL SERVICES

Our Ref.: NG 241
Your Ref.:

Subject to Contract

Date: 28th March 2007

Miss Lynne E. McTaggart
British Nuclear Group
Magnox Electric Ltd
Hunterston A Decommissioning Site
West Kilbride
Ayrshire
Scotland
KA23 9RA

Dear Miss McTaggart,

Re: Radioactive Waste for Incineration at Veolia Environmental Services Fawley Incinerator – Authorisation No. AL5160/BZ6759

I can confirm that Veolia Environmental Services can accept 'in principal (up to our consent)' radioactive wastes that have been generated at the aforementioned address providing that the waste requires treatment by the principal activity of incineration and subsequent chemical treatment within the gas cleaning and effluent treatment plants.

Acceptance of the waste will be subject to:

1. Agreement by the Environment Agency or Scottish Environment Protection Agency.
2. The levels allocated under Veolia Environmental Services Authorisation No. AL5160/BZ6759 (or authorisation issued to any future owners of the site).
3. Our Terms & Conditions.
4. Our Conditions of Acceptance.
5. The price of disposal.

The material must be packed to comply with our authorisation for processing such wastes as outlined in the schedule attached.

For details of the incinerator as required for RSA 3 please see attached.

Full technical details can be discussed with myself on 023 8088 3508 or Mr Mike Beedham – General Manager Organics on 07773 813808.

Yours sincerely,
For and on behalf of Veolia Environmental Services

Mrs Nicki Green
Customer Services Manager (Radioactives) /
Radiation Protection Supervisor

Tel: 023 8088 3508
Fax: 023 8088 3010
Email: nicki.green@veolia.co.uk

APPENDIX C SUMMARY OF GASEOUS DISCHARGE DATA

This annexe presents basic gaseous discharge data and information in support of the main text.

Table A3.1 Summary of Annual Gaseous Discharge Activities from Hunterston A (1994-2007)

Year	Argon 41* (TBq)	Carbon 14 (GBq)	Sulphur 35* (GBq)	Tritium (GBq)	Beta Particulate (MBq)
1994	-	37	-	31	2.5
1995	-	32	-	15.8	1.3
1996	-	0.7	-	9.6	<1.0
1997	-	0.179	-	4.935	0.20
1998	-	0.00	-	0.00	0.13
1999	-	0.00	-	0.00	0.47
2000	-	0.00	-	0.00	0.46
2001	-	0.00	-	0.00	0.36
2002	-	0.18	-	1.45	0.26
2003	-	0.188	-	1.59	0.45
2004	-	0.134	-	1.36	0.29
2005	-	0.114	-	1.61	0.23
2006	-	0.184	-	1.97	0.28
2007	-	0.181	-	1.61	0.38

*Note: Argon 41 and Sulphur 35 are short lived radionuclides and had decayed to level where it is unnecessary to specify a limit in the current authorisation certificate.

Table A3.2 Monthly Gaseous Discharges 2000 to 2007

Year	Month	Carbon 14 (GBq)	Tritium (GBq)	Beta (MBq)
2000	August	0.00	0.00	0.02
2000	September	0.00	0.00	0.05
2000	October	0.00	0.00	0.04
2000	November	0.00	0.00	0.02
2000	December	0.00	0.00	0.04
2001	January	0.00	0.00	0.03
2001	February	0.00	0.00	0.03
2001	March	0.00	0.00	0.03
2001	April	0.00	0.00	0.04
2001	May	0.00	0.00	0.03
2001	June	0.00	0.00	0.02
2001	July	0.00	0.00	0.05
2001	August	0.00	0.00	0.04
2001	September	0.00	0.00	0.03
2001	October	0.00	0.00	0.03
2001	November	0.00	0.00	0.01
2001	December	0.00	0.00	0.02
2002	January	0.014	0.12	0.02
2002	February	0.013	0.09	0.02
2002	March	0.014	0.10	0.05

Year	Month	Carbon 14 (GBq)	Tritium (GBq)	Beta (MBq)
2002	April	0.015	0.10	0.03
2002	May	0.014	0.10	0.02
2002	June	0.015	0.11	0.02
2002	July	0.016	0.12	0.02
2002	August	0.017	0.13	0.01
2002	September	0.014	0.14	0.03
2002	October	0.018	0.16	0.02
2002	November	0.014	0.14	0.01
2002	December	0.016	0.14	0.01
2003	January	0.015	0.12	0.02
2003	February	0.013	0.11	0.02
2003	March	0.015	0.13	0.01
2003	April	0.013	0.12	0.02
2003	May	0.013	0.12	0.01
2003	June	0.016	0.12	0.01
2003	July	0.014	0.14	0.02
2003	August	0.019	0.14	0.02
2003	September	0.019	0.16	0.01
2003	October	0.018	0.15	0.02
2003	November	0.016	0.13	0.02
2003	December	0.017	0.15	0.27
2004	January	0.017	0.11	0.02
2004	February	0.016	0.10	0.02
2004	March	0.015	0.10	0.02
2004	April	0.013	0.12	0.01
2004	May	0.014	0.11	0.02
2004	June	0.013	0.14	0.02
2004	July	0.007	0.12	0.01
2004	August	0.006	0.11	0.10
2004	September	0.007	0.08	0.01
2004	October	0.009	0.11	0.02
2004	November	0.008	0.12	0.02
2004	December	0.009	0.14	0.02
2005	January	0.008	0.14	0.02
2005	February	0.009	0.14	0.01
2005	March	0.008	0.12	0.03
2005	April	0.006	0.10	0.04
2005	May	0.009	0.13	0.03
2005	June	0.008	0.11	0.01
2005	July	0.009	0.13	0.02
2005	August	0.009	0.14	0.01
2005	September	0.013	0.16	0.02
2005	October	0.012	0.15	0.007
2005	November	0.013	0.15	0.006
2005	December	0.010	0.14	0.009
2006	January	0.011	0.13	0.015
2006	February	0.013	0.14	0.007
2006	March	0.013	0.13	0.013
2006	April	0.014	0.14	0.022
2006	May	0.012	0.12	0.036

Year	Month	Carbon 14 (GBq)	Tritium (GBq)	Beta (MBq)
2006	June	0.014	0.16	0.023
2006	July	0.017	0.21	0.035
2006	August	0.020	0.23	0.027
2006	September	0.019	0.18	0.024
2006	October	0.015	0.20	0.030
2006	November	0.018	0.18	0.025
2006	December	0.018	0.15	0.026
2007	January	0.016	0.14	0.017
2007	February	0.013	0.11	0.028
2007	March	0.013	0.10	0.028
2007	April	0.014	0.12	0.024
2007	May	0.015	0.13	0.030
2007	June	0.019	0.14	0.031
2007	July	0.018	0.18	0.025
2007	August	0.016	0.14	0.032
2007	September	0.016	0.15	0.036
2007	October	0.015	0.15	0.053
2007	November	0.014	0.13	0.036
2007	December	0.012	0.12	0.040
Mean	**Aug 00 to Dec 07**	**0.011**	**0.108**	**0.027**
Standard Deviation	**Aug 00 to Dec 07**	**0.006**	**0.058**	**0.029**
Mean + 3 Standard Deviations	**Aug 00 to Dec 07**	**0.030**	**0.281**	**0.115**

APPENDIX D SUMMARY OF LIQUID DISCHARGE DATA

This annexe presents basic liquid discharge data and information in support of the main text.

Table A4.1 Summary of Annual Liquid Discharge Activities from Hunterston A (1994-2007)

Year	Total Beta (GBq)	Tritium (GBq)	Total Alpha (MBq)	Total Alpha & Beta (GBq)	Plutonium 241 (GBq)*
1994	209	195	195	209	-
1995	150	41	334	150	-
1996	140	23	<449	141	-
1997	165.307	10.038	552	165.859	-
1998	241.505	6.681	657	242.162	-
1999	197.404	21.792	527	197.931	-
2000	138.053	2.779	187	138.240	0.684
2001	24.641	4.046	140.47	24.781	1.005
2002	28.656	1.699	147.4	28.803	0.219
2003	43.797	0.962	168.07	43.965	0.152
2004	63.410	0.673	0.152	63.562	0.206
2005	47.331	0.478	0.130	47.461	0.150
2006	45.53	0.53	87.22	45.61	0.063
2007	36.70	0.39	69.29	36.77	0.54

*Note: discharge not required to be reported for Pu241 up until 2000

Table A4.2 Monthly Liquid Discharges 2000 to 2007

Year	Month	Total Beta (GBq)	Tritium (GBq)	Total Alpha (MBq)	Plutonium 241 (GBq)
2000	August	0	0	0	0
2000	September	19.143	0.33	18	0.197
2000	October	18.492	0.306	63	0.344
2000	November	0.058	0.002	0.5	0.017
2000	December	1.962	0.140	19.5	0.126
2001	January	1.667	0.085	15.5	0.092
2001	February	1.899	0.065	14.7	0.044
2001	March	0.113	0.009	3.6	0.009
2001	April	0.060	0.004	2.2	0.012
2001	May	3.374	0.088	11.4	0.091
2001	June	0.133	1.129	2.01	0.029
2001	July	2.079	0.679	7.67	0.103
2001	August	3.836	1.347	26.5	0.176
2001	September	3.128	0.098	19.7	0.053
2001	October	0.121	0.246	4.1	0.20
2001	November	5.535	0.148	19.6	0.160

Year	Month	Total Beta (GBq)	Tritium (GBq)	Total Alpha (MBq)	Plutonium 241 (GBq)
2001	December	2.696	0.148	13.49	0.036
2002	January	0.00	0.00	0.00	0.00
2002	February	3.141	0.178	17.3	0.072
2002	March	3.434	0.117	20.4	0.017
2002	April	0.00	0.00	0.00	0.00
2002	May	3.522	0.115	12.5	0.037
2002	June	0.00	0.00	0.00	0.00
2002	July	2.304	0.05	9.0	0.021
2002	August	3.722	0.980	41.4	0.020
2002	September	7.110	0.117	25.6	0.026
2002	October	5.377	0.126	19.1	0.020
2002	November	0.046	0.016	2.1	0.006
2002	December	0.00	0.00	0.00	0.00
2003	January	5.646	0.133	15.3	0.007
2003	February	5.252	0.091	14.4	0.026
2003	March	0.00	0.00	0.00	0.00
2003	April	3.323	0.108	10.8	0.028
2003	May	0.00	0.00	0.00	0.00
2003	June	4.123	0.098	21.6	0.013
2003	July	0.066	0.114	2.02	0.015
2003	August	5.159	0.133	21.48	0.008
2003	September	0.00	0.00	0.00	0.00
2003	October	8.284	0.119	27.5	0.018
2003	November	0.040	0.002	1.29	0.0002
2003	December	11.904	0.164	53.68	0.037
2004	January	11.67	0.111	26.54	0.031
2004	February	0.00	0.00	0.00	0.00
2004	March	6.327	0.075	30.9	0.020
2004	April	0.00	0.00	0.00	0.00
2004	May	0.00	0.00	0.00	0.00
2004	June	8.39	0.13	41.10	0.03
2004	July	0.043	0.001	0.40	0.0003
2004	August	13.93	0.20	34.9	0.039
2004	September	0.00	0.00	0.00	0.00
2004	October	10.92	0.079	16.72	0.037
2004	November	0.050	0.0008	1.11	0.0002
2004	December	12.08	0.076	0.74	0.048
2005	January	0.051	0.0017	0.560	0.0005
2005	February	10.63	0.07	0.69	0.03
2005	March	0.015	0.0003	0.495	0.001
2005	April	9.64	0.088	15.495	0.032
2005	May	0.00	0.00	0.00	0.00
2005	June	6.875	0.0643	49.26	0.0303
2005	July	0	0	0	0
2005	August	7.54	0.09	16.88	0.036

Year	Month	Total Beta (GBq)	Tritium (GBq)	Total Alpha (MBq)	Plutonium 241 (GBq)
2005	September	0	0	0	0
2005	October	6.8	0.09	31.55	0.0061
2005	November	0	0	0	0
2005	December	5.78	0.074	15.03	0.014
2006	January	7.1	0.08	6.98	0.008
2006	February	5.21	0.05	3.65	0.011
2006	March	0	0	0	0
2006	April	5.38	0.06	2.32	0.006
2006	May	0	0	0	0
2006	June	0	0	0	0
2006	July	4.82	0.06	25.39	0.01
2006	August	7.35	0.08	9.50	0.01
2006	September	4.98	0.06	7.16	0.005
2006	October	3.36	0.05	12.18	0.002
2006	November	3.58	0.05	8.45	0.005
2006	December	3.75	0.04	11.59	0.006
2007	January	3.51	0.03	7.56	0.006
2007	February	5.07	0.07	12.57	0.007
2007	March	2.08	0.02	4.75	0.002
2007	April	0	0	0.87	0
2007	May	1.69	0.02	4.63	0.003
2007	June	5.14	0.04	10.56	0.007
2007	July	2.32	0.02	3.47	0.005
2007	August	2.26	0.02	4.55	0.004
2007	September	4.38	0.06	7.75	0.004
2007	October	2.21	0.02	2.96	0.001
2007	November	5.84	0.06	5.69	0.009
2007	December	2.20	0.03	3.93	0.006
Mean	**Aug 00 to Dec 07**	**3.705**	**0.107**	**11.189**	**0.028**
Standard Deviation	**Aug 00 to Dec 07**	**4.156**	**0.219**	**13.247**	**0.028**
Mean + 3 Standard Deviations	**Aug 00 to Dec 07**	**16.172**	**0.765**	**50.930**	**0.191**

Table A4.3(a) Monthly Liquid Discharge Volumes 2000 to 2007

Year	Month	CCP Volume (m^3)	Misc Waste Vol (m^3)	Replacement Delay Tank (m^3)	Total Vol (m^3)
2000	August	0	0	-	0
2000	September	374.1	20.1	-	394.2
2000	October	387.1	36.1	-	423.2
2000	November	0	19.9	-	19.9

Year	Month	CCP Volume (m^3)	Misc Waste Vol (m^3)	Replacement Delay Tank (m^3)	Total Vol (m^3)
2000	December	100.2	38.2	-	138.4
2001	January	98.8	54	-	152.8
2001	February	87.2	36.5	-	123.7
2001	March	0	35.4	-	35.4
2001	April	0	18.8	-	18.8
2001	May	136	15.5	-	151.5
2001	June	35.2	0	-	35.2
2001	July	67	14.8	-	81.8
2001	August	118	36	-	154
2001	September	93.8	0	-	93.8
2001	October	0	17.2	-	17.2
2001	November	74	17	-	91
2001	December	105	17.5	-	122.5
2002	January	0	0	-	0
2002	February	130	36.4	-	166.4
2002	March	106.4	0	-	106.4
2002	April	0	0	-	0
2002	May	83.6	20.3	-	103.9
2002	June	0	0	-	0
2002	July	64.4	0	-	64.4
2002	August	100	0	-	100
2002	September	106.8	0	-	106.8
2002	October	120	18.6	-	138.6
2002	November	0	15	-	15
2002	December	0	0	-	0
2003	January	145.9	0	-	145.9
2003	February	123.3	0	-	123.3
2003	March	0	0	-	0
2003	April	101.2	15.9	-	117.1
2003	May	0	0	-	0
2003	June	124.4	0	-	124.4
2003	July	0	26.74	-	26.74
2003	August	134.6	13.26	-	147.86
2003	September	0	0	-	0
2003	October	120.93	0	-	120.93
2003	November	0	15.35	-	15.35
2003	December	161.19	0	-	161.19
2004	January	146.65	0	-	146.65
2004	February	0	0	-	0
2004	March	106.01	21.3	-	127.31
2004	April	0	0	-	0
2004	May	0	0	-	0
2004	June	158.33	0	-	158.33

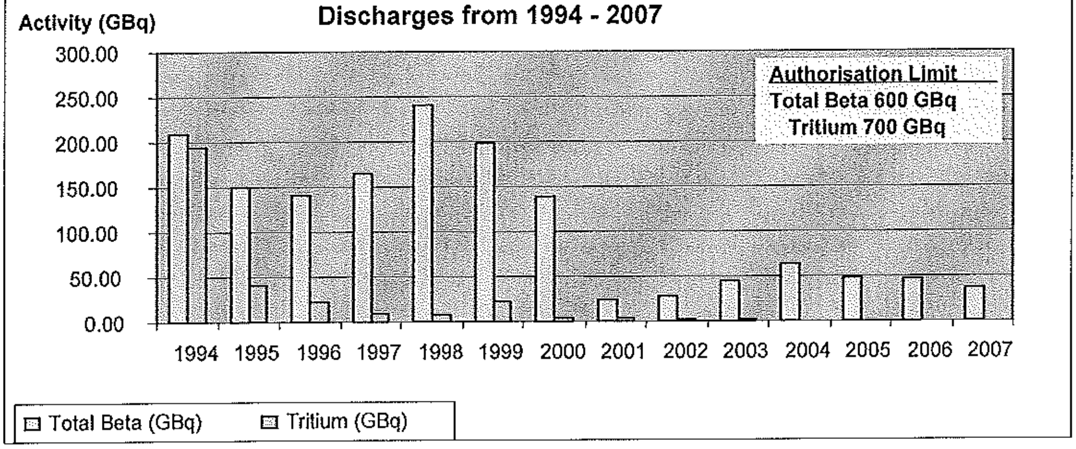
Year	Month	CCP Volume (m^3)	Misc Waste Vol (m^3)	Replacement Delay Tank (m^3)	Total Vol (m^3)
2004	July	0	16.66	-	16.66
2004	August	219.15	0	-	219.15
2004	September	0	0	-	0
2004	October	115.91	0	-	115.91
2004	November	0	16.05	-	16.05
2004	December	117.43	0	-	117.43
2005	January	0	26.64	-	26.64
2005	February	125.25	0	-	125.25
2005	March	0	14.15	-	14.15
2005	April	130.21	0	-	130.21
2005	May	0	0	-	0
2005	June	113.52	21.63	-	135.15
2005	July	0	0	-	0
2005	August	152.04	0	-	152.04
2005	September	0	0	-	0
2005	October	147.62	7.75	-	155.37
2005	November	0	0	-	0
2005	December	110.52	0	-	110.52
2006	January	139.6	0	-	139.6
2006	February	154.0	22.17	-	176.17
2006	March	0	0	-	0
2006	April	116.5	0	-	116.5
2006	May	0	0	-	0
2006	June	0	0	-	0
2006	July	115.95	0	-	115.95
2006	August	116.45	0	-	116.45
2006	September	115.5	0	-	115.5
2006	October	91.57	0	-	91.57
2006	November	92.85	0	-	92.85
2006	December	105.34	0	-	105.34
2007	January	101.07	15.31	-	116.38
2007	February	172.26	13.98	-	186.24
2007	March	60.22	0	-	60.22
2007	April	25.0	0	-	25.0
2007	May	0	54.9	-	54.9
2007	June	-	-	84.9	84.9
2007	July	-	-	42.7	42.7
2007	August	-	-	42.9	42.9
2007	September	-	-	82.9	82.9
2007	October	-	-	27.4	27.4
2007	November	-	-	80.6	80.6
2007	December	-	-	40.3	40.3
Mean	**Aug 00 to**	**78.92**	**9.14**	**57.39**	**84.48**

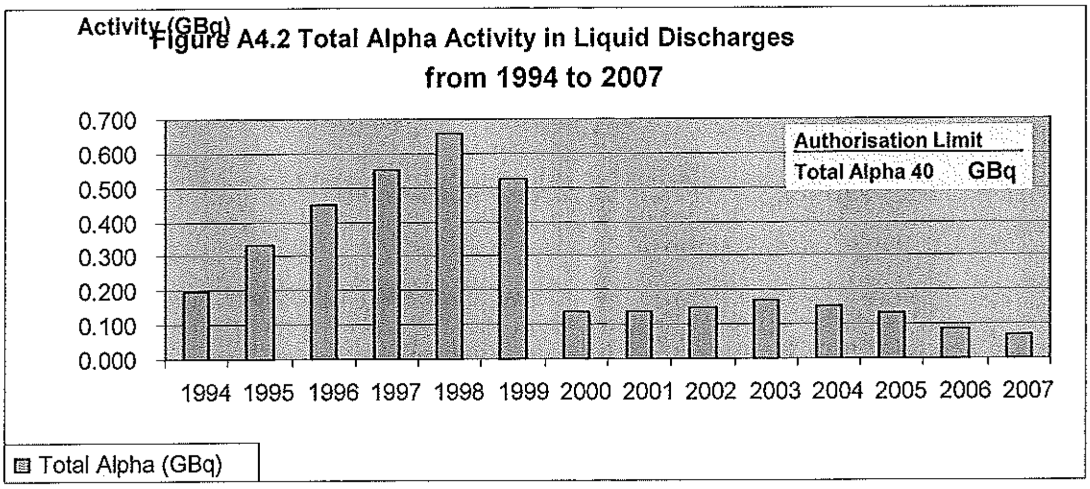
Year	Month	CCP Volume (m^3)	Misc Waste Vol (m^3)	Replacement Delay Tank (m^3)	Total Vol (m^3)
	Dec 07				
St Dev	Aug 00 to Dec 07	78.19	13.39	24.37	77.93
Mean+3stdev	Aug 00 to Dec 07	313.5	49.33	130.50	318.28

Table A4.3(b) Annual Liquid Discharge Volumes

Year	CCP Volume (m^3)	Misc Waste Volume (m^3)	RDT (m^3)	Total Volume (m^3)
1998	6833.600	398.130	-	7231.730
1999	5242.200	397.470	-	5639.670
2000	2996.500	308.200	-	3304.700
2001	815.000	262.700	-	1077.700
2002	711.200	90.300	-	801.500
2003	911.520	71.250	-	982.770
2004	863.480	54.010	-	917.490
2005	779.160	70.170	-	849.330
2006	1047.41	22.17	-	1069.58
2007	358.55	84.19	401.7	844.44

Figure A4.1 Total Beta and Tritium Activity in Liquid Discharges from 1994 - 2007




Activity (GBq)
Figure A4.2 Total Alpha Activity in Liquid Discharges from 1994 to 2007
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007
Authorisation Limit
Total Alpha 40 GBq
Total Alpha (GBq)

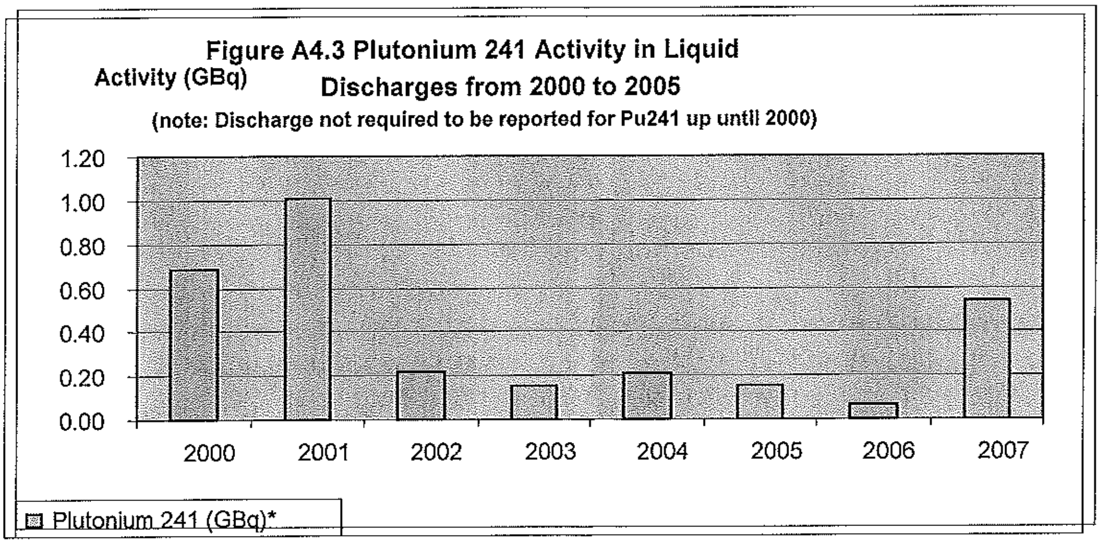
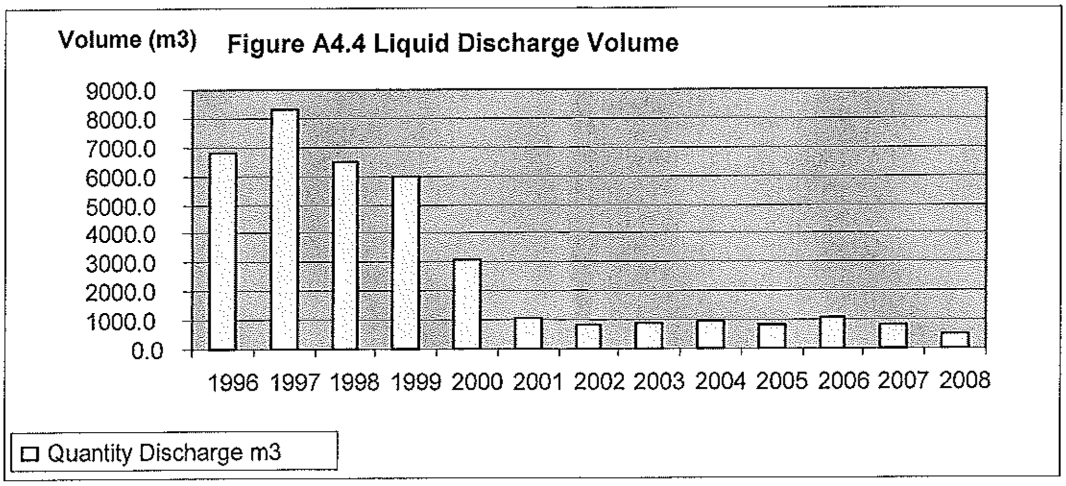


Figure A4.3 Plutonium 241 Activity in Liquid Discharges from 2000 to 2005
Activity (GBq)
(note: Discharge not required to be reported for Pu241 up until 2000)
1.20
1.00
0.80
0.60
0.40
0.20
0.00
2000 2001 2002 2003 2004 2005 2006 2007
Plutonium 241 (GBq)*


Volume (m3)
Figure A4.4 Liquid Discharge Volume
9000.0
8000.0
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Quantity Discharge m3

APPENDIX E SUMMARY OF SOLID LOW LEVEL WASTE DISPOSAL DATA

This annexe presents basic data and information on Hunterston solid LLW disposals in support of the main text.

Table A5.1 Solid Radioactive LLW Streams to Final Site Clearance

Stream Description	Type	2005[a] Waste Stream	Total[b] Volume (1/4/04) (m^3)	Conditioned Volume[c] (m^3)	Packaged Volume[c] (m^3)
HUNTERSTON A – OPERATIONAL WASTE					
Miscellaneous Sludge – MSRT 2[1]	LLW	9J32	16.6	71.9	89.9
Oil in Drums in LLWTF (Taken from 2005 HNA Inventory)	LLW	9J54	1.2	1.2	N/A
Residual oils in Circ. Seal and Main Gas Valve System (Taken from 2005 HNA Inventory)	LLW	9J58	11.5	11.5	N/A
Operational LLW Total			**29.3**	**84.6**	**89.9**
HUNTERSTON A – DECOMMISSIONING WASTE					
Care & Maintenance Preparation: Reactor and Auxiliary Building LLW	LLW	9J948	1831	2308.9	2885.7
Care & Maintenance Preparation: Pond and Effluent Treatment Plant LLW	LLW	9J949	2331	2939.4	3673.7
Care & Maintenance Preparation: Miscellaneous Sludge – Effluent Plant Clean up[2]	LLW	9J950	4.3[2]	8.9	11.2
Redundant Sealed Sources (Not in 2004 UK Inventory)	LLW	9J952	<<1	15.6	19.5
Care & Maintenance Preparation LLW Total			**4166.3**	**5272.8**	**6590.1**
Care & Maintenance: General Reactor LLW	LLW	9J100	128.0	66.6	98
Care & Maintenance LLW Total			**128.0**	**66.6**	**98**
Final Dismantling & Site	LLW	9J302	9301	10872.9	12984.2

Stream Description	Type	2005[a] Waste Stream	Total[b] Volume (1/4/04) (m^3)	Conditioned Volume[c] (m^3)	Packaged Volume[c] (m^3)
Clearance: Concrete (Reactor & Non-Reactor) LLW					
Final Dismantling & Site Clearance: Stainless Steel (Reactor) LLW	LLW	9J310	9	10.5	12.6
Final Dismantling & Site Clearance: Mild Steel (Reactor) LLW	LLW	9J311	5646	6600.2	7881.8
Final Dismantling & Site Clearance: Mild Steel (Non-Reactor) LLW	LLW	9J312	4242	4958.9	5921.8
Final Dismantling & Site Clearance: Graphite LLW	LLW	9J313	1494	1746.5	2085.6
Final Dismantling & Site Clearance: Miscellaneous Metals and materials (Reactor and Non-Reactor) LLW	LLW	9J314	1935	2262	2701.3
Final Dismantling & Site Clearance: Secondary Waste LLW	LLW	9J315	1234	1442.5	1722.7
Final Dismantling & Site Clearance: Contaminated Soil LLW	LLW	9J317	4700	5494.3	6561.2
Final Dismantling & Site Clearance LLW			**28561**	**33387.8**	**39871.2**
TOTAL DECOMMISSIONING LLW			**32855.3**	**38727.2**	**46559.3**
TOTAL LLW			**32884.6**	**38793.8**	**46649.2**

a) The current waste stream description identifiers were taken from Nirex UK Radioactive Waste Inventory for 2004. The identifiers and data change with each issue of the Nirex UK Radioactive Waste Inventory, hence will need updated in any future RSA application documents.
b) These were taken from the Hunterston A Site Inventory of September 2005 and Nirex UK Radioactive Waste Inventory for 2004.
c) Total waste, conditioned and packaged volumes were taken from the Hunterston A UK Inventory with stock volumes at 1/04/04. Total waste volume is the waste stock plus future arisings.

Table A5.2 Radioisotopic Fingerprint of Waste Stream 9J948 (Reactor & Auxiliary Buildings)

Isotope	Fraction of Total Activity (M/TE/HNA/REP/0024/99)
Manganese 54	0.0001
Cobalt 60	0.1343
Barium 133	0.0001
Caesium 134	0.0003
Caesium 137	0.012
Europium 152	0.0004
Europium 154	0.0014
Europium 155	0.0005
TOTAL GAMMA	**0.1491**
Tritium	0.1968
Carbon 14	0.0184
Chlorine 36	0.0273
Iron 55	0.5698
Strontium 90/Yttrium 90	0.0051
Plutonium 241	0.0103
Nickel 63	0.0205
Antinomy 125	0.0001
Ruthenium 106	0.0002
Iodine 129	0.0001
Promethium 147	0.0013
TOTAL BETA	**0.8499**
Americium 241	0.0005
Plutonium 239/240	0.0003
Plutonium 238	0.0002
Curium 242	0.0001
Curium 243	0.0001
Curium 244	0.0001
Uranium 234	0.0001
Uranium 235	0.0001
Uranium 238	0.0001
TOTAL ALPHA	**0.0016**
OVERALL TOTAL	**1.0006**

Table A5.3 Radioisotopic Fingerprint of Waste Stream 9J949 (CCP & AETP)

Isotope	Fraction of Total Activity (M/TE/HNA/REP/0024/99, Issue 5)
Manganese 54	0.0001
Cobalt 60	0.0225
Barium 133	0.0001
Caesium 134	0.0007
Caesium 137	0.2817
Europium 152	0.0003
Europium 154	0.0032
Europium 155	0.0010
TOTAL GAMMA	**0.3096**
Tritium	0.0252
Carbon 14	0.0015
Chlorine 36	0.0075
Iron 55	0.1101
Strontium 90/Yttrium 90	0.2181
Plutonium 241	0.2760
Nickel 63	0.0014
Antinomy 125	0.0002
Ruthenium 106	0.0001
Iodine 129	0.0001
Promethium 147	0.0052
TOTAL BETA	**0.6454**
Americium 241	0.0243
Plutonium 239/240	0.0118
Plutonium 238	0.0071
Curium 242	0.0001
Curium 243	0.0001
Curium 244	0.0011
Uranium 234	0.0001
Uranium 235	0.0001
Uranium 238	0.0001
TOTAL ALPHA	**0.0448**
OVERALL TOTAL	**1.00**

Table A5.4 Radioisotopic Fingerprint of Waste Stream 9J50 (Aluminium CCP Skips)

Isotope	Fraction of Total Activity (M/TE/HNA/REP/0024/99)
Cobalt 60	0.0147
Barium 133	0.0000
Caesium 134	0.0000
Caesium 137	0.0452
Europium 154	0.0009
TOTAL GAMMA	**0.0608**
Tritium	0.000
Chlorine 36	0.000
Iron 55	0.0583
Strontium 90/Yttrium 90	0.7098
Plutonium 241	0.1533
Ruthenium 106	0.0000
Nickel 63	0.0007
Promethium 147	0.0005
Samarium 151	0.0005
TOTAL BETA	**0.9231**
Americium 241	0.0079
Plutonium 239/240	0.0049
Plutonium 238	0.0031
Curium 242	0.0001
Curium 243	0.0001
Curium 244	0.0002
Uranium 234	0.0001
Uranium 235	0.0001
Uranium 238	0.0001
TOTAL ALPHA	**0.0166**
OVERALL TOTAL	**1.00**

Table A5.5 Summary of Annual Solid LLW Volumes & Activities from Hunterston A (1997-2007)

	Vol (m^3)	U (MBq)	Ra/Th (MBq)	C-14 (MBq)	I-129 (MBq)	H-3 (MBq)	C0-60 (MBq)	Alpha (MBq)	Other (MBq)
Current Auth. Limits	600	1000	200	4000	100	25000	75000	10000	800000
1997	19.5	0	0	0	0	64.2	455.26	0.06	2860
1998	74.6	0	0	0	0	109.51	366.33	25.74	4020
1999	58.5	0	0	0	0	167.22	790.15	22.37	6617.59
2000	94.1	0	0	0	0	278.92	504.83	51.12	4095.47
2001	175.5	0.028	0	696	0	7792.286	5649.349	420.87	33752.01
2002	133.1	0.327	0	64.9	0	1043.47	992.2	887.09	30035.63
2003	195	0	0	27.92	0	435.68	408.87	1554.52	85943.3
2004	422.2	0	0	69.91	0	1061.11	1746.98	5653.9	193108.3
2005	363.7	0	0	66.21	0	878.71	1678.37	5903.68	182035.4
2006	386.6	0	0	147.09	0	1825.59	2355.48	5619.73	153768.52
2007	156	0.19	0	4.32	0	39.81	23.22	721.20	11518.49
Mean	**230.6**	**0.06**	**0**	**154.16**	**0**	**1915.03**	**1830.10**	**2411.86**	**88161.68**
SD	**131.8**	**0.13**	**0**	**266.87**	**0**	**2897.25**	**1954.22**	**2657.09**	**81531.78**
M+3SD	**626.0**	**0.45**	**0**	**954.76**	**0**	**10606.8**	**7692.76**	**10383.1**	**332757.0**
Maximum result over 12 Months*	**539.2**	**0.0**	**0**	172.71	**0**	**2075.01**	**3126.36**	**8976.54**	269939.6

DRRF No ...16802...

HUNTERSTON 'A' DECOMMISSIONING SITE

DOCUMENT REVIEW REQUEST FORM (DRRF)

To:	Pollock, Bob	(Reviewer)
To:	Bainbridge, Bob	(Reviewer)
To:	McTaggart, Lynne	(Reviewer)

DOCUMENT TITLE: Application by Magnox North Ltd for Multi-Media Authorisation under RSA93 to Dispose of Radioactive Waste from the Hunterston A Site.

DOCUMENT REFERENCE ...HNA/3800/TC/SR/981.../ISSUE ...ISSUE 01

Magnox Electric Ltd Doc. No.:	HNA/3800/TC/SR/981	**Task:**	-
Contract Number:	-	**MGT Code:**	3800

Purpose of Review

For Review

Please indicate the outcome of your review below and return this form to me by 22/12/2008

Signed: ...[signature]... Date: ...16/12/08

Name in Capitals ...GILLIAN WILSON...

PP. REUBEN PHILLIPS.

Outcome of Review

PAGE 59 MAKES REFERENCE TO THE CEASIUM REMOVAL CARTRIDGES IN THE MAETP REMOVING CS-137 AND CONCENTRATING IT INTO ILW. IT WOULD BE HELPFUL IF THE REFERENCE TO ILW COULD BE REMOVED. OTHERWISE NO SECURITY ISSUES.

Signed...[signature]... Date: ...18/12/08...

Reviewer

COMPLETE BY
REUBEN PHILLIPS &
MYRA CONN.
MARCH 2010.

DRRF No ...16802...........

HUNTERSTON 'A' DECOMMISSIONING SITE

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Contract Number: - — **MGT Code:** 3800

Purpose of Review

For Review

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Signed: ...[signature]............ Date: ..16/12/08......

Name in Capitals ....GILLIAN WILSON.....

PP. REUBEN PHILLIPS

Outcome of Review

1 Consistency – Power Station, Site, Station? ~~Nuclear facility~~ Nuclear facility, Nuclear power stations.

2 Does it need to be this long? It's very "chatty" and repetitive. Probably too late now.

3 There is a lot of "safety". OK where arrangements are common + needed for enviro but some is just safety - page 15

4 Is it a general application? or RSA? There is a lot of general Enviro.

5 Structure) – Top level NDA/Company Strategy + Middle Sites LTP + Programme — then actual discharges could have halved the document. Poor STRUCTURE GULK PROBLEM See Page 8

Signed.........[signature]............ Date: ....18 DEC 2008.........

Reviewer

6 I am really struggling with the repeats of information to check consistency.

7 Search + replace ANNEX # ~~[illegible]~~ with Appendix.

8 Please check all references exist eg Ref 32.

9 We are repeating for each "stream" liquid, gaseous, solid the same information – if its "Multi Media" WHY? SAY THINGS (MANAGEMENT SYSTEM, POLICY, REGULATION, etc etc) ONCE

This is well outside my SOEP lane so many questions + incorrect comments. Sorry some is BLUNT!

COMPLETE BY REUBEN PHILLIPS & MYRA CONN MARCH 2010.

DRRF No ....16802........

HUNTERSTON 'A' DECOMMISSIONING SITE

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Contract Number: - **MGT Code:** 3800

Purpose of Review

For Review

Please indicate the outcome of your review below and return this form to me by 22/12/2008

Signed: ...[signature]...... Date: ..16/12/08

Name in Capitals ....GILLIAN WILSON..

PP. REUBEN PHILLIPS.

Outcome of Review

Needs to be re-structured - See attached Sheet. Also info as required in EA requirements doc. attached.

Suggest we set up 6 x 2 hour sessions to go through new format, Reuben, Bob B & myself & Gillian

Signed...L.M. Taggart...................... Date: ......24/12/08........................

Reviewer

COMPLETE BY
REUBEN PHILLIPS &
MYRA CONN
MARCH 2010