RADIOACTIVE SUBSTANCES ACT 1993

Application by Magnox Limited for Authorisation under Section 13 of The Radioactive Substances Act 1993 to Dispose of Radioactive Wastes from the Decommissioning of the Hunterston A Power Station near West Kilbride, Ayrshire Scotland

CONSULTATION DOCUMENT FOR DISCRETIONARY CONSULTEES AND THE PUBLIC

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1 PURPOSE OF THIS DOCUMENT

Applications have been made to the Scottish Environment Protection Agency (SEPA) by Magnox Limited for the disposal of radioactive waste arising from the decommissioning of the Hunterston A nuclear power station. An application to dispose of radioactive waste under Section 13 of the Radioactive Substances Act 1993 (RSA 93) was received in March 2010 with minor amendments to the application made in October 2011. Two separate applications for variations to the extant authorisation for the disposal of solid radioactive waste under Section 17 of RSA 93 were received in February 2011

Under section 16 of the Radioactive Substances Act 1993 (RSA 93) SEPA carries out discretionary and public consultation on any application for radioactive disposals from nuclear licensed sites as part of its determination of such applications.

In cases where a holder of an Authorisation is seeking a variation that would relax any of the limitations or conditions of an extant authorisation then it has been SEPA's past practice to follow the same process as if an application for a new authorisation had been made. That is to subject the application to public and discretionary consultation. SEPA believes that this consultation should be advertised for public comment.

The original application with minor amendments and the two applications for variation are being taken together under this consultation. Any reference to Section 16 of RSA 93 is also a reference to the relevant parts of Section 17 of RSA 93.

The main purpose of this document is to help consultees understand why they are being consulted and what they are being consulted upon. It summarises SEPA's general remit, gives further detail on the specific remit for the regulation of radioactive substances in Scotland and sets down the general framework in the UK and European Community within which SEPA will determine whether or not to grant authorisation to the applicant. This document should be read in conjunction with the application, its accompanying documents and the further papers enclosed for consultation.

Your comments are being sought by SEPA as part of the 'Discretionary Consultation' on this application. Section 16 4a of RSA 93 requires SEPA to consult with the Food Standards Agency (FSA) and Health and Safety Executive (HSE) whenever an application is received by SEPA from a nuclear licensed site. Further administrative arrangements are in place to consult the Scottish Government to ensure that Scottish Ministers have the opportunity to call in the application for determination. These consultees have raised no objections to the application. Additionally the FSA carried out a prospective dose assessment of the likely impact of the disposal of liquid and gaseous waste on the safety of food.

Further detail on the consultation process is given later in this document. In accordance with the requirements of Section 16(5) of RSA 93, SEPA is specifically consulting with the following bodies:

- Hunterston A Site Stakeholder Group;
- Committee on Medical Aspects of Radiation in the Environment;
- Copeland Borough Council;
- Cumbria County Council;
- North Ayrshire Council;
- Environment Agency;
- Health Protection Agency;
- Ayrshire and Arran NHS Board;

- Nuclear Decommissioning Authority;
- Scottish Natural Heritage;
- Scottish Water;

In order to draw the consultation to the attention of the wider public the consultation is being advertised in:

- The Largs & Millport Weekly News;
- The Edinburgh Gazette; and,
- The Glasgow Herald.

The consultation package can be viewed at:

SEPA
East Kilbride office
5 Redwood Crescent
Peel Park
EAST KILBRIDE
G74 5PP

SEPA
Ayr office
31 Miller Road
Ayr
KA7 2AX

And at **www.SEPA.org.uk** under the "consultations" section.

In undertaking this consultation SEPA is looking for information relevant to this application. Specifically SEPA would like to be informed of any matters that your organisation or you as an individual are aware of that could influence SEPA's decision to grant an authorisation to dispose of radioactive waste. There are some matters that SEPA might particularly invite certain consultees to comment on because SEPA believes their expertise or knowledge could be particularly helpful or important. When this is the case SEPA will write to these consultees asking for such comment. Consultees are of course free to make any comments they wish that are relevant to this application.

1.1 Consultation Process

The following papers are enclosed as part of the consultation package:

Paper 1: Application form and amendment, and two applications for variation.
Paper 2: Information in support of application by Magnox Limited for Authorisation under RSA 93 to dispose of radioactive wastes from the Hunterston A Site;
Paper 3: SEPA's standard nuclear template;
Paper 4: SEPA's Policy on transfer of LLW from nuclear sites;
Paper 5: Hunterston A & B ERICA assessment;
Paper 6: Radiological dose assessment.

The consultation procedure is as follows:

Operators wishing to dispose of radioactive waste must apply to SEPA for an authorisation. For applications received for the disposal of waste originating at nuclear licensed sites, Section 16 of RSA93 requires that SEPA consults with the Health and Safety Executive (Office of Nuclear Regulation (ONR)) and the Food Standards Agency (FSA) before deciding whether to grant an authorisation. The application is also provided to the Scottish Government to allow Scottish Ministers the opportunity to exercise their powers under Section 24 of RSA93 to call in the application.

SEPA is also required to consult with such public bodies as it sees proper to consult regarding the application before granting any authorisation. SEPA also believes that this consultation should be advertised for public comment.

Following this consultation, SEPA is required to consult again with the FSA on the terms and conditions of any authorisation it proposes to grant and to send a copy of any authorisation which it proposes to grant to the FSA. Consultation is also carried out with the HSE under formal working arrangements. Finally, consultation is carried out with Scottish Ministers who have powers to direct SEPA to add, remove or alter any condition or limit specified in the authorisation. Any authorisation for the disposal of radioactive waste from a nuclear licensed site that SEPA is minded to grant is prepared along with a document (known as a "decision document") setting out SEPA's considerations and the rationale for its decision to issue an authorisation. That document supports the final consultation with Scottish Ministers. The document will be made available on SEPA's web site.

Your response to this consultation should be returned to the following address:

The Registrar
Scottish Environment Protection Agency
Dingwall Office
Graesser House
Fodderty Way
Dingwall
IV15 9XB

registrydingwall@sepa.org.uk

Responses should be made to SEPA by **20 July 2012** at the above address. Following the closing date, all responses will be considered prior to the determination of the application.

SEPA may wish to include responses to this consultation document in its decision document. If so, all responses will be made public unless a respondent specifically asks for their response to be treated confidentially. Confidential responses may be included in any statistical summary of numbers of responses received or views expressed.

Respondents should be aware that SEPA is subject to the provisions of the Freedom of Information (Scotland) Act 2002 and would therefore have to consider any request made to it under the Act for information relating to responses made.

2 SEPA'S REMIT AND DUTIES

The Scottish Environment Protection Agency (SEPA) is the body responsible for environmental protection in Scotland. Its main aim[1] is to:

> *"provide an efficient and integrated environmental protection system for Scotland that will improve the environment and contribute to the Scottish Ministers' goal of sustainable development"*

SEPA was established by the Environment Act 1995 and became operational on 1 April 1996. The Environment Act 1995 also sets out SEPA's powers and responsibilities.

In broad terms SEPA regulates:

- activities that may pollute water;
- activities that may pollute air;
- storage, transport and disposal of waste;
- keeping, use and disposal of radioactive substances.

Section 13 of the Radioactive Substances Act 1993 (RSA93) makes it an offence to dispose of any radioactive waste, or permit it to be disposed of, unless it is in accordance with an authorisation granted under that Section, or it falls into one of the categories of radioactive waste specifically exempted from the requirements of this Section. SEPA is the body in Scotland charged with granting authorisations under Section 13.

[1] SEPA's Vision for Regulation 2005. www.sepa.org.uk

3 APPLICATION PROCESS

3.1 Background to the Application

This section is intended to provide some background information to assist consultees and members of the public with the information provided by Magnox Limited.

Authorisations were granted to British Nuclear Fuels plc in 2000 for the disposal of radioactive waste arising from the decommissioning of Hunterston A power station. The reactors were taken out of service in 1990 and de-fuelling was completed in 1995. The nuclear licensed site at Hunterston A is owned by the Nuclear Decommissioning Authority (NDA) and is being decommissioned on their behalf by Magnox Limited. The authorisations granted to British Nuclear Fuels were transferred to Magnox Limited in 2005. Magnox Limited has applied for a new authorisation encompassing their decommissioning plans for the Hunterston A Site.

3.2 Existing Authorisations

Magnox Limited holds the following authorisations permitting the disposal of radioactive waste from the Hunterston A Site:

Certificate Number	Effective Date	Description
RSA/W/21044[1]	03/08/2000	Disposal of gaseous waste arising from the decommissioning of the premises by the company.
RSA/W/21042[1]	03/08/2000	Disposal of solid waste arising from the decommissioning of the premises by the company.
RSA/W/21043[1]	03/08/2000	Disposal of liquid waste arising from the decommissioning of the premises by the company.

1. The limitations and conditions of these authorisations have been subject to variation.

The actual disposals over the 5 year period of 2007 – 2011 are given in the Tables below. Whilst these quantities of waste may not be representative of future decommissioning activities SEPA has noted the difference between the current disposals and the annual limits requested.

Solid	2007	2008	2009	2010	2011
LLW	156	383	231	136	211

Solid waste disposed - cubic metres. Data source: Site discharge returns.

Gas	2007	2008	2009	2010	2011
Tritium	1.6	1.3	1.1	0.92	0.95
Carbon-14	0.18	0.13	0.11	0.09	0.08
Beta	0.0004	0.0004	0.0004	0.00049	0.00048

Gaseous waste disposed - GigaBequerels. Data source: RIFE series.

Liquid	2007	2008	2009	2010	2011
Alpha	0.07	0.15	0.21	0.44	0.17
Beta	36.7	38.6	23.3	13.4	9.31
Tritium	0.39	0.6	0.39	0.29	0.35
Plutonium 241	0.05	0.08	0.1	0.26	0.17

Liquid waste disposed - GigaBequerels. Data source: RIFE series.

3.3 Current Application

In April 2010 SEPA received an application for authorisation under section 13 of RSA93 to dispose of radioactive waste from the Hunterston A power station. Amendments to the application we received in October 2011. In addition two requests (taken to be applications under section 17 of RSA93) for variation of the authorisation for the disposal of solid radioactive waste were received in February 2011. These are all being considered together under this consultation and referred to as "the application".

The company have applied to dispose of the various waste types listed below via the identified routes. Some of these disposal routes are currently used and some are new routes. The company have proposed annual limits for key radionuclides associated with the waste and where they believed applicable annual limits on volumes of radioactive waste to be disposed.

Gaseous Waste

Continued disposal to air:

The authorised limits proposed by Magnox Limited are the same as those set in the current authorisation.

Radionuclide	Proposed Annual Limit
Tritium	10 GBq
Carbon-14	1 GBq
Beta-emitting radionuclides associated with particulate matter	30 MBq

Aqueous Waste

Continued disposal to the Clyde Estuary:

The authorised limits proposed by Magnox Limited are the same as those set in the current authorisation.

Radionuclide	Proposed Annual Limit
Tritium	0.7 TBq
Plutonium 241	1.0 TBq
Alpha emitting radionuclides taken together	0.04 TBq
Beta emitting radionuclides taken together (excluding tritium and plutonium-241)	0.6 TBq

Combustible waste:

Proposed disposal route – incineration at a suitably licensed facility.

(1). Lightly radioactively contaminated oil

Radionuclide	Proposed Annual Limit	Annual volume m3
Tritium	8.1 GBq	No volume limit proposed
Carbon-14	0.45 GBq	
Other Nuclides (excluding alpha)	0.07 GBq	

(2). Lightly radioactively contaminated organic sludge

Radionuclide	Proposed Annual Limit	Annual mass tonnes
Tritium	3.35 MBq	No volume limit proposed
Carbon-14	0.31 MBq	
Other beta and gamma emitting nuclides	6.5 MBq	
Alpha emitting nuclides	0.1 MBq	

Solid low level waste

Decommissioning/routine Waste:

Disposal route: (1). **Continued** disposal to the low level waste facility at Drigg; or
(2). **Proposed** disposal to a suitably licensed facility for the purpose of disposal

Radionuclide	Proposed Annual Limit	Annual volume, m3
Uranium	0.5 GBq	1800
Radium-226/Thorium-232	0.1 GBq	
Other alpha	10 GBq	
Carbon-14	4.0 GBq	
Iodine-129	0.05 GBq	
Tritium	25 GBq	
Cobalt-60	75 GBq	
Other beta/gamma	800 GBq	

Surface contaminated metal.

Disposal route (1). **Proposed** disposal to a suitably licensed facility for the purpose of smelting.

No proposed limits.

Solid High Volume Very low level waste

Disposal route (1): **Proposed** disposal to the operator of the Lillyhall Landfill Facility in Cumbria; or
(2): **Proposed** disposal to a suitably licensed land-fill site for the purpose of disposal. .

No proposed limits, but has accumulated 500m^3.

Question: Do you have any comments on the proposed Authorised Limits or disposal routes (where identified)?

3.4 Determination Process

SEPA will consider the application and arrive at its decision on whether or not to grant an authorisation giving consideration to the following:

1. Details contained in the application;

2. Responses from consultees and members of the public;

3. Further information that SEPA may have sought from the applicant;

4. Findings of SEPA inspections carried out at the applicant's premises;

5. Government Policy (including that contained in Cm 2426[2], Cm2919[3] and the Policy Statement on long term management of LLW in the UK[4]);

6. The UK strategy on the discharge of radioactive waste[5] and Statutory Guidance[6] ;

7. Data relating to disposals of radioactivity from the site;

8. Habits survey data;

9. Environmental monitoring data and assessment; and

10. The Radioactive Substances (Basic Safety Standards) (Scotland) Direction 2000 including assessment of doses to members of the critical group* in the vicinity of the site.

* (Some members of the public close to nuclear installations are assumed to receive higher doses than other members of the population. This is due to their higher than average consumption of certain foodstuffs (as established by habits surveys), frequenting certain areas or living in close proximity to the site. In predicting radiological impacts to man, the concept of critical group is used. For a given source of radioactive discharges, this is the small number of members of the public who are likely to receive the highest radiation dose as a result of that source. By ensuring that the critical group is not exposed to unacceptable levels of radiation as a result of discharges, the wider population is also protected. Critical group methodology is used in two ways: *prospectively* to estimate the radiation dose that will be received by the critical group; and *retrospectively* to determine the actual dose that was received.)

SEPA will take cognisance of any changes to government policy, legislation, European Directives, etc, that occur during the period over which the application is determined.

If SEPA is minded to grant an authorisation, then the conditions and limitations of that authorisation will be set having due regard to any comments received during the consultation and any further information that SEPA may seek as part of its determination process.

If an authorisation is granted as a result of this application it would be SEPA's intention to revoke the existing authorisations listed in section 3.2 and issue a new authorisation. This would be based upon SEPA's standard authorisation for nuclear sites. A copy of this is given in **Paper 3**. It should be noted that SEPA has recently updated this template and in

[2] Sustainable Development: The UK Strategy. Cm2426. HMSO 1994
[3] Review of Radioactive Waste Management Policy: Final Conclusions (Cm2919). HMSO. July 1995.
[4] 2007. See www.defra.gov.uk
[5] UK Strategy for Radioactive Discharges 209 – 2030
[6] Environment Act 1995. The UK Strategy for Radioactive Discharges. Statutory Guidance. 2008

particular has changed the way in which the disposal of low level waste by transfer from the premises is specified. This is supported by a SEPA Policy Statement which is given as **Paper 4**. In essence the disposal of LLW will be authorised to any holder[7] of a suitable permit under the Environmental Permitting (England and Wales) Regulations 2010 or Authorisation under the Radioactive Substances Act 1993 (a waste permitted person). This approach to authorising the disposal of waste is intended to aid the implementation of the Governments UK strategy for the management of solid low level radioactive waste from the nuclear industry (see section 4.1.3 and 4.1.4).

Question: Do you have any comment on SEPA's standard authorisation for issue to nuclear sites – Paper 3?

Periodically it may be necessary to make changes to the authorisation. In cases where this is not relaxing the limits and conditions contained within the authorisation then SEPA would not propose carrying out public consultation. Within the authorisation SEPA will give consideration to setting a total limit on the amount of radioactivity that can be disposed direct to the environment. Subsidiary limits to underpin and drive BPM may be placed upon some parts of the nuclear site. In cases where increases in the total radioactivity to be disposed direct to the environment are proposed or a relaxation of a condition is proposed then SEPA would undertake discretionary and public consultation. If it was proposed to increase a subsidiary limit or to include for example a new facilities gaseous release point but where the overall site Annual Limit is not increased then SEPA would propose to carry out statutory consultation only. In cases where further restrictions for regulatory purposes were considered necessary then SEPA would only carry out statutory consultation. If public consultation was carried out for every change then delays in decommissioning or improving regulation may occur. SEPA does not believe there is any benefit in such delays.

Question: Do you have any comment on SEPA's proposals for dealing with future changes to the authorisation?

[7] The Environment Agency has already made similar changes to its permits.

4 DETERMINATION CONSIDERATIONS

SEPA is required to carry out its regulatory duties in accordance with legislation, taking account of Government policy, SEPA's own principles for open, fair and consistent regulation and the over-riding principles of radiological protection. Policy is set out in a variety of documents and a number of these are summarised below to outline the framework within which SEPA operates when considering applications for authorisation under RSA93.

4.1 Policy and Legal Considerations

4.1.1 Sustainable Development

The UK Sustainable Development Strategy was updated in 2005 with the publication by the Government of *The UK Government's Sustainable Development Strategy* (March 2005), Cm 6467. This states that "*Our [UK] Strategy for sustainable development aims to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations*" and introduces five guiding principles. These are:

• Living Within Environmental Limits
Respecting the limits of the planet's environment, resources and biodiversity – to improve our environment and ensure that the natural resources needed for life are unimpaired and remain so for future generations.

• Ensuring a Strong, Healthy and Just Society
Meeting the diverse needs of all people in existing and future communities, promoting personal wellbeing, social cohesion and inclusion, and creating equal opportunity for all.

• Achieving a Sustainable Economy
Building a strong, stable and sustainable economy which provides prosperity and opportunities for all, and in which environmental and social costs fall on those who impose them (polluter pays), and efficient resource use is incentivised.

• Using Sound Science Responsibly
Ensuring policy is developed and implemented on the basis of strong scientific evidence, whilst taking into account scientific uncertainty (through the precautionary principle) as well as public attitudes and values.

• Promoting Good Governance
Actively promoting effective, participative systems of governance in all levels of society – engaging people's creativity, energy and diversity.

These principles[8] underpin the 2004 Statutory Guidance issued to SEPA.

4.1.2 Review of Radioactive Waste Management Policy

Government Policy on the management of radioactive waste in Scotland is set out in a number of policy documents including the Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom 26 March 2007 and Scotland's Higher Activity Radioactive Waste Policy 2011.

[8] Scottish Executive (2004). The Scottish Environment Protection Agency and Sustainable Development, Statutory Guidance to SEPA made under Section 31 of the Environment Act 1995. Paper 2004/21.

In addition to these documents the government has also published revisions to the Cm2919 policy statements dealing with decommissioning in their document entitled "*The decommissioning of the UK nuclear industry's facilities, 2004*"

4.1.3 Low Level Waste Policy

The Low Level Radioactive Waste Policy 2007 (LLW Policy) provides a statement of UK Government and devolved administrations' policy for the long term management of the UK's solid low level radioactive waste. This policy statement amends or replaces relevant parts of the 'Review of Radioactive Waste Policy: Final Conclusions (Cm2919)

For the purposes of minimising the arising of radioactive waste the policy states:

> "*To ensure that arisings of LLW and the requirements for its disposal are minimised, LLW managers should plan to manage their waste in accordance with the waste management hierarchy principles set out in UK waste strategy document*[9]*. For LLW this means:*
>
> *not creating waste where practicable ("avoidance");*
> *reducing waste arisings (both by activity and by mass) to the minimum through the appropriate design and operation of processes and equipment and making effective use of techniques such as waste characterisation, sorting and segregation, volume reduction and surface contamination removal;*
> *otherwise minimising quantities of LLW requiring disposal through decay storage, re-use and/or recycling, and incineration (under appropriately regulated circumstances);*
> *disposal (which may, for some waste forms, include incineration)."*

The Government went on to say:

> "*Preparation of plans for the management of LLW must be based on an assessment of all practicable options for its long term management. Any implementation of options under this policy will be subject to a satisfactory risk assessment and optimisation study, as required by relevant regulatory bodies. Government believes that disposal to an appropriately engineered facility, either below or above ground, with no intent to retrieve should be the end point for LLW that remains following the application of the waste hierarchy. This position is held on the basis that new disposal facilities will be of sufficiently robust design such that risks to the public in the future will be within the post-closure risk target, and therefore that postponing final disposal to future generations is unjustified. With regard to LLW and VLLW disposal to landfill, Government sees no reason to preclude controlled burial of radioactive waste from nuclear sites from the list of options to be considered in any options' assessment, provided the necessary safety assessments can be carried out to the satisfaction of the environmental regulators This supersedes paragraph 117 of Cm2919*".

The Government then confirmed the role of the Nuclear Decommissioning Authority:

> "*Government wishes to ensure that there are disposal routes available for the long term management of LLW arisings from both the nuclear and non-nuclear industries in the UK, including Ministry of Defence LLW. Under the Energy Act 2004, the NDA has direct responsibility for the UK's civil public sector nuclear liabilities. Wherever appropriate and practicable, the NDA will also make LLW management and disposal facilities available to other nuclear and non-nuclear industry managers of radioactive*

[9] NDA Strategy, Nuclear Decommissioning Authority, 2006.

waste, on the basis of suitable commercial terms. These arrangements will appropriately complement other forms of LLW disposal provision by other organisations, e.g. landfill and incinerator operators".

4.1.4 UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry

In 2009 the Government consulted on a draft strategy for the management of solid low level radioactive waste from the nuclear industry[10]. This identified a need for flexibility in the approach to managing radioactive waste.

SEPA responded to the consultation and in respect to flexibility stated:

> "*SEPA notes that the Strategy refers to the UK Government policy in having flexibility in managing solid LLW radioactive wastes. The LLW Repository Limited has recently been granted a change to their RSA 93 authorisation that will allow the transfer of metallic LLW from their site to the Metals Recycling Facility (MRF) at Lillyhall, operated by Studsvik UK Limited, for treatment (including decontamination) to enable recycling of the metal, with remaining radioactive wastes being returned to the LLWR for disposal. SEPA supports this flexibility in waste management arrangements and is to undertake work to consider how best to regulate transfer of radioactive waste for treatment and subsequent disposal within the UK"*.

In England to support the introduction of the Environmental Permitting Regulations the Department of Energy & Climate Change published[11] draft guidance to the Environment Agency. This guidance stated that:

> "*For solid waste disposals to another permitted operator, it is no longer necessary in most cases to specify in the permit the specific site at which the waste will ultimately be disposed of. Permits can allow transfer to any site where the operator of that site holds a permit to accumulate or dispose of the relevant type of waste. Records of waste transfers must be kept by both the consignor and the receiving site operator*."

In 2010 the Government published[12] The UK strategy for the management of solid low level radioactive waste from the nuclear industry which was developed to reflect and implement Government Policy. The aim was to provide a high level framework within which low level radioactive waste (LLW) management decisions could be taken flexibly to ensure safe, environmentally acceptable and cost-effective management solutions that reflect the nature of the LLW concerned. The guidance stated that:

> "*To deliver this aim, three strategic themes have guided the development of this strategy:*
>
> *I. the waste hierarchy;*
> *II. the best use of existing LLW management assets;*
> *III. and the need for new fit-for-purpose waste management routes.*

[10] UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry, Consultation Document June 2009

[11] Environmental Permitting. Environmental permitting guidance Radioactive Substances Regulation (RSR) For the Environmental Permitting (England and Wales) Regulations 2010. Draft guidance for Consultation – May 2009. DECC.

[12] UK strategy for the management of solid low level radioactive waste from the nuclear industry. NDA 2010.

The strategy is to apply the waste hierarchy more effectively to the management of LLW. We have set out the preference for managing LLW at higher levels of the hierarchy, which will mean a move away from the past focus on disposal. In turn, this will make the best use of the Low Level Waste Repository (LLWR) and ensure the UK's capacity for the management of LLW. Being able to manage the UK's LLW is vital for the nuclear industry, plant operation, decommissioning, power generation (existing and new) and also for other LLW producers, such as hospitals and universities.
Where the preference for higher levels of the waste hierarchy cannot be met and disposal is necessary, it must be optimised to minimise the overall impact of LLW management on people and the environment. We believe that:

- *Waste prevention is a fundamental principle for the operation and decommissioning of nuclear facilities*
- *There are resource and cost benefits in minimising the amount of LLW we have to manage*
- *Reuse defers waste production and extends the life of resources*
- *Recycling is the preferred way forward for the treatment of metallic LLW*
- *Volume reduction ensures best use of disposal capacity*
- *Disposal capacity is a precious resource and it must be used sparingly and as a last resort*

The LLW Strategy requires that managing LLW should not be separated from managing other radioactive wastes and non-radioactive wastes (Controlled wastes) and implementation will require an integrated waste management approach. LLW producers and managers should develop plans for the management of LLW that are informed by the waste hierarchy, the proximity principle and the need for early solutions. Affordability will be a key consideration in the implementation of the strategy. It will be crucial that lifecycle environmental and social benefits of managing waste at higher levels of the waste hierarchy are compared with direct disposal. Decision making should be supported by sound business cases to identify the most advantageous option and should be completed in an open and transparent manner. To make suitable arrangements in the determination of treatment and disposal routes, robust decision making and early dialogue with communities affected by waste management activities are needed and should consider all viable options. This may include in-situ disposal; development of new facilities on or adjacent to sites to manage waste from that site; or extended to manage waste from a number of sites; or the development of facilities away from nuclear sites. There is considered to be sufficient capability in the nuclear estate (including the supply chain) for the provision of waste management, treatment and disposal services and the strategy proposes continued utilisation of this capability rather than investment in centralised facilities in the near term.
However, the strategy does report the need for robust information to underpin these assessments (i.e. volume and radioactivity content and forecast arisings). The strategy presents the drivers for continual improvement in quality of information, principally the need to continually assess the availability of capacity for managing the waste.
The amounts of waste we think will arise in the future mean that we need to change the way we manage it. The consultation on this strategy told us that people want to reduce the environmental impact of LLW management, which means closer alignment with the way other industry manages its wastes and moving away from relying on disposal. The strategy sets out how we will ensure the UK's continued capability and capacity through avoiding generating waste, reusing materials and recycling LLW based on robust information and transparent decision making processes. The LLW Repository, where the majority of UK LLW waste is disposed, is

central to the strategy and it is important that we preserve the capacity at the site and use it wisely. All disposal capacity is a precious resource; it should be used sparingly and as a last resort".

4.1.5 Import and Export of Low Level Waste

The LLW Policy 2007 also sets out Government policy on the import and export of LLW. Relevant sections are reproduced below.

> *"Paragraph 28 of the LLW Policy concerns the Transfer of radioactive waste across national boundaries, which is regulated under the Transfrontier Shipment of Radioactive Waste and Spent Fuel Regulations 2008. The regulations require prior notification and approval by the environmental regulators before any radioactive waste can be exported from, or imported to, the UK. In recognition that technologies for the recycling of certain materials within radioactive waste have advanced over recent years, and that Cm2919 was not written with large scale decommissioning in mind, Government policy on import and export of LLW has been modified as set out below and these modifications now amend, for LLW, the provisions of paragraphs 145 and 146 of Cm2919 (ref 3).*
>
> *Paragraph 29 of the LLW Policy state that the export of LLW to other OECD (Organisation for Economic Co-operation and Development) and EU (European Union) countries may only be authorised or consented to by the competent UK authority in light of an assessment of all practicable options, and should not be permitted except:*
>
> - *for the recovery of re-useable materials; OR*
> - *for treatment that will make its subsequent storage and disposal more manageable.*
>
> *In all cases where such processes would add materially to the wastes needing to be disposed of in the country of destination, the presumption should be that they will be returned to the UK, to a timescale agreed by regulators and competent authorities (as defined in the Transfrontier Shipment Regulations) in the UK and in the country of destination.*
>
> *Paragraph 30of the LLW Policy states that the import of LLW from other countries may only be authorised or consented to by the competent UK authority in light of an assessment of all practicable options, and if it complies with EU and UK legislation and any associated Government guidance provided to the competent UK authority, and should not be permitted except:*
>
> - *for the recovery of re-useable materials; OR*
> - *for treatment that will make its subsequent storage and disposal more manageable.*
>
> *In all cases where such processes would add materially to the wastes needing to be disposed of in the UK, the presumption should be that they will be returned to the country of origin to a timescale agreed by regulators and competent authorities in the UK and in the country of origin".*

4.1.6 Scottish Higher Activity Waste Policy

The Scottish Government published its Policy for Higher Activity Radioactive Waste (HAW) on 20 January 2011. The Policy is for the long-term management of HAW in near-surface facilities. Facilities should be located as near to the site where the waste is produced as possible. Developers will need to demonstrate how the facilities will be monitored and how

waste could be retrieved. All long-term waste management options will be subject to robust regulatory requirements.

It should be noted however that the Policy does not apply to radioactive waste which has already been dealt with under the policies of previous governments. This includes radioactive waste which is the subject of previous or existing contractual arrangements, including waste sent to facilities outside of Scotland, such as Sellafield.

The aim of the Policy is to ensure that all activities for the long-term management of the waste are made in a way that protect the health and interests of people and the integrity of the environment now and in the future. The policy provides a framework for managing HAW in Scotland which allows for the treatment, storage and near-surface disposal of radioactive waste.

When considering long term management options for HAW the Policy requires the Waste Hierarchy to be applied. The Hierarchy requires all waste producers to consider waste management with regard to prevention, minimisation, preparation for re-use, recycling and other recovery with disposal as the final option. The Policy also requires long-term management options to take account of the Proximity Principle.

With respect to the treatment of HAW the Policy allows consideration to be given to the transport of the waste from where it arises for treatment elsewhere in the UK or some countries overseas; for the recovery of reusable materials or treatment that will make the subsequent storage or disposal of the waste more manageable. However, in all cases where such processes would add materially to the waste needing to be disposed of in a country of destination, including in other parts of the UK, the presumption should be that waste will be returned to Scotland, to a timescale agreed by regulators and competent authorities in Scotland and in the country of destination.

Scottish Government recognised that the policy on its own was not sufficient to define the national requirements for radioactive waste management facilities in Scotland. Hence Scottish Government has now launched a programme of work to implement this policy working closely with a range of stakeholders including regulators and the NDA. SEPA understands that this programme of work will be looking at a range of management options and the need for suitable facilities located across Scotland. Scottish Government's HAW Policy Implementation project will be the main vehicle for defining the national need and identifying suitable locations for such waste management facilities.

4.1.7 Best Practicable Environmental Options and Best Practicable Means

Within the context of radioactive waste management, there is a close relationship between implementation of Best Practicable Environmental Option (BPEO) and Best Practicable Means (BPM). In essence BPEO can be used at a strategic level for identifying the best option for managing and treating radioactive waste and BPM requires an optimum level of protection to be chosen and then utilised to its best advantage in minimising the generation and release of radioactive waste.

4.1.7.1 Best Practicable Environmental Option (BPEO)

BPEO is defined in Cm 2919 as:

> '*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 risks, the environmental impacts, the costs and the social implications'*

The application of the concept of Best Practicable Environmental Option (BPEO) forms one aspect of the regulatory response of SEPA to the optimisation principle formulated by the International Commission on Radiological Protection (ICRP). This principle seeks radiation doses to people that are "as low as reasonably achievable" (ALARA), economic and social factors being taken into account.

The Royal Commission on Environmental Pollution (RCEP). RCEP provided the following definition of BPEO in its Twelfth Report (RCEP, 1988):

> *"…the outcome of a systematic and consultative decision-making procedure which emphasises the protection and conservation of the environment across land, air and water. The BPEO procedure establishes, for a given set of objectives, the option that provides the most benefit or least damage to the environment as a whole, at acceptable cost, in the long term as well as in the short term."*

As the BPEO concept has been developed in the UK, it has generally been applied to decisions where a strategic choice between different approaches to managing environmental impact is required. An element of stakeholder input to the process, coupled with transparency regarding data and assumptions, are also generally considered integral to the BPEO concept, which is particularly suited to exploring the impact of different perspectives on the eventual decision.

The key characteristics of BPEO assessments identified and advocated by RCEP are generally regarded as definitive, and include the following:

- The process is essentially strategic – it is geared towards identifying a preferred overall strategy from the perspective of the environment as a whole, as opposed to detailed optimisation of the selected scheme;
- A structured and systematic process is used to identify and compare strategic options. The presumption is that a BPEO assessment will generally be an open and transparent process, documented to make explicit the reasoning, data and assumptions;
- Alternatives should be evaluated in terms of their projected implications for environmental quality. Consideration also needs to be given to questions of practicability (including financial costs and/or benefits, as well as wider social and economic considerations), as well as the overall strategic objectives, in order to reflect the wider context in which the decision is being taken;
- The process should involve consideration of environmental effects in both the short term and the long term, requiring consideration to be given to the relative importance of different indicators of environmental performance (e.g. short-lived versus persistent pollutants);
- Effects on the environment are not necessarily restricted to direct emissions of pollutants to land, air and water from the process (or activity) itself; life cycle considerations (such as energy demand) may also have a part to play in the decision process.

There is an accent on consultation as an integral part of the assessment process – an informed assessment of alternatives necessarily involves taking into account the values and perspectives of a range of stakeholders.

4.1.7.2 Best Practicable Means BPM

BPM is defined in Cm 2919 as:

> *'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. In determining whether a particular aspect of the proposal represents the BPM, the Inspectorates will not require the applicant to incur expenditure, whether in money, time or trouble, which is disproportionate to the benefits likely to be derived'.*

SEPA has a duty to ensure that all exposures to radiation are kept as low as reasonably achievable, taking into account economic and social factors. SEPA has set out[13] how the concept of BPM is used to satisfy the ALARA principle. This is achieved by placing three key requirements into authorisations for the disposal of radioactive waste which require:

- The use of BPM to minimise the radioactivity of and volume of radioactive waste generated;
- The use of BPM to minimise the total radioactivity in radioactive waste that is discharged to the environment; and
- The use of BPM to minimise the radiological effects of any radioactive waste discharges on the environment and members of the public.

Additionally the concept of BPM is used to ensure that all operations carried out at the Authorised premises are conducted within this framework for instance in carrying out radiochemical analysis or taking measurements and samples or in the operation and maintenance of equipment.

The requirement to keep all radiation exposures as low as reasonably achievable, taking into account social and economic factors applies over and above the requirement to control doses to individuals in accordance with the specified dose limits. The qualification that economic and social factors should be taken into account in any assessment of what is reasonably achievable means that all practices that give rise to exposure to radiation must be examined carefully to see what might be done to reduce exposure, but that in deciding whether any particular measures should be used a correct balance must be achieved between the benefit to be derived from those measures and their cost (not only in monetary terms). This does not mean that the decision on what level of protection should be achieved should be taken on the basis of readily quantifiable factors only. The international standards include the requirement to take social factors into account and this recognises the importance of considerations, which cannot be quantified in the process of establishing the appropriate level of protection. When applied to waste disposal, such considerations might include general policies for environmental protection as well as public perceptions of the importance of such matters. However, it is fundamental to the control procedure that measures should not be required which involve costs grossly disproportionate to any benefits likely to be achieved. This is recognised in SEPA's authorisation within the definition of how BPM is to be applied as well as the ongoing duty of the Authorisation Holder to use BPM at all times.

BPM is given the following meaning within SEPA's authorisation (consistent with the various definitions of Best Available Techniques) as follows:

[13] Satisfying the ALARA requirement and the role of Best Practicable Means. SEPA 2010.

(a) In determining whether particular means are the "best practicable" for the purposes of this Authorisation, the Authorisation Holder shall not be required to incur expenditure whether in money, time or trouble which is, or is likely to be, grossly disproportionate to the benefits to be derived from, or likely to be derived from, or the efficacy of, or likely efficacy of, employing them, the benefits or results produced being, or likely to be, insignificant in relation to the expenditure.

Where reference is made to the use of "best practicable means" in this Authorisation, the terms "best", "practicable" and "means" have the following meaning:

"Best" – means the most effective techniques for achieving a particular objective having due regard to technological advances (state of the art) and changes in scientific knowledge; and understanding.

"Practicable" – indicates that the "means" under consideration should only be selected following an optimisation process that includes consideration of the technical viability including comparable processes, facilities or methods of operation which have recently been successfully tried out and takes into account social and economic costs and benefits.

"Means" – includes technology, the way that installations / plant is designed, built, maintained, operated and decommissioned and wider management arrangements.

(c) The social and economic costs and benefits that should be taken into account in the optimisation process used to decide what is practicable includes (where relevant);

- *economic costs*
- *social benefits*
- *radiological exposures to the public*
- *occupational radiological exposures*
- *radiological impact on the environment*
- *conventional safety*
- *consistency with the waste hierarchy*
- *impact of the non-radioactive properties of radioactive waste*
- *the generation and associated impact of non-radioactive wastes, including climate change emissions*
- *the proximity principle*
- *applicable government policy*

4.1.8 UK Strategy for Radioactive Waste Discharges (OSPAR)

At the 1998 Ministerial meeting of the Oslo and Paris (OSPAR) Commission, contracting parties to the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic agreed a Strategy with regard to Radioactive Substances. The strategy was endorsed in a Ministerial Declaration, signed by the UK and other OSPAR contracting parties. The aims of the strategy are:

progressive and substantial reduction of radioactive discharges and discharge limits to achieve strategy targets for identified sectors;
progressive reduction of human exposure to ionising radiation arising from radioactive discharges, as a consequence of reductions in discharges, such that a representative member of a critical group of the general public will be exposed to an

estimated mean dose of no more than 20 microsieverts a year from liquid radioactive discharges to the marine environment made from 2020 onwards;
progressive reduction of concentrations of radionuclides in the marine environment resulting from radioactive discharges, such that by 2020 they add close to zero to historic levels.

Following public consultation in June 2000, the Government produced the UK strategy for radioactive discharges 2001-2020[14] in July 2002 (updated in 2009). The strategy describes how the Government and the devolved administrations will implement the OSPAR strategy with regard to Radioactive Substances. Statutory guidance on OSPAR was issued to SEPA by the Scottish Government[15] in 2008. The guidance is "high level" in nature requiring SEPA to take account of OSPAR and the UK discharge Strategy for radioactive substances when issuing authorisations. The Statutory guidance states that "*The Scottish Government considers that decommissioning of nuclear sites is an inherently justified activity. Thus, provided that discharges are minimised by the normal regulatory approach of using BPM, and the processes that they derive from are considered to be best practicable environmental option (BPEO) or equivalent, then in principle we do not think that decommissioning, when set against historic operational discharges, need compromise OSPAR commitments.*"

4.1.9 Conservation

The Conservation (Natural Habitats & Conservation) Regulations 1994 (Habitats Regulations) implement Council Directive 92/34/EC on the conservation of natural habitats and wild flora and fauna (the Habitats Directive), and pick up and strengthen the requirements of Council Directive 79/409/EEC on the Conservation of Wild Birds (the Birds Directive). The Directive aims to establish a network of the most important sites for wildlife and maintain them at favourable conservation status. The network consists of Special Protection areas (SPAs) for birds and Special Areas of Conservation (SACs) for other species and habitats. The Habitats Regulations require SEPA to be satisfied that the integrity of designated European sites (SACs and SPAs) will not be adversely affected by relevant permissions issued by SEPA.

In addition, the Nature Conservation (Scotland) Act 2004 sets out a series of measures which are designed to conserve biodiversity and to protect and enhance the biological and geological natural heritage of Scotland. In doing so, the Act provides the principal legislative components of a new, integrated, system for nature conservation within Scotland. The Act also locates the conservation of biodiversity and of Scotland's natural environment within a wider British, European and global context. In relation to biodiversity in particular, it requires public bodies and office-holders to consider the effect of their actions at a local, regional, national and international level. Measures relating to the protection of species and habitats also recognise the importance of the wider international context.

As a public body under Section 1 of the 2004 Act, SEPA is required to further the conservation of biodiversity when exercising its regulatory functions. As part of the consultation process, SEPA will identify any significant biodiversity interests that might be affected, and will take these into account in its decision-making. The 2004 Act also introduced tighter controls for the protection of Sites of Special Scientific Interest (SSSIs). These include stronger requirements for SEPA and other regulatory bodies to protect SSSIs through the implementation of regulatory regimes.

[14] UK Strategy for radioactive discharges 2001-2020, Department for Environment, Food and Rural Affairs, DEFRA Publications.
[15] Environment Act 1995. The UK Strategy for radioactive discharges, Statutory Guidance, February 2008. The Scottish Government.

To fulfil the requirements of the Directive, SEPA has adopted the ERICA[16] assessment tool. The key outputs of ERICA are dose rates and risk quotients. The risk quotient is the ratio of the predicted environmental dose rate and the benchmark dose rate assumed to be environmentally 'safe'. The default benchmark in ERICA is a screening dose rate for incremental exposure of 10 μGy h^{-1}. This value is considered to be sufficiently cautious that if it is not exceeded there would not be a deleterious affect on designated sites from the discharge.

SEPA carried out a dose assessment to non human species for disposals to air and water from the Hunterston A nuclear licensed site at the authorised limits requested in the application. The dose rates to non-human species as a result of exposure to the gaseous and liquid discharges were all predicted to be less than the screening dose rate of 10µGyh^{-1}. Therefore the exposure of non-human species to the discharges is considered to be of negligible radiological concern. The summary report is given in **Paper 5**.

4.1.10 Article 37

As a Member State of the European Union, UK activities involving radioactive substances are governed by legislation set down under the Euratom Treaty (Council Directive 80/836/EURATOM).

Article 37 of the Euratom treaty states:

> *"Each Member State shall provide the European Commission with such general data relating to any plan for the disposal of radioactive waste in whatever form as will make it possible to determine whether the implementation of such a plan is liable to result in the radioactive contamination of the water, soil or airspace of another Member State".*

It is not for SEPA to decide when submissions are required; it is for the UK Government. SEPA does however provide technical advice to Government and co-ordinates submissions in Scotland on behalf of the Scottish Government. Thus SEPA's role in the preparation of an Article 37 submission is as an intermediary between the facility operator and the Scottish Government, and includes advising the facility operator on the contents of the submission, reviewing the submission and advising the Scottish Government that the submission is complete.

An Article 37 opinion for the dismantling of the Hunterston A power station was received in October 2002. It concluded that:

> "*the Commission is of the opinion that the implementation of the plan for the disposal of radioactive waste in whatever form arising from the dismantling of the Hunterston A power station in the United Kingdom, both in normal operation and in the event of an accident of the type and magnitude considered in the general data, is not liable to result in radioactive contamination, significant from the point of view of health, of the water, soil or airspace of another Member State."*

4.1.11 Human Rights

The Scotland Act 1998 and the Human Rights Act 98 (HRA98) incorporate the provisions of the European Convention of Human Rights ("the ECHR") into Scots law. Under the HRA98, SEPA must consider whether its decisions in respect of an authorisation under RSA93 will result in any potential or actual breach of a Convention right. If SEPA does identify such a

[16] Environmental Risk from Ionising Contaminants: Assessment and Management (ERICA). CEC

breach it must then consider whether it has the discretion to act otherwise, as its primary obligation must be to fulfil its statutory duty. Where SEPA does have discretion and the Convention right at issue is not absolute, it must then consider whether its decision is justified.

4.1.12 Proximity Principle

The proximity principle has been set out by SEPA in relation to non-radioactive wastes in its publication of a National Waste Strategy for Scotland:

> *"The proximity principle requires that wastes are managed as close as possible to their point of arising and places a greater degree of responsibility on communities to deal with the wastes they produce."*

It has also been set out in relation to planning regulation in the form of National Planning Policy Guidelines:

> *"The Proximity Principle concerns the establishment of an adequate network of treatment and disposal installations to handle waste arisings as close as possible to the point of production. This encourages communities to take responsibility for locally produced household, commercial and industrial wastes."*

SEPA in its publication went on further to explain that:

> *"The application of the principle will vary according to the waste concerned, the volume of arisings, its potential environmental impact and the techniques applied to its management."*

In respect of radioactive waste, Government policy is that radioactive wastes should not be unnecessarily created, such wastes that are created should be safely and appropriately managed and treated, and that waste should be safely disposed of at appropriate times and in appropriate ways.

The LLW Policy 2007 and the HAW Policy 2011 both discuss the proximity principle with respect to managing radioactive waste. Although there is a desire expressed in these policy documents to avoid excessive transportation of waste it is important to balance this with all the other relevant factors on a case by case basis.

4.1.13 Transport

SEPA's remit in determining applications made under RSA93 does not extend to regulating the transport of radioactive material or waste. SEPA is aware that radioactive waste is routinely transported by road, rail and sea and is subject to regulation by the Office of Nuclear Regulation (ONR) an agency organisation of the Health and Safety Executive.

4.1.14 Nuclear Safety

The storage and accumulation of radioactive waste on a Nuclear Licensed Site is a nuclear safety issue. Issues[17] relating to nuclear safety at Chapelcross are a matter for the Office of Nuclear Regulation and agency organisation of the Health and Safety Executive. They have informed SEPA that "*The Hunterston A site is well into a programme of decommissioning. Much of the remaining radioactive inventory, in the form of ILW, is about to be conditioned into a safer form and stored. However, dealing with that ILW will entail the generation of*

[17] But not any disposal of radioactive waste from the storage and accumulated of radioactive waste.

further wastes for disposal, and ONR believes that the decommissioning work should not be needlessly constrained, now or in the future, by limits on the activity or volume of wastes destined for disposal". They have further informed SEPA that "*In the case of LLW and VLLW it does not seem to us that a restriction on volume that may be disposed of annually is in the interests of safety*."

4.2 SEPA's Principles for Regulation

In order to encompass the changes currently driven by the EU, UK and Scottish policy and legislation, to reflect community expectations and to progress the requirements of SEPA's Management Statement, SEPA has developed a set of principles which are expected to be reflected in both the application determination process and the authorisation itself.

The over-arching principle is that of Sustainable Development which is enshrined in SEPA's Main Aim (see Section 2) and has been described as:

> *"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs".*

Within this umbrella principle of Sustainable Development are contained five higher-level principles and five lower-level, or process, principles. The higher-level principles are:

1. Integrated Environmental Protection;
2. Efficiency and Effectiveness;
3. Polluter Pays;
4. Sound Science and Information; and
5. Precautionary Principle.

Together with the higher-level principles, the process principles are designed to produce outcomes in licensing, enforcement and routine matters that are both reasonable and achievable. These lower-level principles are:

1. Environmental Protection and Improvement;
2. Proportionality;
3. Fairness, Consistency and Legal Correctness;
4. Transparency and Accountability; and
5. Awareness Raising and Good Practice.

SEPA has incorporated all of the above principles into its procedures for determination of applications under RSA93.

4.3 Radiological Protection Principles

When considering any application to dispose of radioactive waste, SEPA is guided by the radiological protection principles recommended by the International Commission on Radiological Protection in ICRP60 and given effect within the European Community by the 13 May 1996 Council Directive 96/29/Euratom, referred to as the Basic Safety Standards Directive (BSS Directive 96). In May 2000 the Scottish Executive issued a Direction, the Radioactive Substances (Basic Safety Standards) (Scotland) Direction 2000, to SEPA specifying the duty of the Agency to observe the requirements of the Directive. For radioactive substances, the system of protection is based on three principles; (i) justification of a practice, (ii) optimisation of protection and (iii) the application of individual dose limits.

4.3.1 Justification

In accordance with EC Directive 80/836 (EURATOM 1980), Article 13 requires Member States to ensure that the exposure of a population as a whole from each activity is minimised taking into account the principle of justification set out in Article 6(a) as amended by Directive 84/467 (EURATOM 1984):

> *"the various types of activities resulting in an exposure to ionising radiation shall have been justified in advance by the advantages which they produce".*

Directive 96/29/EURATOM contains, amongst other things, a revision of the requirement to justify new classes or types of practice and limiting the consideration of detriment to radiation induced health detriment:

> *"Member States shall ensure that all new classes or types of practice resulting in exposure to ionising radiation are justified in advance of first being adopted or first approved by their economic, social or other benefits in relation to the health detriment they may cause" ;*
>
> and
>
> *"existing classes or types of practice may be reviewed as to justification whenever new and important evidence about their efficacy or consequence is acquired"*

The requirement that practises resulting in exposure to ionising radiation need to be justified became a part of UK law on the 2nd of August 2004 when The Justification of Practices Involving Ionising Radiation Regulations 2004 came into force. Regulation 6 defines the relevant "Justifying Authority", which takes justification decisions and performs most of the functions under the Regulations. The "Justifying Authority" in Scotland is Scottish Ministers. These regulations also make provision for the maintenance of a register of justification decisions; this register along with a list of existing practices can be found on the Department of Environment Food and Rural Affairs (DEFRA) justification web pages.

4.3.2 Optimisation

The principle of optimisation of dose or risk is derived in Council Directive 96/29/EURATOM from the recommendations of the ICRP and has been enshrined in European Directives, (EC Directive 80/836, 84/467 and 96/29/Euratom). ICRP 60 states the principle as:

> *"In relation to any particular source within a practice, the magnitude of individual doses, the number of people exposed, and the likelihood of incurring exposures where these are not certain to be received should be kept as low as reasonably achievable, economic and social factors being taken into account."*

The requirement to keep all radiation exposures as low as reasonably achievable, taking into account social and economic factors applies over and above the requirement to control doses to individuals in accordance with the specified dose limits. The qualification that economic and social factors should be taken into account in any assessment of what is reasonably achievable means that all practices that give rise to exposure to radiation must be examined carefully to see what might be done to reduce exposure, but that in deciding whether any particular measures should be used a correct balance must be achieved between the benefit to be derived from those measures and their cost (not only in monetary terms). This does not mean that the decision on what level of protection should be achieved should be taken on the basis of readily quantifiable factors only. The international standards include the requirement to take social factors into account and this recognises the

importance of considerations which cannot be quantified in the process of establishing the appropriate level of protection. When applied to waste disposal, such considerations might include general policies for environmental protection as well as public perceptions of the importance of such matters. However, it is fundamental to the control procedure that measures should not be required which involve costs grossly disproportionate to any benefit likely to be achieved.

4.3.3 Dose Limits and Constraints

Exposure to ionising radiation can cause cancer and hereditary defects. The higher the radiation dose the greater the likelihood or risk that a cancer or hereditary defect will develop. But, apart from very high levels of radiation dose, there is no certainty that an individual exposed to radiation will suffer a health effect. The dose/risk relationships have been determined by studies on various groups that have been exposed to radiation, predominantly survivors of the atomic bombs in Japan and certain medical patients.

There is little evidence that very low doses of radiation can cause harm. However, the approach taken in radiation protection errs on the side of caution by assuming that there is no dose so low that it cannot potentially cause harm and there is no absolutely safe threshold of radiation dose below which the risk may approach zero. In the present state of knowledge it is appropriate to assume an increasing risk with increasing dose. This approach is accepted by the ICRP and by national bodies like Health Protection Agency (formerly NRPB) in the UK.

The Radioactive Substances (Basic Safety Standards) (Scotland) Direction 2000 requires SEPA when discharging its functions in relation to the disposal of radioactive waste under RSA93 to ensure that the dose limits for members of the public set out in Article 13 of Council Directive 96/29/EURATOM are not exceeded. The dose limit is set at 1 milliSievert in a year (excluding medical irradiation) which is estimated to equate to a risk of death from fatal cancer of 1 in 20,000. The Direction to SEPA also requires that the contribution to public dose arising from the authorised radioactive discharges of any one new nuclear installation should be constrained to a maximum of 0.3 milliSieverts in a year which equates to a risk of approximately 1 in 66,000. In addition where a number of nuclear facilities are adjacent, possibly owned by different organisations, an overall site constraint of 0.5 milliSieverts (a risk of 1 in 40,000) will be applied. Additionally SEPA is required to ensure that reasonable steps are taken such that the contribution to the exposure of the population as a whole from practices is kept as low as reasonably achievable, economic and social factors being taken into account.

A prospective dose assessment was carried out by the Food Standards Agency and this is given in **Paper 6**.

The contribution to the critical group dose for comparison with dose limits is given in the table below.

Pathway	Annual Dose, microSieverts per year
Critical group prospective	190 (0.06 from terrestrial pathways)
Marine critical dose retrospective[18] (from 2010 disposals	<5
Terrestrial Critical group retrospective (from 2010 disposals)	8
Total individual dose all sources retrospective	67 (dominated by radiation shine)

[18] RIFE-16 Radioactivity in Food and the Environment, 2012.

The prospective dose to the critical group of 190 microSieverts is below the dose constraint of 300 microSieverts.

The indicative effects of disposals from the Sellafield site combined with past disposals from the Hunterston A site can be estimated from the results of SEPA's environmental monitoring programme. The latest results are for the year 2010 and published in the Radioactivity in Food and the Environment series of reports (RIFE-16). For marine groups the estimated annual dose is <5 microSieverts. Combining the retrospective marine critical group dose with the prospective dose (190 microSieverts) indicates that the dose to the most exposed adults is below the overall site constraint of 500 microSieverts.

Habit surveys have not indicated that the effects of liquid and gaseous disposals are wholly additive. However, if they are considered together the combined dose is 13 microSieverts. The radiological assessment of the impact of discharges at the proposed annual limits indicate that when the effects of historic disposals and direct irradiation are taken into account the total annual dose to the representative critical group is about 0.26 milliSieverts (260 microSieverts). This is below the 1 milliSievert public dose limit.

5. RADIOACTIVITY AND RADIATION UNITS AND QUANTITIES

Radioactivity may be defined as the process of disintegration or transformation of unstable atoms which leads to the emission of ionising radiations. The unit used to express the quantity of radioactivity present is the becquerel. One becquerel (Bq) is equal to the disintegration or transformation of one atom every second. One becquerel is a small quantity of radioactivity and it is normal to deal in large multiples such as those listed below.

kilobecquerel (kBq) .....one thousand (10^3) becquerels

megabecquerel (MBq).....one million (10^6) becquerels

gigabecquerel (GBq).....one billion (10^9) becquerels

terabecquerel (TBq) .....one thousand billion (10^{12}) becquerels

The basic unit of radiation dose is the gray (Gy). This is a unit of absorbed dose and is a measure of the amount of energy deposited in a material, such as tissue, by radiation passing through it. When passing through tissue some radiations deposit their energy in a more biologically harmful way than others. In order to take account of this effect a unit of dose equivalent known as the sievert (Sv) is used. The sievert is related to the gray by a simple weighting factor for each type of radiation. One sievert is a large unit of radiation dose. Radiation doses to members of the public are usually measured in small fractions of a sievert such as those listed below.

millisievert (mSv) .....one thousandth (10-3) of a sievert

microsieverts (μSv).....one millionth (10-6) of a sievert