Decision Document

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Proposed decision for the future regulation of disposals of radioactive waste from British Nuclear Fuels plc Sellafield

Radioactive Substances Act 1993

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Preface

Proposed Decision for the future regulation of disposals of radioactive waste from British Nuclear Fuels plc Sellafield

In April 2000, the Environment Agency started to review all six current authorisations for the disposal of radioactive waste from BNFL's Sellafield site. BNFL Sellafield is the largest and most complex nuclear site in the UK and is one of the principal sources of radioactive discharges. Any review of the site is therefore of great significance and interest to a broad range of stakeholders.

This review was probably the most comprehensive and thorough nuclear authorisation reviews ever carried out by the Environment Agency. It has been characterised by its openness and wide ranging approach. The Agency consulted first on the scope of the review and the methods to be employed in carrying it out, and then consulted on the technical review and proposals.

We were pleased to see the interest and response showed by many diverse organisations in the UK and overseas. We would like to thank all those who responded with comments.

As the third and final stage of this review, this document sets out the Agency's proposed decisions, having taken into account the responses to the public consultation. The document will be submitted to the Secretary of State for Environment, Food and Rural Affairs and the Secretary of State for Health, to enable them to decide whether they wish to exercise their statutory powers to intervene on the Agency's decisions, or whether they agree with the Agency that these decisions and improvements to environmental protection should be implemented as soon as possible.

Our decisions provide a significant framework of limits and authorisation conditions, which substantially reduce the amount of radioactivity BNFL will be allowed to dispose of to the environment, and strengthens regulatory controls. The decisions result in:

- reductions to 8 out of 10 of aerial and half of liquid discharge limits from the Sellafield site thus ensuring that doses to the most exposed members of the public from aerial and liquid discharges at the proposed limits are controlled further below the legal dose limit;
- significant reduction in 'headroom' or margins between limits and expected levels of discharges;
- no increases in discharge limits above the current limits;
- control of discharges from individual plants as well as the site as a whole;
- new best practicable means (BPM) conditions;
- a new, single integrated certificate of authorisation for regulating waste disposals to air, sea and land from Sellafield;
- new conditions requiring BNFL to have management systems, organisational structure and resources to achieve compliance with the authorisation; and
- a significant programme of environmental improvements.

Our decisions set the foundations for a cleaner future, partly by enabling BNFL to continue to clean up the legacy of waste from Sellafield's industrial past, within a tighter and more focused regulatory control framework. The benefits of these decisions on the future regulation of radioactive waste disposal from Sellafield are:

- reduced permitted radioactive discharges, and consequently reduced potential prospective doses to the most exposed members of the general public, by 25–35% for discharges made at the proposed limits. The Agency recognises that current annual discharges for certain radionuclides are significantly less than the existing limits;

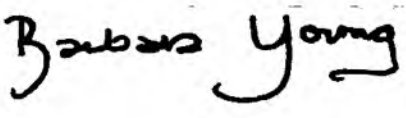
- potential savings in collective doses, average doses to members of the public and to the most exposed members of the public living in coastal communities bordering the Irish Sea;
- reduced potential environmental impact of discharges on ecosystems and wildlife species;
- minimisation of the headroom between discharges and limits by ensuring that the proposed decisions are consistent with the Government's draft Statutory Guidance to the Agency on the regulation of radioactive discharges into the environment from nuclear sites;
- reduction in the overall radionuclide limits for liquid discharges as a first step toward the progressive reduction in such discharges into the Irish Sea consistent with the Government's finalised UK Strategy for Radioactive Discharges 2001–2020;
- strengthening of the conditions to use best practicable means (BPM) by requiring waste minimisation at source, which will maintain downward pressure on waste disposals below the limits imposed by the authorisation and will minimise the environmental and radiological impact;
- provision of a more transparent approach to the regulation of the site;
- improvement in the routine regulation of the site; and
- regulation of radioactive discharges from individual plants at Sellafield in line with the regulation of discharges from facilities on other nuclear sites and non-radioactive discharges from plants on major industrial sites in England and Wales.

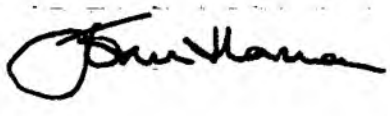
In addition, while the decisions require BNFL to give a higher priority to environmental performance, they do not involve disproportionate cost to BNFL in implementing the decisions and will not constrain:

- the operation of the Magnox Reprocessing Plant and hence BNFL's ability to meet the projected date of 2012 for the closure of the plant;
- the operation of THORP;
- BNFL's progress in treating historic legacy wastes into a safe passive form suitable for long-term storage and ultimate disposal; and
- BNFL's decommissioning programmes for redundant plants.

In summary, the Agency's proposed decisions make an important contribution to the Government's policy and commitments for substantial reductions in discharges from the UK nuclear industry. The Agency is forwarding the decisions on the Sellafield authorisations to Ministers and we commend it to them.

Signed





Barbara Young

Sir John Harman

Contents

1.0 Introduction

1.1 This document sets out in detail the outcome of the Agency's review of the authorisations for radioactive waste disposal from BNFL Sellafield. The Agency's decisions from the review are included in Section 5 of this document and in a separate Summary Document which also includes a summary of the overall benefits of the proposed decisions.

1.2 The review has addressed all of the current authorisations, for the discharge of liquid (aqueous) and aerial (gaseous) radioactive wastes and for disposal of solid waste from the Sellafield site. In February 2000 the Agency published its plans for a re-examination of the authorisations granted to BNFL Sellafield under the Radioactive Substances Acts of 1960 and 1993.

1.3 The plans for the Sellafield review were set out in a Scope and Methodology document on which public comment was sought. In August 2000 the Agency responded to comments received.

1.4 The Agency undertook an initial review of the Sellafield authorisations and set out its proposals resulting from this review in an Explanatory Document (ED). On 30 July 2001, the Agency began a four-month wide-ranging public consultation on these proposals, which ended on 3 December 2001.

1.5 The ED explained that, after careful consideration of all responses to the consultation, the Agency would reach its proposed decisions. It stated that the Agency would then prepare and publish a further document (the present Decision Document - DD) setting out its proposed decisions.

1.6 This DD sets out and explains the Agency's proposed decisions having taken account of all responses to the public consultation. It will be submitted to the Secretary of State for Environment, Food and Rural Affairs and the Secretary of State for Health to enable them to decide whether they wish to exercise their statutory powers to issue directions to the Agency on the proposed decisions.

1.7 Copies of the Summary Document including a CD-ROM, containing the DD, its annexes, appendices and supporting information and all the main review consultation documents, are being sent to all those who requested copies of the DD in responding to the public consultation and to the statutory consultees and other organisations listed in Annex 1 of the ED. Hard copies of all review documents are being placed on appropriate public registers (see Annex 2) and are available on the Agency's web-site under `closed consultations' (www.environment-agency.gov.uk/consultations).

1.8 This DD does not repeat in detail matters that were addressed in the ED. For details of the methodology used for the review and the legal and policy framework the reader is referred to the Appendices of the ED. Section 3 of this DD indicates how these have been taken into account.

1.9 Copies of the ED and the DD are available on request from the Agency at:

Sellafield Review
Environment Agency
Penrith
Cumbria
CA11 9GN

Tel: 01768 866666

Fax: 01768 892456

1.10 The ED for the main review, and the ED and DD for the separate technetium-99 review, are also available on the Agency's web-site under `previous consultations' (www.environment-agency.gov.uk/consultations).

Outline of the Document

1.11 ***Section 2*** provides the background to the review process leading up to the preparation of the DD and sets out its scope and aims.

1.12 ***Section 3*** describes the process involved in the review and summarises how the Agency has reached its proposed decisions on the future regulation of radioactive waste disposals at Sellafield.

1.13 ***Section 4*** summarises the findings of an independent assessment of the estimated cost to BNFL of the Agency's proposals in the ED. This section also summarises the Agency's decisions on specific issues related to the proposed discharge limits where potential major costs could be incurred by BNFL resulting from delays to operating programmes and extended plant lifetimes.

1.14 ***Section 5*** provides an explanation of the Agency's proposed decision on each of the proposals set out in the ED.

1.15 ***Section 6*** identifies the wider issues raised by respondents that are outside the Agency's regulatory responsibilities and are considered to be matters for Government.

1.16 ***Section 7*** consists of concluding remarks and summarises the potential benefits of the Agency's decisions.

1.17 ***Section 8*** confirms that the next step in the decision making process is to pass this DD to Ministers to determine whether they wish to exercise their statutory powers to give direction to the Agency on the proposed decisions. This section also describes the subsequent steps involved in issuing the new integrated authorisation.

1.18 ***Annex 1*** consists of the proposed certificate of authorisation.

1.19 ***Annex 2*** contains a list of addresses where the DD may be viewed.

1.20 ***Appendix 1*** contains a list of organisations that were invited to respond to the consultation.

1.21 ***Appendix 2*** contains a list of organisations and numbers of individuals who have responded to the public consultation.

1.22 ***Appendix 3*** considers the general issues that were raised in the responses to the public consultation.

1.23 ***Appendix 4*** considers the issues relating to discharge limits that were raised in the responses to the public consultation. It includes explanations of any changes that have been made to the proposals in the ED as a result of the responses to the consultation and the assessment of information received from BNFL shortly before the Agency's scheduled public consultation. The Agency decided that, rather than delay consultation, it would take this information into account when decisions were being formulated.

1.24 ***Appendix 5*** considers the issues relating to the use of the Best Practicable Environmental Option (BPEO) for the disposal of radionuclides and the use of Best Practicable Means (BPM) for abating disposals, that were raised by respondents to the public consultation. It includes explanations of any changes that have been made to the proposals in the ED as a result of the consultation.

1.25 ***Appendix 6*** consists of an assessment of the radiological impact of the Agency's proposed decisions with respect to limits for discharges to sea and air and it considers the responses on the assessment methodology used by the Agency.

1.26 ***Appendix 7*** contains a list of supporting information to the proposed decisions in this DD.

1.27 ***Appendix 8*** contains a glossary of terms and abbreviations used in this DD.

Benefits of the Decisions

1.28 The Agency considers that its decisions on the future regulation of radioactive waste disposal from Sellafield will:

- reduce permitted radioactive discharges and consequently reduce the potential prospective doses to the most exposed members of the general public by 25-35% for discharges made at the proposed limits. The Agency recognises that current annual discharges for certain radionuclides are significantly less than the existing limits;
- lead to potential savings in collective doses, average doses to members of the public and to the most exposed members of the public living in coastal communities bordering the Irish Sea;
- reduce the potential environmental impact of discharges on ecosystems and wildlife species by ensuring that it is unlikely that radionuclides discharged from Sellafield will lead to significant effects in the terrestrial and marine fauna and flora around Sellafield and the Irish Sea, including those in designated (European) sites;
- minimise the headroom between discharges and limits by ensuring that the proposed decisions are consistent with the Government's draft Statutory Guidance to the Agency on the regulation of radioactive discharges into the environment from nuclear sites;
- reduce the overall radionuclide limits for liquid discharges as a first step toward the progressive reduction in such discharges into the Irish Sea consistent with the Government's finalised UK Strategy for Radioactive Discharges 2001-2020;
- provide a more transparent approach to the regulation of the site;
- facilitate and improve the routine regulation of the site;
- strengthen the BPM conditions by requiring waste minimisation at source, which will maintain downward pressure on waste disposals below the limits imposed by the authorisation and will minimise the environmental and radiological impact; and
- bring the regulation of radioactive discharges from individual plants at Sellafield in line with the regulation of discharges from facilities on other nuclear sites and non-radioactive discharges from individual plants on major industrial sites in England and Wales.

1.29 The Agency considers that its decisions will:

- not constrain the operation of the Magnox Reprocessing Plant and hence BNFL's ability to meet the projected date of 2012 for the closure of the plant;
- not constrain the operation of THORP;
- not constrain BNFL's progress in treating historic legacy wastes into a safe passive form suitable for long-term storage and ultimate disposal;
- not constrain BNFL's decommissioning programmes for redundant plants; and
- not involve disproportionate cost to BNFL in implementing the decisions.

1.30 The Agency considers that the total additional cost to BNFL associated with the Agency's decisions could be relatively small (around £6M) which is not disproportionate when set against the potential benefits of the major changes in the regulation of discharges from Sellafield. Furthermore, the total additional cost is considered to be a similar order of magnitude to the cost of recent requirements by HSE for improvements in safety management systems on the site.

1.31 The Agency's decisions on limit setting will in most cases reduce the amount of headroom between actual discharges and authorised limits. However, this will not necessarily lead to reduced discharges from the site. Discharges from spent fuel reprocessing have been relatively low over recent years due to extended maintenance shutdowns of the Magnox Reprocessing Plant resulting in relatively low fuel throughput. Similarly, fuel throughput in THORP has been well below design since the plant began operating in 1994, but is planned to continue to increase up to the design level in the future to meet BNFL's commercial contracts for reprocessing foreign fuels.

1.32 The Agency recognises there may be a need for BNFL to increase discharges from particular plants as a consequence of, for example, measures to increase the safety of operations (these may, of course, require prompt implementation). The Agency has the statutory power to vary any plant limit if necessary but would require BNFL to provide a fully substantiated case for any such increase. Provided that the proposed change would not entail any increase in a site limit, the Agency would not normally expect to consult beyond the statutory consultees (HSE and FSA). The Agency would inform Ministers of variations in appropriate circumstances.

1.33 The Agency anticipates significant reductions in radionuclide discharges, in particular gaseous discharges of argon-41, following the closure of Calder Hall nuclear power station in March 2003. The Agency would anticipate varying the authorisation at such time in order to reflect this. Further discharge reductions are anticipated with the planned cessation of Magnox reprocessing in 2012.

2.0 Background

Authorisation History

2.1 The current authorisations under the Radioactive Substances Act 1993 (RSA 93) permitting the discharge of liquid and gaseous radioactive wastes from the Sellafield site came into effect in January 1994. The disposal of solid radioactive waste arising at Sellafield is regulated by the Agency under separate authorisations that were issued in the 1970s under the Radioactive Substances Act 1960 (RSA 60). In addition, the disposal of contaminated waste oil arising from maintenance of plant is covered in a separate authorisation issued in 1994 under RSA 93.

2.2 In November 1996, BNFL submitted applications for variations to the liquid and gaseous discharge authorisations to cover operating changes to fuel reprocessing and for the commissioning and subsequent operation of the Solvent Treatment Plant (STP).

2.3 The Agency published its proposed decisions on these applications in October 1998. The decisions imposed reductions in overall limits for a number of radionuclides discharged from the site to air and sea. The decisions allowed increases in gaseous discharge limits at one discharge point to enable the new Solvent Treatment Plant to operate to clean up the backlog of stored waste solvent. In addition, BNFL was required to fit new abatement equipment to reduce overall gaseous discharges of carbon-14 and iodine-129 and to undertake work to provide more information on discharge reduction and on the impact of discharges.

2.4 The Agency submitted its proposed decisions to the Department of the Environment Transport and the Regions (DETR) (now the Department for Environment, Food and Rural Affairs (DEFRA)) and the Department of Health (DoH) in November 1998 to enable Ministers to consider whether they wished to exercise their powers of direction to the Agency on the decisions.

2.5 The Ministers published their decision in November 1999 and concluded that, in the light of the available evidence, it was not appropriate for them to intervene or to seek to vary the proposed decisions of the Agency. Accordingly, the Agency issued variations to the gaseous and liquid discharge authorisations effective from 1 January 2000. The Ministers' decision included a statement inviting the Agency, in its forthcoming review of the Sellafield authorisations, to give prompt and detailed consideration to the issues related to discharges of technetium-99 and to any increases in discharge limits or actual discharges of ruthenium-106 and iodine-129. They also indicated that any headroom allowed between actual discharges and discharge limits should be kept to the absolute minimum and that limits should be set that are no more than strictly necessary for the normal operation of the plant, whilst at the same time achieving progressive reductions in those limits over time in accordance with established Government policy.

2.6 The Agency carried out a separate 'fast track' review of technetium-99 liquid discharges from Sellafield and passed its proposed decision to Ministers (see below). For the current review, the Agency has carried out a detailed assessment of BNFL's past discharges and limits and predicted future discharges of other significant radionuclides, including ruthenium-106 and iodine-129 (see Section 5 and Appendix 7 of the ED).

Scope and Methodology for the Review

2.7 In February 2000, the Agency published its plans for the Sellafield review. Public comment was sought on the plans which were set out in the Scope and Methodology for the Full Re-examination of the Sellafield Authorisations for the Disposal of Radioactive Waste. The Agency's response to the consultation comments was published in August 2000. This established a finalised Scope and Methodology for the review, which included a "fast track" consideration of its future regulation of technetium-99 (Tc-99) discharges to the Irish Sea. The approach set out in the finalised Scope and Methodology has been used by the Agency to undertake the review (see CD-ROM for Scope and Methodology as stated in paragraph 1.7 of this DD).

2.8 The Sellafield review has considered:

- all six of the authorisations granted to BNFL under the Radioactive Substances Acts of 1993 and 1960 and takes account of other authorisations, consents and licences issued under other relevant legislation;
- past operations and disposals made from the Sellafield site for the years 1994-1999 inclusive and BNFL's future plans for operations and discharges up to 2008;
- whether it would be practicable to use uranium oxide fuel in place of Magnox fuel in Magnox reactors as a means of phasing out the operation of the Magnox Reprocessing Plant;
- the current situation with regard to the possible use of THORP for reprocessing spent Magnox fuel as a means of phasing out the operation of the Magnox Reprocessing Plant; and
- statutory requirements on the Agency and Government policy and commitments (including draft policy).

Technetium-99 Review

2.9 In November 2000, the Agency published an ED setting out proposals for the future regulation of Tc-99 discharges from Sellafield. The proposals detailed four options for future discharge limits for Tc-99 which are indicative of the range that might be set and identified the Agency's preferred option. The proposals were subjected to a wide-ranging consultation lasting 3 months with the public, public bodies and interested groups.

2.10 In September 2001, the Agency published a document containing its proposed decision on the future regulation of Tc-99 discharges from Sellafield into the Irish Sea.

2.11 The Agency passed its proposed decision to Ministers in September 2001 and is currently awaiting a decision on whether they wish to exercise their statutory powers of direction to the Agency on its proposed decision.

Main Review

2.12 In January 2000, the Agency requested BNFL to provide information that was required for the main review of the Sellafield authorisations. BNFL provided most of the information in accordance with an agreed programme during the year 2000. Some information was provided in March 2000 which enabled the Agency to begin the review of the authorisations at the end of April 2000. In July 2001 the Agency published an ED detailing its overall proposals for the future regulation of disposals of radioactive waste from Sellafield, excluding those for Tc-99. The proposals were subjected to a 4-month wide-ranging public consultation from 30 July to 3 December 2001.

Aims of the Review

2.13 The aims of the review as set out in the ED are:

- to strengthen the requirements of the authorisations for the Sellafield site, particularly with respect to the use of Best Practicable Environmental Option (BPEO) for the disposal of radioactive waste and the use of Best Practicable Means (BPM) for minimising the activity of radioactive waste that will require disposal;
- to check that the BPEO is currently being used for the disposal of wastes and that the BPM are being applied to minimise the radioactivity in waste being disposed of;
- to tighten the regulation of discharges from the site by introducing discharge limits at source for individual major plants;
- where appropriate, to introduce new waste disposal limits for the site;
- to ensure that any headroom between actual discharges and proposed limits is the minimum required to enable spent fuel reprocessing and associated operations to continue;
- to ensure that any proposed limits will enable BNFL to continue the treatment of the legacy of stored liquid wastes and thereby to reduce the hazard and potential risk from such wastes; and
- to require the implementation of discharge reduction schemes, where reasonably practicable.

2.14 The Agency has a legal obligation in granting disposal authorisations to ensure that radiation doses to members of the public, resulting from operations on nuclear sites, are As Low As Reasonably Achievable (ALARA) and within national and international limits and constraints. The Agency reviews nuclear site authorisations on a regular basis to ensure that existing limitations and conditions remain appropriate and that the BPM are being applied to minimise the radioactivity in waste disposals.

3.0 The Agency's decision making approach

Technical Assessment

3.1 The Agency has kept in mind all the various considerations and requirements on it throughout this review of the Sellafield authorisations. This includes of course Government policy on radioactive waste management, the Government's finalised UK Strategy for Radioactive Discharges 2001-2020 and the Government's draft Statutory Guidance to the Agency on the regulation of radioactive discharges (see below).

3.2 The Agency's approach to the review of the Sellafield authorisations involved an examination of the existing framework of discharge limits and the numerical values of individual limits to assess whether any changes are appropriate for the future regulation of waste discharges from the site. The Agency derived a set of numerical limits based on an assessment of past discharges from the site over the period 1994-1999 and BNFL's estimates of predicted discharges up to 2008. The assessment included extensive correspondence and technical discussions with BNFL in connection with the structure of limits, issues related to individual radionuclide limits and discharge abatement options in consideration of BPEO/BPM. The Agency challenged BNFL's information on numerous issues and exerted considerable pressure on the company to provide detailed technical arguments for its future discharge predictions.

3.3 BNFL responded to the Agency's proposals for discharge limits with revised estimates of worst case discharges and put forward a set of limits that it considered were necessary to meet future business requirements for fuel reprocessing. This information was received shortly before the Agency's scheduled public consultation and the Agency decided that, rather than delay consultation, it would be taken into account when decisions were being formulated. The Agency has considered this information in making its decisions together with the latest data on actual discharges for 2000-2001 and further discharge information relating to recent site operations (see Appendix 7 and Supporting Information).

3.4 In setting the limits in its proposed decisions, the Agency has taken into account the latest information on current operations on the site. In certain cases this has necessitated increases and decreases in a number of discharge limits from those proposed in the ED (see Section 5), although in no case has any existing site limit been raised. In some other cases, BNFL provided sufficient information to satisfy the Agency that particular ED limit proposals would restrict plant operations, potentially lead to delays in the treatment of stored liquid waste and hence potentially incur substantial additional costs. In such cases, the Agency has responded by adjusting a particular limit whilst still adhering to the principle of minimising headroom between future discharges and the limit and no increases above current limits. The Agency regards this as an appropriate approach based primarily on assessing operational and technical factors and consideration of Government policy.

3.5 The Agency required BNFL to review current practices used on the site for disposing of radioactive wastes and to assess whether they represent the BPEO. The Agency assessed BNFL's current practices against other potential disposal options for principal radionuclides and whether they represent the BPEO (see Appendix 6 of the ED).

3.6 The Agency identified a number of areas in which it may be practicable for BNFL to implement improvements to the abatement of individual radionuclide discharges. The Agency therefore included appropriate improvement requirements in its proposals in the ED. The Agency also proposed in the ED that BNFL would be required to monitor its environmental performance. In addition, BNFL would be required to submit a number of written reports including an annual environmental management report, and other reports relating to the assessment of BPEO for new waste streams and individual radionuclides, and the use of BPM for minimising discharges.

3.7 The Agency reviewed the conditions in the authorisations and proposed that the 6 current certificates of authorisation should be integrated into a single certificate. In addition, new conditions relating to BPM and environmental management were proposed.

3.8 The Agency has carefully considered responses to the public consultation (see Appendices 3-6), the latest information on actual and projected discharges from BNFL (see Appendix 7) and the findings of an independent assessment of the potential cost of the proposals to BNFL (see Section 4 and Appendix 7). The decision on each of the proposals in the ED and the reason(s) for the decision are set out in Section 5. The Agency has assessed the reduction in the potential radiological impact of its proposed decisions on discharge limits compared with the current limits (see Appendix 6).

3.9 The Agency considered that it would be beneficial to have an independent view on the assessment procedure used in the review. A contract was therefore placed with an independent, environmental consultant to carry out a peer review of the whole process. The consultant's report will become available to the Agency after the publication of this DD. The Agency will place the report on the appropriate public registers (see Annex 2).

3.10 The Agency's procedures throughout the period of the review have been subject to checking by an independent quality assurance auditor.

Limit Setting Methodology

3.11 The methodology used by the Agency to propose future radioactive waste disposal limits for the Sellafield site is set out in detail in Appendix 7 of the ED. A number of respondents to the consultation raised issues relating to this methodology. These are discussed in detail in Appendix 4, together with the Agency consideration of the respondents' views. This consideration has resulted in a number of changes to the methodology used. These are given below.

Plant Limits

3.12 The Agency assessed the significance of radionuclide discharges to establish which radionuclides should be limited. The significance of each radionuclide was determined by assessing BNFL's worst-case plant discharge predictions against a set of criteria (see Appendix 7 of the ED). In the ED, an individual plant limit was proposed for radionuclides where any of the following applied:

- the dose to the most exposed group from the established worst case plant discharge exceeds 1 microsievert per year (μSv/year);
- the collective dose (world-wide truncated at 500 years) from the established worst case plant discharge exceeds 0.1 man sieverts per year (man Sv/year) of discharge;
- the quantity of the established worst case plant discharge exceeds 1 gigabecquerel per year (GBq/year) for aerial (gaseous) discharges;
- the quantity of the established worst case plant discharge exceeds 1 terabecquerel per year (TBq/year) for liquid (aqueous) discharges;
- the quantity of the established worst case plant discharge exceeds 50% of the relevant proposed site limit (see below); and
- the discharge will be used as a plant performance or process control indicator or for effective regulatory control and enforcement.

3.13 A number of respondents to the consultation felt that the quantity criterion of 1 GBq/year for setting a plant gaseous discharge limit was too low. The Agency re-considered this criterion in the light of the consultation responses and recognising that this criterion is set using technical judgement, decided that a single quantity criterion of 1 TBq/year is more appropriate for setting both gaseous and aqueous discharge limits. The Agency considers that the quantity criterion should be independent of other considerations and based solely on the quantity discharged. Setting different criteria for aerial and liquid discharges would introduce another consideration (i.e. the medium to which the discharge takes place). On reflection, the Agency would accept that this is undesirable. The change to this limit setting criterion means that a number of plants with aerial discharges no longer meet any of the plant limit setting criteria (see Section 5 and Appendix 4). The Agency considers that this change will not have a significant effect on the regulation of aerial discharges from Sellafield.

Site Limits

3.14 The Agency assessed BNFL's worst case radionuclide discharge predictions for the Sellafield site as a whole (see Appendix 7 of the ED) and proposed site discharge limits by:

- basing a requirement for a site discharge limit for a given radionuclide on a range of criteria covering the amount of activity discharged, the associated radiological impact and the half-life and persistence/accumulation of the radionuclide concerned in the environment (see below);
- calculating the established worst case site discharges as the lower of the sum of the individual established worst case plant discharges, or the current limit; and
- applying an additional constraint to the established site worst case discharge value which takes account of whether the proposed site limit is dominated by a single plant or whether a number of plants contribute significantly (see below).

3.15 As stated above, when proposing site limits, the Agency assessed the significance of radionuclide discharges, in order to establish which radionuclides should be limited. The significance of each radionuclide discharge was judged by assessing the established worst case site discharges against a set of criteria. In the ED, a site limit was proposed for radionuclide discharges where any of the following applied:

- the dose to the most exposed group from the established worst case site discharges exceeds 1μSv/year;
- the collective dose (world-wide truncated at 500 years) from the established worst case site discharges exceeds 0.1 man Sv/year of discharge;
- the quantity of the established worst case site discharge exceeds 1 GBq/year (for aerial discharges);
- the quantity of the established worst case site discharge exceeds 1 TBq/year (for liquid discharges);
- the half-life of the radionuclide exceeds 10 years and the radionuclide is concentrated in environmental materials by a factor greater than 1000; and
- the discharge will be used as plant performance or process control indicator or for effective regulatory control and enforcement.

3.16 In addition, the Agency applied an additional constraint to the established worst case site discharge value to take account of the situations where it is dominated by a single plant or where significant contributions to the discharge arise from a number of plants. The Agency applied the rationale that it is very unlikely that all the plants contributing to an overall site discharge will experience worst case discharges, simultaneously. The approach taken is described by the equation:

Proposed Annual Site Discharge Limit = *F* x *(The sum of the established worst case plant discharges)*.

Where:

F= 1 if any established worst case plant discharge is greater than 80% of the sum of established worst case plant discharges.

F= 0.9 if any established worst case plant discharge is 50-80% of the sum of established worst case plant discharges.

F= 0.8 if all established worst case plant discharge are less than 50% of the sum of established worst case plant discharges.

3.17 With this methodology the proposed site discharge limits are always lower than, or the same as, the sum of the plant disposal limits. In addition, proposed site discharge limits are always less than, or the same as, BNFL's worst case estimates of site discharges and the current limits.

3.18 As in the case of plant limits, the Agency re-considered the quantity criterion for setting a site limit on aerial discharges in the light of the consultation responses and recognising that this criterion was set using technical judgement, decided that a single quantity criterion of 1 TBq/year is more appropriate for setting both site gaseous and aqueous discharge limits.

3.19 BNFL argued that there is greater uncertainty in predicting future discharges of short-lived radionuclides as small changes in the time of discharge can significantly affect the amount discharged. The Agency accepts that there is substance to this argument and has decided that the constraint on site limits (i.e. that site limits should be set at lower values, down to 80% of the sum of predicted worst case plant discharges, where predicted discharges arise from a number of plants rather than one plant being dominant) should not be applied to radionuclides with half-lives of 2 years or less.

Quarterly Notification Levels

3.20 Quarterly Notification Levels (QNLs) are used in the existing authorisations to highlight discharges which represent a significant fraction of the discharge limits. A QNL provides the Agency with early information of elevated discharges which, if continued, might lead to a limit being breached. In these circumstances, close regulatory scrutiny is appropriate to determine whether the operator has used BPM to minimise discharges. A QNL is not a limit and any exceedance of it would therefore not normally initiate enforcement or prosecution by the Agency provided that BNFL was able to demonstrate that BPM had been applied to minimise the discharge.

3.21 In the current authorisations, QNLs relate to three consecutive calendar months starting 1 January, 1 April, 1 July and 1 October in any year. This approach can potentially delay the reporting of elevated discharges. To take account of this, the Agency proposed in the ED to change the system so that a QNL relates to any period of three consecutive calendar months and simply to set QNLs as 25% of each annual discharge limit.

3.22 A majority of responses, many in the form of standard letters, expressed general concerns regarding the number of limits/compliance points and that compliance would be resource intensive and would encourage limit watching rather than environmental improvement. There were also concerns that the approach of setting QNLs at a standard 25% of the annual limit did not take account of practical plant operational issues such as plant shutdowns, washout, batch processes and transient retrieval operations.

3.23 The Agency therefore re-assessed the framework of QNLs and decided to implement rolling QNLs for all liquid and aerial site limits only. It was recognised that the large number of plant-rolling QNLs proposed in the ED would make compliance with them too complex. The Agency is satisfied that the removal of such QNLs will not lead to a slackening of regulation, as the minimisation of headroom between discharges and limits will ensure tight regulation. The numerical value of each site QNL has been set on a case by case basis to take account of potential variations in plant performance that apply to the specific radionuclide concerned. For many radionuclides, site discharges are dominated by one, or a few, plants and the Agency considers that these site QNLs will act as notification markers to highlight elevated discharges where the application of BPM to minimise discharges should be further investigated.

BPEO/BPM Methodology

3.24 The BPEO is a concept developed by the Royal Commission on Environmental Pollution, which suggested the following definition:

"...the outcome of a systematic consultative and decision-making procedure which emphasises the protection 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 as well as the short term."

3.25 The Royal Commission also made, inter alia, a key point about the BPEO concept as they saw it i.e. that it is doubtful whether there is an absolute 'best'- there may be more than one solution and the solutions may change with time. It is therefore possible for different studies to produce different results.

3.26 An interpretation of BPM is provided in the Sellafield aerial and liquid discharge authorisations and is repeated in the new integrated authorisation (see Annex 1). This states that in determining whether particular means are the "best practicable", the Operator 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. The aims for the Agency in the context of the current review, include ensuring that the BPEO for the disposal of radionuclides is implemented and that BPM continue to be used for minimising the radioactivity of waste disposed of (see paragraph 2.13).

3.27 A number of criteria need to be taken into account in arriving at a decision on BPEO and BPM for the disposal of radioactive waste. The criteria include not only those related to radiological and environmental risk but also those related to Government commitments, monetary and non-monetary costs, technical feasibility and socio-economic factors. The criteria include and reflect Government policy and all relevant duties on the Agency. The main criteria that the Agency considered for major waste stream disposals, plant disposals and schemes to reduce disposals or improve regulation/control of disposals were highlighted in Appendix 6 of the ED.

3.28 The Agency recognises that there is at present no generally agreed methodology for assessing BPEO and BPM for the disposal of radioactive wastes. It recognises also that the outcome of any such assessment is dependent on the relative significance placed on individual attributes considered in the assessment, and that the assessment itself is to be regarded only as an aid to decision making. The Agency has set up a working group with the Scottish Environment Protection Agency (SEPA) to establish guidance related to BPEO assessments for use in future authorisation reviews for nuclear sites. To facilitate this work, the Agency has let a contract with a firm of independent consultants. Before the guidance is finalised, the Agency and SEPA will seek views on it from the nuclear industry and other interested bodies and will consider whether any wider consultation should be carried out.

3.29 In making its decisions on the proposals, the Agency has addressed the issues of BPEO and BPM for the disposal of individual radionuclides and waste streams at Sellafield: see Section 5 and Appendix 6 of the ED, and Appendix 5 of this DD which considers relevant responses to the public consultation.

Public Consultation

3.30 The ED launched a four-month public consultation on the Agency's proposals (to 3 December 2001). The consultation documents consisted of the ED, its appendices, a separate Summary Document and another separate document containing relevant Supporting Information. The consultation package included electronic versions of the consultations on a CD-ROM. The Agency invited comments not only on the proposals themselves but also on all matters set out in the consultation package.

3.31 The Agency consulted statutory consultees under Section 16 of RSA 93 (see Annex 1 of the ED). It also consulted with other national and local bodies, the Sellafield Local Liaison Committee, interested groups and organisations, and the Agency's relevant Advisory Committees and Groups (see also Annex 1 in the ED). Individual members of the public were invited to respond to the consultation. The UK Government consulted the Governments of the Isle of Man and the Irish Republic.

3.32 Copies of the consultation documents were made available to the public nationally at the Agency's Public Registers, at all local authority Public Registers in Cumbria, the Public Register at Lancashire County Council and a number of libraries in Cumbria and Lancashire. The ED was placed on the Agency web site at www.environment-agency.gov.uk/consultations. The consultation was advertised in the national and Cumbria press, and the Agency issued a press release.

3.33 The Agency invited consultees to submit comments using a pro-forma in the ED, which was also available on the Agency's web site. Comments were requested on the Agency's proposals and on the consultation process itself.

3.34 During the consultation the Agency gave a number of presentations on its proposals to local authorities (parish councils close to Sellafield and borough councils in Cumbria) and the government-appointed Radioactive Waste Management Advisory Committee (RWMAC). In addition, a two-day surgery was held in the Beacon Museum, Whitehaven, on 16/17 October 2001 to allow local residents in the area close to Sellafield to meet the review team and to seek further clarification of the Agency's proposals.

3.35 A one-day open meeting was held in the Town Hall, Manchester, on 1 November 2001 at which the Agency gave a presentation covering the review and its proposals. Representatives of the Agency, BNFL and other bodies including the Food Standards Agency, Health and Safety Executive (Nuclear Safety Division), the National Radiological Protection Board and the Regional Health Authority (NHS Northern and Yorkshire Executive) were available to answer questions.

3.36 As explained in the ED, BNFL submitted information relating to revised discharge projections shortly before the public consultation which the Agency stated that it would take into account when reaching its decisions. That information was included in the Supporting Information with the ED. Since the consultation, BNFL has submitted further information relating *inter-alia* to operating developments on the Sellafield site, including details of the closure of the Calder Hall nuclear power station (see paragraph 3.2 above). This is included in the Supporting Information with this DD (see Appendix 7).

3.37 In reaching its proposed decisions, the Agency has considered all BNFL's information together with data on Sellafield discharges up to the end of 2001, information gathered through the routine regulation of the site and other information including BNFL's cost estimates relating to the Agency's proposals (see Sections 4 and 5 and Appendix 7). As explained in the ED, in the event of any significant changes to its consultation proposals, such as exceeding the site limits in the existing authorisations, the Agency would consider the need for further public consultation. The Agency does not consider that the modifications made to the ED proposals, on the basis of BNFL information or otherwise, are such that a further round of public consultation is required. In particular, there are no changes to site limits which result in their exceeding existing authorisations levels.

3.38 The Agency received a total of 895 consultation responses. The responses showed a wide spread of opinions and views on the Agency's proposals. Details of the points and issues raised, and of the Agency's consideration of them, are set out in Appendices 3-6. All consultation responses were considered by the Agency in reaching its proposed decisions.

Regulatory Framework for the Agency's Decision

3.39 The Environment Agency is a public body corporate, established by the Environment Act 1995 (EA 95). It is a regulatory organisation whose responsibilities are defined by legislation, for example authorising the disposal of radioactive waste. The Agency is not responsible for national policy on nuclear power or on nuclear fuel reprocessing or for considering the 'justification' of such practices. Those are matters for the Government. Accordingly, the Agency's review of the Sellafield authorisations has not considered such issues. The review has focused on the regulatory controls necessary to secure a high level of public health and environmental protection within the legal and policy framework.

3.40 Appendix 10 of the ED sets out the legal and policy framework which the Agency must apply (and act within), in making its decisions on the future regulation of radionuclide discharges from Sellafield. Its application is noted below.

Regulatory Powers (Radioactive Substances Act 1993)

3.41 RSA 93 empowers the Agency to grant authorisations for the disposal of radioactive waste subject to such conditions and limitations as it deems appropriate.

3.42 In accordance with the requirements of RSA 93, the Agency has consulted both the Health and Safety Executive (HSE) and the Food Standards Agency (FSA) in reaching its decisions resulting from the current review of the Sellafield authorisations.

Government Policy

3.43 As explained in Appendix 10 of the ED, the 1995 Government policy document on radioactive waste management Cm2919 remains in place. In reaching its proposed decisions, the Agency has had regard to this document and to the subsequent specific Government policy statements referred to in the ED (at A10.7), including progressive reductions in discharges and limits and keeping headroom between actual discharges and discharge limits to the absolute minimum.

3.44 The Agency has also had regard to the draft Statutory Guidance to the Agency on the Regulation of Radioactive Discharges into the Environment from Nuclear Licensed Sites (in England), which the DETR and the Department of Health issued for public consultation in October 2000. The consultation period ended in January 2001, and the Government is expected to issue the finalised guidance in the near future, following the recent publication of the UK Strategy for Radioactive Discharges 2001-2020 (see below).

3.45 The draft Statutory Guidance sets out a number of general and specific principles that should be applied to the regulation of radioactive discharges. It states that radioactive waste management policy should be based on the same basic principles that apply more generally to environmental policy and in particular that of sustainable development.

3.46 The draft guidance indicates that, when setting new discharge authorisations, the Agency should act within its statutory duties and functions and in a manner that is comprehensive, rigorous, prospective and transparent.

3.47 The draft guidance identifies several specific principles for the Agency's regulation:

- the use of BPM for waste minimisation;
- the use of BPEO - evaluation of alternatives, with the choice being one which will have a low environmental impact (including consideration of the "concentrate and contain" and the "dilute and disperse" principles for waste discharges, with the former to be preferred where possible);
- assessment of the radiological impact of discharges on members of the public (critical group, dose limit, dose constraint, collective dose), taking into account Community Food Intervention Levels (that limits on routine radioactive discharges should not, in general, be set at a level where CFILs may be exceeded) and impact on other species;
- environmental protection (use of best practicable means, progressive reduction of discharges with increases being considered only in exceptional cases, consistency with UK Strategy for Radioactive Discharges 2001-2020, sociological and economic effects (no prejudice to legitimate use of the seas and the land), taking into account possible radiation exposure of groups beyond the UK);
- health and safety (exposure of workers and risk of accidents to be kept ALARA and any additional/continued exposure or accident risks as a consequence of reductions in discharges should not be disproportionate to the environmental and radiological protection benefits. Increases in discharges from existing operations on the site may be permissible if the inevitable result of measures to reduce significant risks associated with historic waste legacies and with existing redundant plant, provided such increases are time limited and the minimum necessary to achieve the required risk reduction - a specific detailed case required in each instance);
- limits and conditions in discharge authorisations (site and plant limits, limits on those individual radionuclides of the greatest significance individually or collectively, minimisation of headroom between discharge limits and the expected actual levels during normal operation, plant notification levels, capping discharges at plant design levels); and
- other conditions to be applied to discharge authorisations (monitoring of discharges and the surrounding environment, including separate identification of discharges from each plant or individual source; research and development, including timescales; record keeping).

3.48 Bearing in mind the draft status of the Guidance, the Agency has taken due account of these specific principles, particularly where they reflect existing government policy and/or international UK commitments. A number of the principles outlined above have been addressed through consideration of BPEO/BPM for waste discharges in Appendix 6 of the ED. The radiological impact of discharges has been considered in Appendix 8 of the ED and in Appendix 6 of this DD. The Agency's assessment of Sellafield discharges has taken account other principles, including minimisation of headroom and specifying radionuclide limits both for individual plants and the Sellafield site as a whole (see Appendix 7 of the ED and Section 5 and Appendix 4 of this DD). Annex 1 of this DD sets out the proposed certificate of authorisation for Sellafield. As well as specific limits and notification levels, it includes a number of improvement and information provisions (including segregation of discharges, requirements for research into discharge abatement techniques and the effect of radionuclides discharged on the environment), monitoring and record keeping requirements. Relevant responses to the public consultation have been carefully considered and, where appropriate, have been taken account of in the Agency's proposed decisions (see Section 5 and Appendices 3-6 of this DD).

3.49 The Government has also recently issued its finalised UK Strategy for Radioactive Discharges 2001-2020 (the ED referred to the consultation draft document in Appendix 10) - see further below. The Agency's proposed decisions take appropriate account of the finalised UK Discharge Strategy.

3.50 The Agency will send this DD to Ministers for their consideration. This is particularly important given the continuing draft status of the Government's Statutory Guidance to the Agency. Ministers will therefore have the opportunity, by virtue of their statutory powers of intervention, to decide whether they wish to direct the Agency to amend any of its proposed decisions.

Euratom Basic Safety Standards Directive/BSS Direction 2000

3.51 This Euratom Directive *(Council Directive 96/29/Euratom Laying Down the Basic Safety Standards for the Health Protection of the General Public and Workers Against the Dangers of Ionizing Radiation)* covers the radiological protection principles of justification, optimisation and limitation (see Appendix 10 of the ED). The BSS Direction 2000 *(The Radioactive Substances (Basic Safety Standards) (England and Wales) Direction 2000)*, issued on 9 May 2000, requires the Agency to ensure, when discharging its functions under RSA 93, that certain provisions of the 1996 BSS Directive are complied with. In particular it requires the Agency to ensure that the Directive dose limits for members of the public are complied with, that the dose from a single new source of radiation does not exceed 0.3 millisieverts per year (mSv/year) and that the dose from a single site does not exceed 0.5 mSv/year. The Direction also requires the Agency to ensure that exposures of members of the public and the population as a whole resulting from the disposal of radioactive waste are kept as low as reasonably achievable, economic and social factors being taken into account. The Direction does not deal with justification.

3.52 The justification principle is that *"...classes and types of practice resulting in exposure to ionising radiation are justified ...by their economic, social or other benefits in relation to the health detriment they may cause"*. It was explained in the Agency's document "Response to comments on the Scope and Methodology for the full re-examination of the Sellafield authorisations for the disposal of radioactive waste" (August 2000) that:

"The current status at Sellafield with relation to justification is as follows. In 1993 the then Secretary of State for the Environment and Minister of Agriculture, Fisheries and Food considered the wider policy issues concerning the Sellafield nuclear fuel reprocessing activities, and THORP in particular (i.e. beyond those relating to the environmental and health effects of discharges). These issues were addressed by the Government Ministers in their decision document issued in December 1993, and were grouped under the headings of Spent Fuel Management, Waste Management, Decision to Reprocess, Economic Aspects, Transport and Non Proliferation. The Ministers reached a decision that there was a sufficient balance of advantage in favour of the operation of THORP, and expressed themselves satisfied that the activities giving rise to the discharges permitted by the Sellafield authorisations were justified. The Agency interprets this as referring to all activities on the Sellafield site contributing to discharges permitted by the authorisations in 1993.

It follows therefore that a review of the Ministers' 1993 decision would be required by the BSS Directive if there is "new and important evidence as to the efficacy or consequences" of reprocessing spent nuclear fuel and other activities at Sellafield.

Given the wide nature of the issues encompassed by the justification principle, including those relating to government policy, the Agency considers that the Government is better placed both to assess and take into account these issues and considerations and to determine the overall balance of advantages and disadvantages from a national perspective."

3.53 In 1998, the Agency envisaged that it would be responsible for considering justification as part of its review of the Sellafield authorisations. Since then, however, this has changed, with the Government stating that it is responsible for considering justification, including for the Sellafield review. The Government has recently reiterated the position in the 11 February 2002 Decision of the Secretary of State for Environment, Food and Rural Affairs and the Secretary of State for Health on the Environment Agency's proposed decision on the application made by Devonport Royal Dockyard Limited to dispose of radioactive waste from Devonport Royal Dockyard, Plymouth: *"The Government has decided that where a decision on justification is required it should be taken by the appropriate Secretary of State rather than by the Regulator. This has been the position since October 2000"*. It has been reiterated by the Government in its recently issued UK Strategy for Radioactive Discharges 2001-2020, which confirmed that decisions on justification will be taken by the appropriate Secretary of State. The Agency understands that the Government's proposed Regulations to implement the justification requirement of the BSS Directive have been notified to the European Commission. It was explained in the ED and in Section 3.39 of this DD that the Government had confirmed that justification decisions are for the appropriate Secretary of State, rather than the Agency.

3.54 The optimisation principle is that *"all exposures to ionising radiation of any member of the public and of the population as a whole resulting from the disposal of radioactive waste are kept as low as reasonably achievable (ALARA), economic and social factors being taken into account"*. This principle is addressed partly through the Agency's consideration of relevant criteria in its assessment of BPEO/BPM for waste disposals, its consideration of the cost of its proposals to BNFL (see Section 4, Appendix 7 and Supporting Information) and its consideration of relevant responses to the consultation (see Appendices 3 and 5). It is also addressed through the inclusion in the proposed authorisation of conditions requiring BNFL to use BPM in various respects in managing its facilities and operations at Sellafield. In addition, it is addressed by the setting of discharge limits at levels no more than are strictly necessary for normal operations and taking account of BNFL's future business plans.

3.55 The limitation principle provides an effective dose limit for members of the public for exposure to ionising radiation of 1 mSv/year from all man-made sources of exposure (excluding medical applications). As stated above, the BSS Direction 2000 also requires that the dose from a single new source of radiation does not exceed 0.3 mSv/year (source dose constraint) and that the dose from a single site does not exceed 0.5 mSv/year (site dose constraint). The Agency has addressed this dose limit and these dose constraints in its radiological assessment of its proposals for radionuclide discharge limits in Appendix 8 of the ED and a similar assessment of its decisions in Appendix 6 to this DD.

OSPAR Obligations/Sintra Agreement

3.56 Government commitments at the 1998 Ministerial meeting of the OSPAR Commission require the UK to achieve substantial and progressive reductions in radionuclide discharges to sea. A key obligation is to ensure that, by the year 2020, discharges are reduced to levels where the additional concentrations in the marine environment above historic levels, resulting from such discharges, are close to zero. Issues raised by consultees in respect of OSPAR obligations are considered in Appendix 3.

3.57 In achieving the objective of "progressive and substantial reductions of discharges", the Sintra agreement requires that three particular issues are taken into account, namely: the technical feasibility of potential abatement options; radiological impacts to man and biota; and legitimate uses of the sea. The technical feasibility of potential abatement options is addressed in Appendix 6 of the ED. Radiological impacts to man and biota are considered in Appendix 8 of the ED, and Section 5 and Appendix 6 of this DD. As to "legitimate uses of the sea", this term is not defined in the agreement or in the OSPAR Convention itself. The reference to "legitimate uses" in the Preamble to the Convention would appear to be to such uses as are "threatened by pollution". In the OSPAR Strategy with regard to Radioactive Substances that was issued by the OSPAR Commission in conjunction with the Sintra Agreement, the reference is to evaluating "adverse effects which may affect other legitimate uses of the sea".

3.58 In the absence of any specific definition, the Agency would take the concept as applying to legal and sustainable fishing activities (both commercial and recreational) and the exploitation of sea-shore and sea-bed resources; navigation; and recreational uses of the sea (including coastal and offshore sailing and other water sports, sea-shore holidays and other activities). The Agency has taken such matters into account (see Appendix 3) and considers that its proposed decisions are appropriate. Some generalised comments were made by consultees about impacts of Sellafield discharges on tourism and fishing/economic interests (see Appendix 3). However, the Agency is not aware of any substantive evidence of impacts on legitimate uses of the sea which would suggest that its proposed decisions are out of line with the OSPAR "progressive and substantial reductions of discharges" commitments. It considers that its proposed decisions are in accord with the UK Discharge Strategy, and make appropriate progress towards the achievement of its targets for reducing discharges from Sellafield (see below).

3.59 The Agency considers that there is no current evidence that exposure to anthropogenic radiation is causing damage to wildlife in the UK. The OSPAR Quality Status Report 2000 for the Celtic Seas examines the impact of radioactivity in that part of the UK marine environment where man-made radionuclide concentrations are generally at their highest. It states: *"Reviews of available data on the effects of chronic radiation exposure on aquatic organisms indicate that the estimated dose rates to organisms in the north-eastern Irish Sea and elsewhere in Region III (the Celtic Seas), are unlikely to produce adverse effects at the population level. This applies even to historical dose rates that are likely to have been more than an order of magnitude greater than at present."*

3.60 The UK submitted its intentions for implementing the OSPAR Strategy for radioactive substances to the OSPAR Secretariat in October 1999. It has now issued its finalised UK Strategy for Radioactive Discharges 2001-2020, which describes how the UK will implement its OSPAR commitments. The UK Strategy is intended to provide a clear policy base for reviews of discharge authorisations by the regulators and for strategic planning by nuclear operators. Its objective is to implement the UK's obligations in respect of the OSPAR Strategy rigorously and transparently. It is to be read in conjunction with the Statutory Guidance, which will provide the vehicle through which the UK Strategy will be implemented.

3.61 The UK Strategy is intended to set a strategic framework for radioactive discharges from UK installations over the next twenty years. It explains that it is set in the context of a well-established framework for the control of discharges and radiation exposure, comprising national legislation, policy and regulatory arrangements and international commitments and codes of practice. Its guiding principles and aims, as set out in the consultation draft, were noted in the ED (paragraph A10.38). These are essentially unchanged in the finalised document. The Agency notes, however, that the reference to the precautionary principle has been updated (see Appendix 3), that the application of the ALARA principle is emphasised and that there is reference to the cost of discharge reductions not being grossly disproportionate to their benefits (as part of a proportionate approach).

3.62 The UK Strategy states that it is important that decisions relating to radioactive waste management should be based on the best scientific information and analysis of risks. This should include consideration of risks to human health (to members of the general public and to workers), and, where sufficient information is available, risks to non-human species and the wider environment. Pressures to reduce these risks should be seen alongside issues such as the technological feasibility and cost of introducing measures to reduce discharges. Balancing and prioritising these and other considerations (e.g. international legislation and agreements, sustainable development, the precautionary principle) is a matter of fine judgement.

3.63 In relation to spent fuel reprocessing at Sellafield, the UK Strategy has four targets for discharge reductions:

- Technetium-99 discharges from reprocessing are expected (if the Agency adopts its proposed decision) to be reduced from close to 90 TBq a year to below 10 TBq a year as soon as possible and by no later than the end of 2006, and to less than 1 TBq a year by 2020.
- By around 2012, reprocessing of spent Magnox fuel is expected to cease.
- By 2020, total beta liquid discharges from reprocessing (excluding tritium) are expected to be reduced from 165 TBq a year to around 50 TBq a year.
- By 2020, total alpha liquid discharges from reprocessing are expected to be reduced from 0.31 TBq a year to about 0.2 TBq a year.

3.64 In Section 6 of the ED, the Agency said that it had considered reducing the overall annual limit for total beta radionuclides to sea by 5% per calendar year up to the next review of the authorisation. This was to provide a possible means of achieving the Government's commitments under OSPAR and the target in the draft UK Strategy of around 30 TBq/year total beta radionuclides discharges from Sellafield to sea by 2020 (note that this target was amended in the finalised Strategy - see above). However, HSE and other Government Departments were concerned about the potential impact of such reductions on BNFL's ability to deal with legacy wastes at Sellafield. The Agency therefore invited comments from respondents to the public consultation on the suitability of year-on-year progressive reductions in discharge limits and on the scale of any progressive reductions. The Agency's decision on this matter reflects the concerns expressed by a number of parties concerning the need to treat stored legacy wastes (see Section 5 and Appendix 4), and has decided not to introduce any year on year reduction in this review.

3.65 The Agency's assessment (see Section 6 in the ED) concluded however, that there was scope to reduce the authorised annual discharge limit to sea for total beta radionuclides. Consequently, the Agency proposed that the site liquid annual total beta radionuclide discharge limit would be reduced from 400 TBq/year to 220 TBq/year whilst retaining the authorised limit for total alpha radionuclide discharges at 1 TBq/year. The reduced limit would apply from the effective date of the integrated authorisation. The Agency's decision is consistent with this proposal and provides a significant step toward achieving the Government's commitments under OSPAR (see Section 5 and Annex 1).

Habitats Regulations and Other Statutory Conservation Requirements

3.66 As explained in Appendix 10 of the ED, the Agency has various duties in relation to conservation. These include those under Sections 6 and 7(1)(b) of EA 95, and under The Conservation (Natural Habitats, &c.) Regulations 1994 ("the Habitats Regulations"). The latter require the Agency to have regard to the requirements of the Habitats Directive so far as they may be affected by the exercise of the Agency's functions (including those under RSA 93).

3.67 In addition to those requirements explained in the ED, the Agency has duties under Section 28G of the Wildlife and Countryside Act 1981. The Agency must take reasonable steps, consistent with the proper exercise of its functions, to further the conservation and enhancement of the flora, fauna, or geological or physiological features, by reason of which a site is of special interest. Under Section 85 of the Countryside and Rights of Way Act 2000, the Agency must have regard to the purpose of conserving and enhancing the natural beauty of relevant Areas of Outstanding Natural Beauty, when exercising its functions.

3.68 In the past it was assumed when making regulatory decisions about radioactive discharges that if humans were adequately protected then so too were other species. However, it is becoming increasingly recognised that non-human species and ecosystems should be protected in their own right. In collaboration with English Nature (the public body responsible for promoting nature conservation in England), the Agency has commissioned work to develop an assessment framework specifically for wildlife.

3.69 The Agency has completed a wider assessment of the radiological impact of all Sellafield's discharges on wildlife, using both the data generated by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) specifically for the current review of the Sellafield authorisations and a similar approach recently developed by Westlakes Scientific Consulting and Liverpool University under contract to the Agency and English Nature. These assessments were included in the public consultation package for the review. The results of these assessments suggest that the radiation doses to a range of fauna and flora in close proximity to Sellafield are low. The Agency believes that radiation doses to fauna and flora further from Sellafield will be lower (see Appendix 6). The Agency is, therefore, satisfied that radionuclide discharges are not having a significant effect on aquatic and other organisms. This will include species/sites protected under the Habitats Directive.

3.70 The current aerial and liquid discharge authorisations require BNFL to submit annual reports that include detailed programmes and research findings on the behaviour of radionuclides discharged from Sellafield. The objective behind this requirement is to improve understanding of the effect of discharges on the sustainability of ecosystems and communities of wildlife species. The Agency proposed in Section 6 of the ED to retain such requirements and has been informed by the consultation responses in making its decision on this matter (see Section 5 and Appendices 5 and 6).

3.71 The Agency considers that by its assessments and the intended requirements on BNFL, it has taken account of its duties under EA 95, the Habitats Regulations and other conservation legislation in arriving at its decisions (see Section 5 and Appendix 6).

Objectives Guidance/Sustainable Development

3.72 The requirements on the Agency in respect of sustainable development were outlined in Appendix 10 to the ED (paragraphs A10.10-A10.11 and A10.49-A10.54). As referenced in that document, the Government's Policy White Paper "Review of Radioactive Waste Management Policy: Final conclusions" (July 1995), Cm2919, stated that radioactive waste management policy should be based on the same basic principles as apply more generally to sustainable development. These include the use of "precautionary" action where there is uncertainty and potentially serious risks exist.

3.73 The Agency has been given Ministerial guidance as to the objectives it should pursue in discharging its functions (under Section 4(2) of the Environment Act 1995 (EA 95)). The 1996 Guidance to the Agency on sustainable development *(The Environment Agency and Sustainable Development, November 1996, 96EP189/1)* was summarised at paragraph A10.51 of the ED. The explanatory document with that guidance referred in Chapter 3 to the most commonly quoted definition of sustainable development from the 1987 Brundtland report "Our Common Future": *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*. It states that sustainable development does not mean that every aspect of the present environment should be preserved at all costs - *"what matters is that decisions throughout society are taken with regard to their environmental impact"*.

3.74 Chapter 3 of that guidance goes on to explain that a key objective of environmental and sustainable development policy is to ensure that environmental costs and benefits are properly and fully taken into account in public and private sector decisions alongside the economic costs and benefits. Chapter 6 gives specific guidance material for the Agency's Regulation of Radioactive Substances and Radioactive Waste, in particular paragraph 6.9 states that:

"radioactive wastes should be managed and disposed of in ways which protect the public, the workforce and the environment. The radiation protection principles and criteria adopted in the UK and applied by the regulatory bodies are designed to ensure that there is no unacceptable risk associated with radioactive waste management. In defining these principles and criteria and in their application by the regulators, it is recognised that a point is reached where additional costs of further reductions in risk exceed the benefits arising from the improvements in safety achieved and that the level of safety, and the resources required to achieve it, should not be inconsistent with those accepted in other spheres of human activity."

3.75 Objectives set by Ministers in the 1996 Guidance include that the Agency should:

- *adopt, across all its functions, an integrated approach to environmental protection and enhancement which considers impacts of substances and activities on all environmental media and on natural resources;*
- *work with all relevant sectors of society, including regulated organisations, to develop approaches which deliver environmental requirements and goals without imposing excessive costs (in relation to benefits gained) on regulated organisations or society as a whole;*
- *operate to high professional standards, based on sound science, information and analysis of the environment and processes which affect it; and*
- *develop a close and responsive relationship with the public, local authorities and other representatives of local communities, regulated organisations and public bodies with environmental responsibilities.*

3.76 In 1999, the Government published a strategy for Sustainable Development *(A better quality of life: A strategy for sustainable development for the United Kingdom, Cm4345).* Cm4345 restated the Government's commitment to sustainable development. To take further account of Cm4345, the Government intends to issue revised guidance to the Agency. This would replace the 1996 Guidance. In January 2002, DEFRA issued a Consultation Document "The Environment Agency's Objectives and Contribution to Sustainable Development: Statutory Guidance". This draft document listed a number of general "statutory objectives" for the Agency in discharging its functions. It gave a specific objective for the Agency in discharging its Radioactive Substances functions: *"To regulate aerial and liquid discharges, and solid radioactive waste disposal, in accordance with statutory duties, statutory guidance and Government policy".* The document also stated that the Agency's main contribution to achieving sustainable development will be to deliver the statutory objectives set out in the document in a way which takes into account (so far as is consistent with its legal obligations) economic and social considerations.

3.77 Any consideration of "sustainable development" is therefore closely linked to the consideration of social and economic factors, radiological protection principles, and the assessment of the potential impact of discharges both in terms of critical and collective doses, and potential harm to flora and fauna.

3.78 The Agency considers that its review of the Sellafield authorisations has satisfied the terms of the Ministerial guidance. In particular, the review has considered BPEO for the disposing of individual radionuclides to land, sea or air and BPM for minimising disposals from Sellafield. This has included the assessment of the costs and benefits, in line with the 1996 Guidance (see further below). The Agency's decisions in this DD, as implemented in the conditions in the certificate of authorisation (Annex 1), will ensure that the effect of radioactive waste disposals on the environment including ecosystems and wildlife will continue to be assessed by BNFL. The Agency has developed by means of the consultation process at each stage of the review of the Sellafield authorisations, a responsive relationship with members of the public national and local bodies, local authorities and interested groups and organisations. The Agency authorises discharges only if it considers the potential detriment to human health and environment to be within nationally and internationally recognised radiation dose limits. The Agency considers that its proposed decisions will ensure that exposures of members of the public and the population as a whole resulting from the disposal of radioactive waste are kept as low as reasonably achievable, economic and social factors being taken into account.

3.79 The Agency considers that in following the overall approach described in this decision document, it has ensured a proper application of the sustainable development requirements in reaching its decisions.

Human Rights Act 1998

3.80 The Agency's duties under The Human Rights Act 1998 ("the HRA") were explained in Appendix 10 of the ED. The Agency has considered whether any of its decisions would result in any potential or actual breach of a Convention right. Potentially relevant articles might be:

(a) Article 2 - Right to Life: For this Article to be engaged the European Court of Human Rights has considered that there must be a real and imminent threat of danger to health and physical integrity. The Agency is satisfied that none of its decisions present such a threat. The BSS Direction 2000 implements the UK obligations under the 1996 BSS Directive. The Direction requires the Agency to ensure that doses to the public resulting from radioactive waste disposal are kept as low as reasonably achievable, economic and social factors being taken into account. It also requires the Agency to ensure that the sum of doses to any member of the public do not exceed the dose limit set out in Article 13 of the Directive. The decisions will not result in the dose limit being exceeded.

(b) Article 8 - Right to Respect for Private and Family Life: The Agency is satisfied that its decisions will not result in pollution to the environment or harm to human health to the extent that Article 8 is engaged. Even if it were engaged, the Agency considers that its decision would be warranted and proportionate under Article 8(2).

(c) First Protocol, Article 1 - Right to Protection of Property: On the same grounds as for Article 8, the Agency is satisfied that its decision will not result in any interference with rights to the enjoyment of property to such an extent that this right is engaged. Even if it were engaged, the Agency considers that its decision on BNFL's applications would be warranted and proportionate.

(d) Article 6 - Right to a Fair Trial: To the extent that this article is engaged, the Agency is satisfied that the consultation process has provided the public with a fair opportunity to make informed representations. The Agency has considered carefully all the consultation responses and has addressed substantive comments made by respondents (see Appendices 3-6).

Other Statutory Requirements

3.81 As noted in Appendix 10 of the ED, Section 5 of EA 95 sets out the statutory purpose for which the Agency's pollution control powers are exercisable - *"preventing or minimising, or remedying or mitigating the effects of, pollution of the environment"*. The Agency considers that in implementing its decisions, it will be exercising its power of variation under RSA 93 in accordance with this statutory purpose.

3.82 EA 95 places a duty on the Agency to have regard to the effect of its decisions on the economic and social well being of local communities in rural areas. The Agency is satisfied that it has carried out this duty and has carefully considered responses to the public consultation which relate to this duty (see Appendix 3). The Agency is satisfied that its decisions would not have a significant impact on the health of workers and more broadly on the economic and social well being of West Cumbrian communities that rely heavily on Sellafield for employment (see Appendix 5).

Costs and Benefits

3.83 The Agency has a duty to take account of costs and benefits under Section 39 of EA 95. A similar duty applies through the requirement to take into account economic and social factors in ensuring that exposures to ionising radiation of any member of the public and of the population as a whole resulting from the disposal of radioactive waste are kept as low as reasonably achievable.

3.84 Cost-benefit and cost-effectiveness considerations are also part of the sustainable development and statutory guidance to the Agency (see above). "Costs and benefits" include, but are not limited to, direct financial costs on a regulated industry. Indeed, under Section 39 of EA 95, "costs" are specifically defined as including costs to any person and costs to the environment (Section 56 of EA 95).

3.85 The Agency views the assessment of costs and benefits, including that based on monetary valuation, as a tool to inform the decision. A combination of qualitative and quantitative factors will inevitably need to be considered in determining an overall decision.

3.86 In the assessment of, for example, the costs and benefits of a specific radionuclide abatement/disposal option, quantitative factors to be considered include radiation dose saving to members of the public, extra radiation dose to the workforce, additional monetary cost to BNFL and timescale required to implement the option. The Agency has considered such factors where appropriate in its assessments of BPEO/BPM cases for individual radionuclide disposals (see Appendix 6 of the ED).

3.87 Qualitative factors are more difficult to assess and include:

- Government policy and commitments
- non-monetary costs and benefits
- other legal requirements
- impact on safety

3.88 The Agency considered such factors where relevant in formulating the proposals set out in the ED (see Sections 5 and 6 and Appendices 6 and 7 of the ED). It has considered them further in reaching its proposed decisions, particularly where raised in consultation responses or by developments such as the finalisation of the UK Discharge Strategy (see above and Appendices 3-6 of this DD). Figure 3.1 illustrates these inputs to the Agency's decisions.

3.89 To inform its decision-making process, the Agency commissioned an independent assessment of the additional monetary costs to BNFL of the proposals (see Section 4, Appendix 7 and Supporting Information).

3.90 The Agency has also considered all the information from BNFL. As explained above, the company submitted information just prior to and also in response to the consultation. This consisted of revised worst case projected discharge data, business requirements discharge limits, plant operating conditions, recent discharge data for 2000-2001 and estimated monetary costs to the company associated with the Agency proposals (see also Sections 4 and 5 and Appendix 7 of this DD).

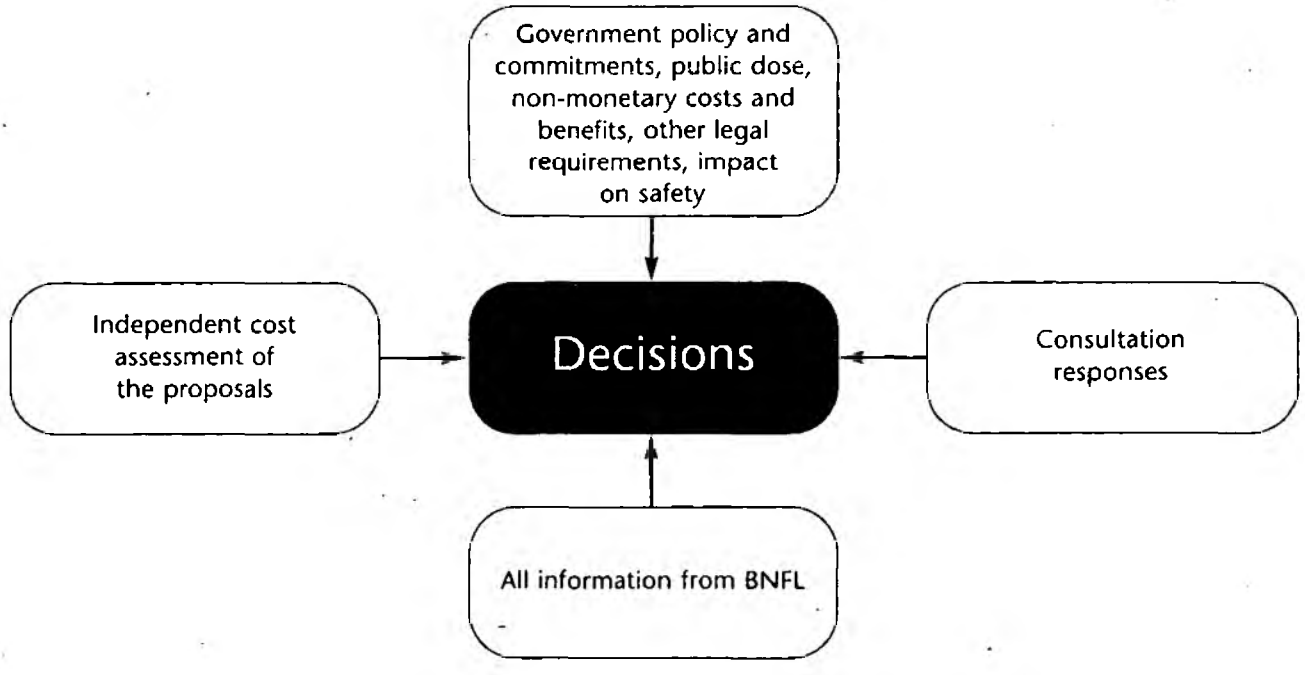


Figure 3.1: Inputs to the Decision

3.91 An input that may be used in any decision on the optimisation of radiological protection is the comparison of the cost of measures to reduce radiation dose with the attributable benefit from the reduction in collective radiation exposure. The underlying basis for such analyses is the premise that collective dose is an indicator of what the International Commission on Radiological Protection (ICRP) describe as the `objective health detriment', i.e. a measure of the total risk of stochastic effects (cancers and hereditary defects) in an exposed population. It should be noted that the optimisation of radiological protection is a requirement in addition to the radiological protection principle that the level of radiation dose to individuals (i.e. the critical group dose) is less than the dose limit, and therefore is used to drive down doses even further.

3.92 The National Radiological Protection Board (NRPB) issued advice in 1993 on the monetary value of a unit of collective radiation dose for use during the 1990s (£20,000 per man sievert for public exposure). This can be used to provide a rough monetary valuation of collective radiation dose. Allowance for inflation at an average rate of 3% since 1993 would result in an increase of about 30% in the monetary valuation taking it to around £25,000 per man sievert.

3.93 The Agency is aware of the debate about the usefulness of collective dose, particularly when it is made up predominantly of very small doses to a very large number of individuals. The valuation of unit collective dose is also subject to uncertainty. The value given above was derived by the NRPB using data representative of research carried out in the UK context which gave a median value of life of £1.6 million (1990 prices). One of the underpinning concepts involved in the research was 'Willingness to Pay', which can vary from country to country. However, the ICRP states in its Publication 37 that the value of collective dose for exposures in other countries should be no less than that applied for exposures in the country of the source. The Agency has therefore decided that the value recommended by NRPB should be the principal value for use in its cost assessment.

3.94 In addition to the value recommended by the NRPB for the UK, other values can be found in the scientific literature. For example, a paper published in 1997 *(Guenther and Thein, Estimated Cost of Person-Sv Exposure, Health Physics vol. 72(2), 1997)* analysed data for the USA and suggested that a "conservative average" for public exposure is $200,000 per man sievert (or about £140,000 per man sievert at the current rate of exchange). Another paper published in 2001 *(Zeevaert et al, Evaluation and ranking of restoration strategies for radioactively contaminated sites, Journal of Environmental Radioactivity, vol. 56(1-2), 2001)* referred to a value agreed by the Nordic Radiation Protection Authorities in 1991 of Euro 100,000 per man sievert (of the order of £60,000 per man sievert at the current rate of exchange). In recognition of the uncertainties surrounding collective dose valuation the Agency has taken account of the implications of these higher values.

3.95 Another means of assessing the detriment of radiation exposure is to assess the implied statistical deaths derived by the application of an appropriate `risk factor' to the collective dose. This involves determining a Value of Prevented Fatality (VPF) or Value of Statistical Life (VOSL) which is used in the assessment of road transport schemes in the UK. The value calculated can then be compared with the costs of abatement measures. A VPF often used in the UK is around £1 million per life saved. A report by National Economic Research Associates (NERA) in 1998 for the DETR and Department of Trade and Industry (DTI) on the valuation of deaths arising from (non-radioactive) air pollution suggested that the Valuation Of Statistical Life (VOSL) saved for the potential latent effects of air pollution such as cancer, could be valued up to 2.5 times more than the value used for assessing road traffic fatalities. This implies a VOSL of £2.5 million.

3.96 The Agency has determined the monetary value of collective dose savings associated with potential abatement options in its assessment of BPEO/BPM for the disposal of individual radionuclides (see Appendix 6 of the ED). The Agency has assessed the collective dose saving to the world population from projected discharges at the limits in the authorisation (see Annex 1) truncated over 500 years. The Agency has determined the monetary value of this saving and compared it with the estimated cost to BNFL of the Agency's decisions (see Section 4). The Agency considers that the use of discharge limits for such assessments is appropriate as BNFL could, if necessary, discharge up to an individual limit. It is also considered that they provide the only firm basis on which such prospective assessments can be carried out.

3.97 The monetary value of radiation dose and assessed dose detriment are contributory factors only, alongside other factors in the Agency's regulatory decision making process. The Agency considers that, in addition to assessing collective dose, it is important to take account of the dose to the most exposed members of the public from Sellafield discharges. At present there is no standard method for assessing the monetary value of this dose. The Agency has therefore adopted a qualitative approach for assessing the significance of such dose savings associated with potential radionuclide abatement options (see Appendix 6 of the ED).

3.98 By permitting discharges of radionuclides from Sellafield into the environment the UK continues to receive criticism from other European countries. It is essentially for the Government, not the Agency, to consider relations with those other countries, through OSPAR or other appropriate fora. For its part, the Agency considers that its decisions set out in this document demonstrate that the site is tightly regulated and that pressure is being placed on BNFL to reduce radionuclide discharges in accordance with Government policy. The Agency also considers that the estimated cost of the decisions is not disproportionate to the potential benefits (see Sections 1 and 7).

4.0 Assesment of additional costs

Introduction

4.1 The Agency recognised during the review of the authorisations that its proposals could result in BNFL incurring additional costs in a number of areas. In addition, the Agency noted that many respondents to the public consultation were concerned about the potential costs associated with the proposals (see Appendix 5). Therefore, to quantify any additional costs, the Agency let a contract with RM Consultants Ltd (RMC) to carry out an independent financial assessment of the proposals. The Agency requested RMC to use source data derived from other industries where possible to ensure an appropriate comparison with BNFL cost estimates.

4.2 The results of RMC's work are summarised below and the full report is included in the Supporting Information (see Appendix 7). BNFL provided information in response to issues raised by RMC and to requests for cost estimates related to the proposals.

Methodology

4.3 An outline of the methodology used by RMC for the cost assessment is given in Figure 4.1 below.

4.4 RMC identified from the ED a number of proposed changes (55) that would result from the introduction of the single integrated authorisation for Sellafield. These changes were summarised in a 'Gap Analysis' with details of the differences (gaps) between the conditions and limitations in the current authorisations and those in the proposed authorisation. RMC checked the Gap Analysis against both BNFL and Agency understanding. The proposed changes were then arranged in nine classes (see Table 4.1 and Appendix 7).

4.5 RMC requested cost estimates from BNFL for the proposed changes identified in the Gap Analysis and additional information to support such estimates. The cost estimates were to be:

- capable of presentation in terms of `capital' and `annual operating' cost components;
- qualified by uncertainty, and quoted in terms of `maximum', `minimum' and `most likely' costs;
- supported by all key assumptions made; and
- additional to costs that would be incurred to comply with the proposed authorisation.

4.6 RMC interpreted the cost data from BNFL and reproduced them in a format suitable for cost modelling. Cost data for nine of the ten classes of proposals were reduced to two components:

- capital and other one-off costs assumed to be incurred during the first year of the proposed new authorisation; and
- annual operating costs.

4.7 Cost data relating to potential delays in plant operations and consequential extensions to plant operating lifetimes that could result from reductions in discharge limits (Class G) were not amenable to the same rigorous analysis as all other classes of proposal (see Table 4.1).

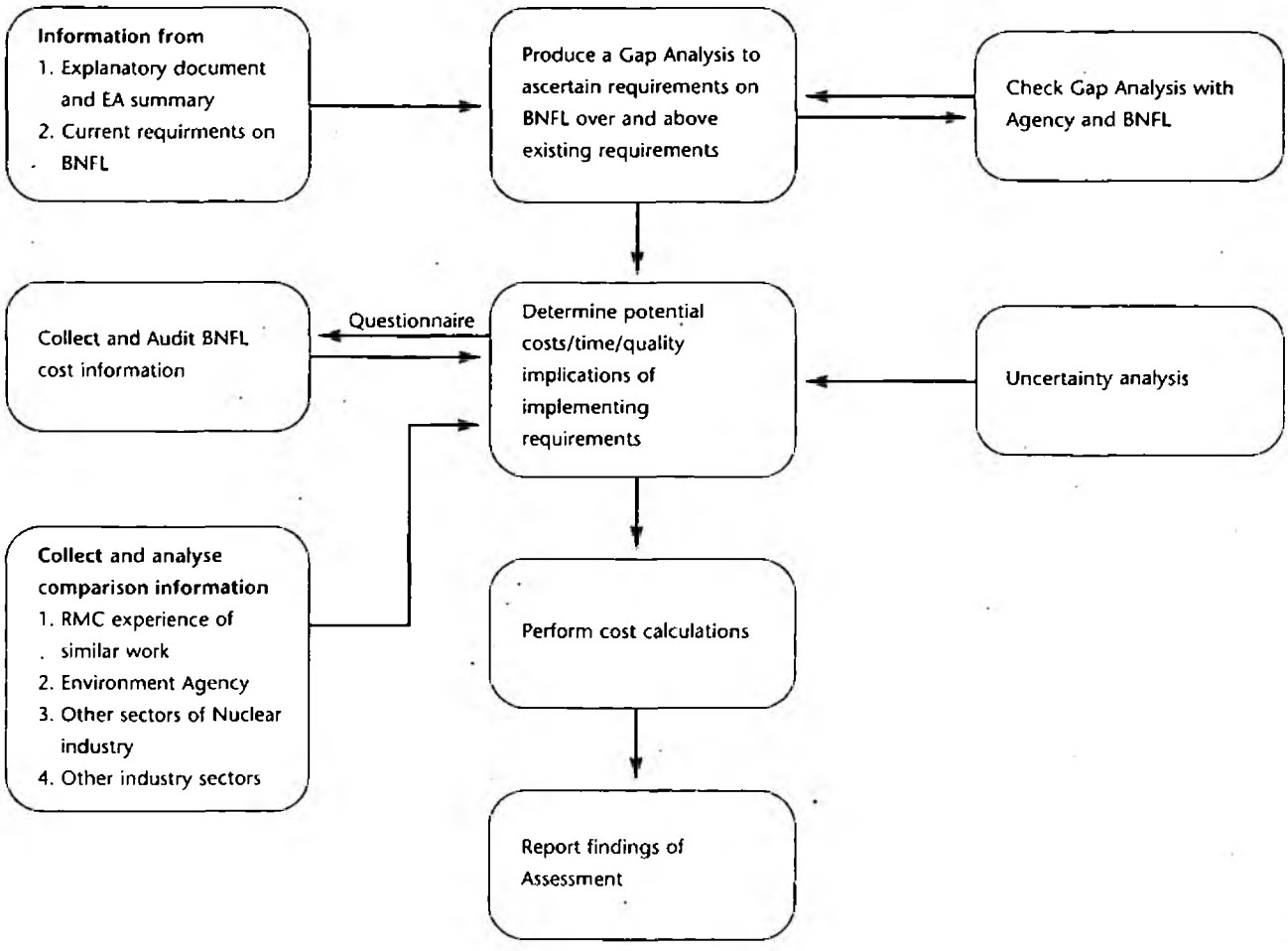


Figure 4.1: RMC Assessment Methodology

4.8 RMC informed the Agency that it was not possible due to the unique nature of the operations at Sellafield to make a realistic comparison of BNFL's cost estimates for potential restrictions in plant operations with external cost data from other sources. Consequently, BNFL's cost estimate only for limit reductions (Proposal Class G) is presented in Table 4.1.

4.9 Proposed changes were selected by RMC for financial analysis on the basis of:

- practicality (some costs could not be acquired from external sources);
- significant spend; and
- significant difference between the Agency and BNFL in interpretation of the proposed new authorisation conditions.

4.10 Cost information acquired from external sources other than BNFL was collated and presented on the same basis as BNFL's cost data. Differences in the acquired costs were explained by comparing assumptions made by BNFL and those of the Agency for changes and additional requirements in the proposed authorisation (see RMC Report in the Supporting Information).

RMC's Conclusions

4.11 The Agency notes RMC's conclusions resulting from the assessment of additional costs:

- the additional costs are dominated by possible costs associated with throughput restrictions resulting from reduced discharge limits; and
- there are large differences in some areas between the costs provided by BNFL and those acquired from other sources.

4.12 RMC examined the reasons for these differences in estimated costs as summarised below:

- **Differences of interpretation of costs:** Differences in the exact interpretation of the Information Requirements in the proposed authorisation, even though the Agency had previously discussed in detail its proposals with BNFL. For example, differences between the Agency and BNFL in the interpretation of the number of new BPEO studies needing to be carried out to comply with the authorisation. This feature applies in particular to the proposed conditions relating to environmental management (see Proposal Class E in Table 4.1).
- **Differences of perspective:** The Agency proposed that BNFL would be required to report discharges from a number of individual outlets that are not required in the existing gaseous discharge authorisation. The data would enable the Agency to assess whether such outlets should have individual limits rather than be grouped with other discharge outlets and regulated as 'approved places' (see Section 5). BNFL indicated that it would not submit discharge data for release into the public domain unless it met the same quality standard as discharge data submitted in compliance with the current authorisation. Even though the Agency was satisfied in particular instances that the current methods of sampling and analysis for such outlets would be sufficient to facilitate its assessments. BNFL considered that as a consequence of Agency's requirement it would have to upgrade some of its sampling and analysis methods for certain discharge outlets. BNFL regarded that it could not appear to be in breach of the letter or the spirit of any authorisation condition and has built 'insurance' costs into its estimates for regulatory compliance. In addition, BNFL considered that the proposed discharge limits would have a significant effect on costs by way of reducing plant throughputs leading to extensions to plant lifetimes. This feature applies also to the proposed conditions relating to new sampling, analysis and reporting requirements (see Table 4.1).
- **Cost allocation:** Costs are incurred by BNFL for a number of reasons, e.g. safety, environmental, commercial, public relations, etc., and the allocation of costs to the various categories can be problematical. This feature is evident across the range of differences in the cost estimates (Table 4.1). BNFL has chosen to treat, for example, a Quarterly Notification Level (QNL), (i.e. a discharge level in the authorisation that if exceeded BNFL is required to report in writing to the Agency including the means it has used to limit the activity of relevant waste discharged), as a `legal limit', with all the implications in the event of its being `breached', and has allocated costs accordingly. In fact, a QNL is not a limit and in the event of its being exceeded the Agency would normally initiate enforcement action only if it were satisfied that BPM had not been used to minimise the activity of waste discharged.

4.13 The Agency notes RMC's overall conclusion that the major difference of view concerns the possible impact on future BNFL operations of the proposed system of limits and the proposed reductions in limits.

Additional Cost Estimates

4.14 BNFL has stated in correspondence with the Agency (see Appendix 7), *"In response to the series of questions raised by the Agency's consultants, we estimate the resource impact to be a minimum added cost of £160M, with potential for further very substantial costs."* The Agency has been informed by BNFL this estimate is comprised of mainly operating costs spread over a number of years and includes a relatively small element of capital cost.

4.15 In relation to the potential impact of the proposals on planned operations in particular BNFL has also stated (see Appendix 7), *"...we have only been able to quantify the potential impact of the Agency's proposals on some key plants. The estimated impact of the Agency's proposals, in terms of additional cost, on a 'lifetime-of-the -plant' basis and assuming the Agency's proposals remain in place, is an added cost of at least £120M. It is important to note that this is an absolute minimum cost estimate and that the analysis shows other cost estimates higher than this by an order of magnitude (particularly if new capital investment is required). There may also be an impact on a range of waste treatment facilities and decommissioning operations at Sellafield, but these impacts are problematic to assess with comparable confidence. The potential cost could amount to several £Ms per year."*

4.16 The Agency notes that BNFL's estimate of *"minimum added cost"* (£160M) resulting from the Agency's proposals is comprised of £120M for potential restrictions in operations resulting from limit reductions (proposal class G in Table 4.1) and £40M relating to the other proposals (proposal classes A-F in Tables 4.1 and 4.3). The cost figure (~£1000M) for limit reductions in Table 4.1 is based on BNFL's assessment of the maximum impact in terms of plant lifetime extensions and potential capital costs for new plant.

4.17 The estimated additional costs of the Agency's proposals are summarised in Table 4.1 from RMC's report. Cost estimates are expressed in £millions and in most cases have been approximated to the nearest £0.1million.

Table 4.1 | Estimated Potential Cost of Agency's Proposals

Proposal Class	Estimates based on costs elicited by RMC form BNFL (£million)		RMC estimated costs (£million)	
	Cost Range*	Median Cost Value	Cost Range*	Median Cost Value
A. General conditions and scope of authorisation	0	0	0	0
B. Diversions to SIXEP	11.3 – 18.8	14.4	11.3 – 18.8	14.4
B. THORP modifications	3.2 – 4.1	3.7	2.0 – 2.7	2.4
B. Stack sampler at B204	0.11 – 0.12	0.12	0.11 – 0.12	0.12
C. Solid waste disposals	-0.17 – 1.3	0.51	-0.37 – 1.1	0.28
D. Sampling, analysis and reporting	2.2 – 2.6	2.4	1.1 – 1.4	1.2
E. Environmental management system	11.8 – 13.9	12.8	6.1 – 7.1	6.6
F. Miscellaneous	0.12 – 0.15	0.14	0.10 – 0.13	0.11
Total Cost (A-F)	28.56 – 40.97	34.07	20.34 – 31.35	25.11
G. Limit reductions	~1000	~1000	-	-

* Cost range is presented as 5th to 95th percentile i.e. 5% probability that actual cost is less than or equal to the lowest figure in the range and 95% probability that actual cost is less or equal to the highest value in the range, to reflect a degree of uncertainty in some cost estimates. The 50th percentile is represented by the median cost value.

Limit Reduction Costs

4.18 In formulating its proposals for future discharge limits, the Agency applied a constraint that there would be no increases above the current limits for waste discharges to sea and air. The Agency proposed in the ED a set of individual plant limits and site limits that were in most cases substantially lower than current limits. The Agency reduced the headroom between the assessed future discharges and the proposed limits compared to the headroom provided by current limits. In some cases the proposed limits have been changed after consideration of the responses to the public consultation and assessment of further information and issues raised by BNFL (see below and Table 4.2).

4.19 The total estimated cost of the Agency's proposals is dominated by the potential cost resulting from the proposal to reduce the headroom between actual discharges and limits to the minimum necessary for plant operation. BNFL claimed that reducing headroom and, for example, the introduction of individual plant limits and rolling year plant throughput limits would restrict plant operations causing operational delays and extensions to plant operating lifetimes. A number of respondents to the public consultation expressed concern that the proposed limits would restrict BNFL's operations.

4.20 The Agency has reconsidered its proposals for certain discharge limits (see Table 4.2) in the light of responses to the public consultation, the information provided by BNFL on its business requirements for future discharges, BNFL's revised worst case discharges information, past discharge data up to the end of 2001, information gathered through the routine regulation of the site and other information including cost information supplied by BNFL (see Section 5 and Appendix 4). As a result, the Agency has made changes to the proposed site limits for 6 and 10 radionuclides discharged to sea and air respectively (see Table 5.1). The changed radionuclide site limits are, in every case, lower than the current site discharge limits.

4.21 BNFL provided specific examples of where it believed that the proposed individual plant limits would delay work programmes and would prolong operating plant lifetimes leading to significant extra costs. The Agency assessed this information and has revised the plant limits appropriately to allow BNFL to be in a reasonable position to achieve future work programmes. Increases in proposed plant limits have been introduced for some radionuclides, whilst reductions have been made in proposed plant limits for other radionuclides (for details see Section 5 and Appendix 4). These changes have necessitated the changes to the proposed site discharge limits referred to above. It should be noted, however, that there will be no increase in any existing plant limit as a result of the Agency's decisions on plant limits.

4.22 BNFL and other respondents to the public consultation raised concerns that rolling 12-month plant throughput related limits would make compliance with limits too complex (see Table 4.2). In particular, BNFL argued that the detailed proposals relating to modifying the current calendar year throughput limits to rolling 12-month annual limits, and also the reductions in throughput limits would potentially restrict fuel throughput and thereby prolong the operational lifetime of THORP and the Magnox Reprocessing Plant. The Agency recognises the concerns of some respondents relating to throughput limits and has made a number of changes to take account if these concerns (see Section 5 and Appendix 4).

4.23 The Agency notes that the throughput performances of THORP, the Magnox Reprocessing Plant and the Waste Vitrification Plant in recent years have been significantly less than those projected for the next several years. The Agency also notes that at present BNFL's management strategy for historical waste is undergoing further development and that current indications are that waste retrieval from a number of facilities will not begin before 2010/11. The Agency and HSE have given clear indications to BNFL that prolonged delays in waste retrieval work are unacceptable and need to be justified.

4.24 There may be occasions in future when BNFL requires further operational flexibility in respect of plant limits, to allow the expeditious treatment of stored waste or for other safety reasons. The Agency would expect BNFL to provide a fully substantiated case for the variation of any individual plant limit under the Agency's RSA 93 powers. Provided that the proposed change would not entail any increase in a site limit, the Agency would not normally expect to consult beyond the statutory consultees (HSE and FSA). The Agency would inform Ministers before issuing such plant limit variations. In accordance with normal procedure, the Agency would place such variations on the appropriate public registers (see Annex 2).

Table 4.2 | Summary of Issues Related to Agency's Discharge Limit Proposals

Operation	Issue	Agency Decision
1. THORP Reprocessing	i) Aerial and liquid rolling year throughput limits. ii) Reductions in aerial tritium and iodine-129 throughput limits.	i) Calendar year throughput limits will remain in force instead of introducing rolling year throughput limits. ii) Existing tritium and iodine-129 calendar throughput limits will not be reduced.
2. Magnox Reprocessing	i) Rolling year throughput limits. ii) B204 stack tritium throughput aerial limit may constrain operations towards the end of Magnox reprocessing due to the reprocessing of higher burn-up fuel. iii) B204 stack total beta radionuclides limit. iv) Fuel Handling Plant (FHP) aerial limits for caesium-137 and total beta radionuclides.	i) Calendar year throughput limits will remain in force instead of introducing rolling year throughput limits. ii) The latest information from BNFL suggests that fuel burn-up will not increase towards the end of Magnox reprocessing as the Wylfa and Oldbury closure dates have been brought forward. However, minor revisions have been made to the Magnox throughput related limits to ensure that the allowance within the limits for discharges at zero fuel throughput is consistent with that allowed for THORP (see Section 5 and Appendix 4). iii) B204 stack total beta radionuclide limit has been revised upwards from the Agency's proposal with a pro-rata reduction in the STP total beta limit to ensure no increase in the current Schedule 1 limit in the gaseous discharge authorisation. iv) Fuel Handling Plant (FHP) strontium-90, caesium-137 and total beta radionuclides aerial limits have been revised upwards from the Agency's proposal with a pro-rata reduction in other Schedule 3 plant limits where appropriate to ensure no increase in the current Schedule 3 limit.
3. Waste Vitrification Plant	i) Iodine-129 aerial limit proposal. ii) BNFL cite concerns regarding several other limits but no details provided.	i) Iodine-129 limit has been revised upwards from the Agency's proposal to take account of uncertainty in the trapping efficiency of radio-iodine sampling equipment and cross-over between the B215 and WVP ventilation systems. ii) Ruthenium-106 limit has been revised upwards from the Agency's proposal due to uncertainty over the use, by the Agency, of a BNFL model adjustment factor to compensate for fuel cooling times.

Table 4.2 | Summary of Issues Related to Agency's Discharge Limit Proposals (continued)

Operation	Issue	Agency Decision
4. Site Liquid Discharges	i) Liquid limits for shorter half-life radionuclides (zirconium-95/ niobium-95 and cerium-144). ii) Liquid limits for antimony-125, strontium-90, amercium-241, plutonium-alpha, total alpha radionuclides and total beta radionuclides.	i) BNFL say that the proposed short half-life radionuclide limits are too low on the basis of 1994 discharge data. The Agency considers this discharge data is not representative of the current effluent management arrangements. However, the Agency has adjusted the limits for short half-life radionuclides to take account of Magnox and THORP fuel burn-up/cooling factors, the THORP/SETP factor and revised SIXEP data. ii) The proposed antimony-125 limit has been revised upwards from the Agency's proposal to allow the current issues with corroded fuel in FHP to be resolved. iii) BNFL say that the proposed radionuclides limits for strontium-90, americium-241, plutonium-alpha, total alpha radionuclides and total beta radionuclides are too low on the basis of 1994 discharge data.* The Agency considers this discharge data is not representative of the current effluent management arrangements. In the case of americium-241, plutonium-alpha and total alpha radionuclides the proposed site limits are set at the current site limits. BNFL has not applied for an increase in these discharge limits but the Agency does not propose to increase these limits
5. THORP Pond Purges	i) Liquid total alpha radionuclides limit.	i) Investigations revealed that recent elevated limits of detection of total alpha discharges relate to the use of different counting equipment & samples with a high solid content (thought to be related to THORP cleaning operations). Agency has revised the plant limit upward from the Agency's proposals to take account of these factors.
6. SIXEP Liquid Discharges	i) Liquid limits for zirconium-95/ niobium95, antimony-125, strontium-90.	i) In the case of zirconium-95/niobium-95 limits, BNFL revised the SIXEP worst-case discharge data but do not appear to have taken this into account in their resource impact assessment. The proposed antimony-125 discharge limit has been revised upwards from the Agency's proposal to allow the current issues with corroded fuel in FHP to be resolved. Regarding Sr-90, BNFL concerns relate to 1994 discharge data. Sr-90 discharges have decreased over recent years "resulting from a general decrease over the period January 1994-October 1999 due to plant optimisation" (see BNFL Part A Submission, February 2000 in Supporting Information to the ED). Discharges over the last year have increased again due to issues related to corroded fuel in FHP and were 34% of the proposed limit at the end of 2001. The Agency does not consider that a change to the proposed plant limit is appropriate at this time.

Table 4.2 | Summary of Issues Related to Agency's Discharge Limit Proposals (continued)

Operation	Issue	Agency Decision
7. SETP Liquid Discharges	i) Liquid limits for zirconium-95/ niobium-95, amercium-241, total alpha radionuclides and total beta radionuclides.	i) BNFL states that the proposed radionuclide limits are too low on the basis of 1994 data. * The Agency considers this discharge data is not representative of the current effluent management arrangements. However, in the case of Zr/Nb-95, the Agency has adjusted the limits to take account of the potential to reprocess shorter cooled Magnox fuel. ii) In the case of americium-241 and total alpha the proposed plant limits for SETP are set at the current site limits. BNFL has not applied for an increase in these discharge limits and consequently the Agency does not propose to increase these limits.

*BNFL states it has used 1995-2001 actual discharge information for its assessment. This suggests that americium-241 and total alpha discharges have exceeded the proposed site limits. Since the proposed site limits are the same as the existing site limits, which came into force in 1995, the BNFL assessment implies that BNFL has breached their current discharge limits. The Agency has checked the record of past discharges, which shows that the referenced levels of discharge occurred in 1994 when the site limits were higher. This issue has been highlighted to BNFL.

Table 4.3 | Estimated Potential Cost of Agency's ProposalsEstimated Potential Cost of Agency's Decisions

Proposal Class	Estimates based on costs elicited by RMC form BNFL (£million)		RMC estimated costs (£million)	
	Cost Range*	Median Cost Value	Cost Range*	Median Cost Value
Total cost (classes A-F)	29 - 41	34	21 - 31	25.0

*Cost range is presented as 5th to 95th percentile i.e. 5% probability that actual cost is less than or equal to the lowest figure in the range and 95% probability that actual cost is equal to or less than highest value in the range. The 50th percentile is represented by the median cost value. Costs have been rounded to the nearest £1M.

4.25 As a result of some changes to discharge limits, the Agency considers that the total additional cost to BNFL (£20-31M, Table 4.3) associated with the Agency's decisions on limits has been reduced substantially compared to the BNFL estimated cost (~£1000M) of the Agency's proposals in the ED (see Table 4.1). Furthermore, no major additional cost associated with operational delays and extended plant lifetimes should be incurred by BNFL as a result of the decisions. The Agency also considers that the outstanding limit issues raised by BNFL (see Table 4.2) have been addressed and that there is a relatively small extra cost only associated with its decisions on limits. The Agency considers that its decisions will permit the normal operation of plants at Sellafield and will allow BNFL to meet its business requirements for fuel reprocessing, as well as retrieval of historical waste and decommissioning of redundant plant. The changes made to the ED proposals will not compromise the protection of public health or the environment in any way.

Other Costs

4.26 The remaining extra cost relates to improvement and information requirements for which BNFL provided a maximum lifetime cost estimate of around £40M (see Tables 4.1 and 4.3 and Appendix 7). Two of the improvement requirements, involving a total estimated cost of £11-21, relate to the re-routing of B27 and B29 pond purges to SIXEP. Both requirements include the proviso that they should be implemented only if reasonably practicable. In addition, the Agency is aware that current B27 pond purges are routinely discharged to SIXEP when biocide is not used in the pond. BNFL has informed the Agency that re-routing B29 pond purges to SIXEP during post operational clean out (POCO) and associated work in the pond is BPM because radioactivity levels in the pond water at that time are likely to be too high to be discharged to SETP. With respect to the requirement for the use of iodic acid to reduce iodine-129 discharges from THORP (cost estimated at around £1M), this is conditional on plant trials being successful. Similarly, the requirement for cobalt-60 abatement in THORP liquid discharges (estimated extra cost around £12-18M) is conditional on ion exchange trials being successful.

4.27 The Agency considers that when these requirements and their associated costs are viewed realistically, the true extra costs resulting from the Agency decisions could be in the region of £3-6M based on the information in BNFL's Resource Impact Assessment (RIA) Summary Document (see Appendix 7).

4.28 This cost is not disproportionate when set against the potential benefits of the major changes in the regulation of discharges from Sellafield and is considered to be a similar order of magnitude to the cost of recent requirements by HSE for improvements in safety management systems on the site. The estimated cost of the decisions is relatively small in comparison with BNFL's turnover in 2001 from Sellafield operations (excluding Calder Hall nuclear power station) that was reported to be £549 million (ref. BNFL Annual Report 2001).

Technetium-99 Costs

4.29 The estimated costs of the Agency's decisions regarding technetium-99 (Tc-99) discharges are not included here because a detailed cost/benefit assessment has been carried in a separate review of this radionuclide. The Agency's decision on Tc-99 requires BNFL to implement the diversion of Medium Active Concentrate (MAC) to vitrification that will lead to a reduction in discharges not only of Tc-99 but also of other radionuclides. The Agency derived a best estimate figure of around £4 million for the discounted cost of MAC diversion. This is explained in the Tc-99 Decision Document that analyses the benefits/detriments of the diversion scheme.

Assessed Benefits

4.30 A maximum collective dose saving to the world population (over 500 years) of around 100 man Sv per year of discharge at the limits has been assessed (see Appendix 8 of the ED). The Agency considers that the use of discharge limits for such assessments is appropriate as BNFL could, if necessary, discharge up to an individual limit. The use of discharge limits provides the only firm basis on which such prospective assessments can be carried out. Assuming discharges over a 10 year period (Magnox reprocessing is due to end in 2012 and oxide fuel reprocessing is currently planned to continue for at least 10 years), this equates to a collective dose saving of around 1000 man Sv. Based on around £25,000 per man Sv, as advised by NRPB, this dose saving is equivalent to a monetary value of around £25 million. The maximum cost of the Agency's decisions is estimated to be £20-40 million (see Table 4.3), which is not significantly different from the value of the collective dose saved.

4.31 The Agency notes that other monetary values for collective dose have been published in international scientific journals by researchers in other countries in recent years (see Section 3). Using these data, where figures of around £60,000-140,000 per man Sv have been derived, a collective dose saving of 1000 man sievert equates to a monetary value of around £60-140 million.

4.32 The NRPB monetary value of collective dose was derived using data representative of research carried out in the UK context which gave a median value of life of £1.6 million (1990 prices). One of the underpinning concepts involved in the research was 'Willingness to Pay', which can vary from country to country. However, the ICRP has stated that the value of collective dose for exposures in other countries should be no less than that applied for exposures in the country of the source. The Agency has therefore decided that the value recommended by NRPB should be the principal value for use in its cost assessment.

4.33 The Agency recognises that the monetary equivalent of collective dose savings is only one of a number of factors that should be considered when assessing the benefits of regulatory proposals. It would be wrong to emphasise the importance of collective dose above other factors, particularly when it is made up predominantly of very small doses to a very large number of individuals. In addition to the factors that are quantifiable there are those e.g. social and political factors that are difficult to quantify. As the recently issued UK Discharge Strategy explains, balancing and prioritising all the considerations involved in radioactive waste management decisions is a matter of fine judgement. It is also essentially a matter of subjective judgement.

5.0 The Agency's proposed decisions

Introduction

5.1 This section presents the Agency's decision on each of its proposals in the ED. The Agency has carefully considered all issues raised during the public consultation as well as all the information provided by BNFL. This includes information submitted by BNFL after the deadline set by the Agency for it to be taken into account in the discharge limit proposals set out in the ED, and the latest data on actual discharges for 2000-2001 and further discharge information relating to recent site operations (see Appendix 7 and Supporting Information).

Integrated Certificate of Authorisation

> ***Decision:*** *A single integrated certificate of authorisation will be introduced for regulating waste disposals to air, sea and land from Sellafield.*

5.2 The Agency identified in the ED a number of options for revising the format of the Sellafield authorisations and proposed that a single integrated certificate of authorisation for regulating waste disposals to air, sea and land from Sellafield should be introduced (see paragraph 6.2 and Appendix 1 of the ED).

5.3 The Agency notes that the option for a single integrated certificate of authorisation was supported by those respondents to the public consultation who commented on this proposal (see Appendix 5).

5.4 The introduction of an integrated authorisation is considered to be consistent with both the Agency's holistic approach to environmental protection and its regulation of waste disposals from non-nuclear sectors of industry. The Agency considers that a single integrated authorisation (see Annex 1) that covers radioactive waste disposals to all media will reduce the complexity involved in the variety of existing authorisations and will improve the overall transparency of the Agency's regulation of the Sellafield site.

No Increases in Limits

> ***Decision:*** *There will be no increases in discharge limits above the current limits.*

5.5 In formulating its proposals for future discharge limits, the Agency applied a constraint that there should be no increases above the current limits. This approach is considered to be consistent with the objectives of the review (as set out in Section 3) and appropriate given that BNFL did not put forward any application for increases in the existing discharge limits.

5.6 In general, respondents who addressed this specific issue supported this constraint but a few were concerned that this may only be a temporary measure, with the possibility of future increases in limits. Some respondents were concerned that provision should be made to allow increases in limits in the interests of making the site safer.

5.7 The ED made it clear that *"The Agency will assess the need for any increases in discharge limits and will increase limits in individual circumstances where BNFL has provided a justified case."* This advice is in line with the draft Statutory Guidance to the Agency on the regulation of radioactive discharges from nuclear sites which states: *"increases in discharges, from existing operations on the site, may be permissible if these are the inevitable result of measures required to reduce significant risks associated with dealing with historic waste legacies and with existing redundant plant, provided such increases in discharges are time limited, and the minimum necessary to achieve the required reduction in risks. But this will require a specific detailed case in each instance."* To date BNFL has not applied for any such increases to existing discharge limits. The Agency will consider any future application from BNFL for increases to discharge limits in line with Government guidance.

5.8 The Agency has decided that the constraint - that there will be no increases in discharge limits above the current limits - remains appropriate and has applied it when reaching its decisions on future discharge limits. The Agency considers that this position is consistent with the UK's OSPAR commitments and with current UK Government policy, which is directed towards reduction in discharge levels (see Appendix 3 of this document and Appendix 10 of the ED).

Site Discharge Limits

5.9 A number of proposals were consulted on which, if implemented, would broaden the scope of site limits to cover all the principal radionuclides discharged from Sellafield and also make significant reductions to the existing limits.

Reductions in Annual Site Limits for Discharges to Air and Sea

> ***Decision:*** *The annual site limits for 13 and 8 radionuclides discharged to air and sea respectively, will be reduced (see Table 5.1).*

5.10 In undertaking the review the Agency has been charged with ensuring that: *"Any headroom allowed between actual discharges and discharge limits should be kept to the absolute minimum. Limits should be set that are no more than strictly necessary for the normal operation of the plant, whilst at the same time achieving progressive reductions in those limits over time in accordance with established Government policy."* (Letter Rt. Hon. M. Meacher to Lord De Ramsey (Environment Agency Chairman) dated 19th November 1999).

5.11 Accordingly, the Agency developed and utilised a limit setting methodology to implement this policy whilst also taking account of developments with regard to the UK Discharge Strategy and the draft Statutory Guidance to the Agency on the regulation of radioactive discharges from nuclear sites. The methodology proposed site limits on the basis of the lower of the sum of the predicted worst case discharges from the plants on the Sellafield site and the current site limit. The proposed site limits were set at lower values (down to 80% of the sum of predicted worst case discharges) where predicted discharges arise from a number of plants, rather than one plant being dominant (see Section 3 for methodology). By applying this methodology the Agency established consultation proposals for the reduction of 14 and 8 annual site limits covering radionuclide discharges to air and sea respectively. The size of these reductions ranged from 14-93% depending on the radionuclide.

5.12 Many of those responding to the consultation commented on this proposal. Some respondents supported the Agency's proposed site limits, whilst others believed that the headroom (the margin between the proposed limits and actual discharges) was over-generous and contrary to OSPAR commitments. The large majority of the responses, many in the form of standard letters, opposed the reductions in limits. Common reasons for this were stated as being that:

- the reductions were not justified in terms of the environmental benefits they would create;
- provision should be made for BNFL's emerging historic waste management strategy; and
- plant production levels would have to be reduced in order to stay within discharge limits.

5.13 Immediately prior to the public consultation (June 2001), BNFL provided the Agency with information on its *"business requirements"* for future discharge limits (see Appendix 4 for more detail). Business requirements are the numerical values at which BNFL considers that discharge limits could be set without affecting site operations. The business requirements take account of BNFL's future business plans, including decommissioning and dealing with legacy wastes. There was insufficient time for the Agency to consider this information prior to the consultation. However, it formed part of the consultation (see ED, Supporting Information). Some of these *"business requirements"* would exceed current site discharge limits. However, BNFL had already stated that for this review of the Sellafield authorisations it: *"has decided not to seek an increase, at this time, in any of the aerial and liquid authorisation limits, which would otherwise provide adequate margins and flexibility. It has been accepted that a degree of business risk is appropriate in order to maintain downward pressure on discharges"* (see ED, Supporting Information, BNFL Part A Submission, February 2000).

5.14 BNFL subsequently wrote to the Agency expressing its view that by adopting its *"business requirements"* as discharge limits, where they are less than the current discharge limits, *"that significant reductions in discharge limits could be achieved, but would not result in serious constraints to site operations"* (Letter BNFL to Agency dated 30 April 2002 - see Appendix 7 and Supporting Information). In summary, BNFL's proposal would result in reductions in 10 and 5 site limits to air and sea respectively.

5.15 However, the Company's proposed reductions would result in very modest reductions to the total dose to the most exposed members of the public from liquid and aerial discharges made at the site limits, as they would only apply to the less radiologically significant radionuclide discharges. Furthermore, the Agency considers that the BNFL *"business requirements"* would provide for a multitude of allowances (see Appendix 4), which is not consistent with the review objective of minimising headroom (see Section 3). Therefore the Agency has rejected BNFL's proposal that its *"business requirements"* be used as the future discharge limits.

5.16 BNFL also provided revised information on plant discharges in late May 2001 prior to the consultation. As with BNFL's *"business requirements"*, there was insufficient time for the Agency to consider this information prior to the consultation. However, it formed part of the consultation (see ED, Supporting Information). BNFL also provided information in response to the consultation and information relating to developments on the Sellafield site, such as the early closure of the Calder Hall nuclear power station. In reaching its decision on reductions in site discharge limits the Agency has considered all this information together with consultation responses, recent past discharge data up to the end of 2001, information gathered through the routine regulation of the site and other information including the cost information supplied by BNFL (see Section 4 and Supporting Information).

5.17 As a result of these considerations, the Agency has decided that a number of minor changes to the consultation proposals are appropriate. The overall decision is that 13 (rather than 14) and 8 radionuclides discharged to air and sea, respectively will be reduced. The reductions to the limits are in some cases different to those proposed during the public consultation. These differences are identified in Table 5.1 and discussed in more detail in Appendix 4. It should be noted that in all circumstances the proposed limits are the same as, or lower than, the existing site discharge limits.

Early Closure of Calder Hall

Decision: A decommissioning plan for the Calder Hall nuclear power station will be required to allow the discharges limits to be reviewed after operations cease.

5.18 On 21st June 2002, BNFL announced that the closure of the Calder Hall nuclear power station had been brought forward to March 2003. Based on the reactor operating programme to March 2003 and the fact that a new authorisation will not be place before September 2002, the Agency has decided that a further reduction can be made in the argon-41 limit (see Table 5.1). Furthermore, the Agency has decided to require BNFL to provide detailed plans for the decommissioning of the Calder Hall nuclear power station. As more information becomes available and Calder Hall ceases operating, further reductions in associated limits will be possible. At the same time, BNFL has also announced that the closure of Chapelcross nuclear power station is to be brought forward. These closure plans are likely to reduce the total amount of Magnox fuel requiring reprocessing, prior to the closure of the Magnox reprocessing plant, and the associated total amount of radioactivity discharged to the environment (see Section on Plant throughput related limits below).

5.19 The Agency has assessed the proposed decision on site annual limits against available information on past routine annual discharges from Sellafield. In summary, this assessment shows that:

- routine annual discharges from Sellafield since 1952 have never exceeded 8 out of 36 of the proposed site limits;
- of a further 16 site limits, routine annual discharges have not exceeded the proposed values since the 1980's;
- for the remaining 12 site limits, in 6 cases routine annual past discharges exceeded the proposed values in the early 1990s prior to measures designed to abate and divert discharges; in a further 4 cases routine annual discharges were in excess of the proposed site limits due to an elevated discharge from B203 in February 1993. The final 2 cases relate to technetium-99 liquid discharges and argon-41 gaseous discharges. Technetium-99 has been the subject of a separate review (see Tc-99 Decision Document, published September 2001) and the reduction in the argon-41 limits results from the recently announced closure of Calder Hall (see above).

5.20 This assessment indicates that, if the proposed site limits had applied retrospectively to past discharges where the current best practicable means arrangements were being used to minimise discharges from Sellafield, BNFL would have remained within the proposed limits.

5.21 BNFL has cited significant operational costs arising from the Agency's consultation proposals (see Section 4). Whilst these costs are related to specific plant limits, there are situations where BNFL's information suggested that costs were also associated with the consultation proposals for site limits. The Agency considers that the significant issues that BNFL raised have been addressed in its decision on site and plant limits and revisions have been made to the proposals where appropriate. Consequently, the Agency considers that, provided BNFL continues to apply BPM to minimise site discharges, no major costs will arise from the proposed reductions.

5.22 The Agency notes that some respondents to the consultation considered that the headroom allowed for in the proposed limits was over-generous. When reaching its decision on headroom, the Agency has considered the best available information regarding BNFL future work programmes. The Agency has assessed the validity of BNFL's information and has challenged BNFL to justify predictions of future discharges (this is recorded in the Supporting Information to both the ED and this DD). In a number of cases this led to BNFL revising information or re-assessing predictions of future discharges. However, the BNFL information does indicate that higher burn-up and shorter cooled fuel (shorter cooled fuel will contain larger quantities of short-lived radionuclides such as the fission product Iodine-131) will be reprocessed at higher throughput rates in both THORP and the Magnox reprocessing plant in future years. Additionally, the processing rate of highly active liquor into a glass form is programmed to increase as a new processing line comes into operation. BNFL also has a major programme to undertake decommissioning of redundant facilities and retrieval and processing of legacy wastes, which is the subject of a major BNFL review and likely to be influenced by the creation of the Liabilities Management Authority.

5.23 All of these factors indicate that there is significant uncertainty associated with predictions of future discharges. It appears that discharges of certain radionuclides over the coming years may at times be higher than their current levels. The proposed limits are set with headroom to allow for these expected variations in discharges. However, it should be noted that the Agency's decisions on throughput limits (see below) ensures stricter limitation of Magnox and THORP discharges at lower plant reprocessing throughputs.

5.24 The reductions in site limits have primarily been achieved by reducing headroom, although in some cases reductions in discharges via abatement have facilitated the reductions in limits. This approach has been applied to exert additional pressure on BNFL to reduce discharges through the application of BPM and to meet Government policy requirements. The Agency considers that its proposed decisions on site limits will allow BNFL to meet its future business plans, whilst taking fully into account environmental and health considerations, policy drivers and all other relevant considerations. Nevertheless, the values will be challenging for BNFL to meet if the company realises maximum throughput in all its major facilities simultaneously.

5.25 The Agency considers that the potential benefits of the reductions in site limits are that:

- Prospective doses to the most exposed members of the general public are reduced by 25-35% for discharges made at the proposed limits (see Table 5.2).
- Prospective doses savings are also achieved in terms of collective doses, as well as average doses to members of the public and to the most exposed members of the public living in coastal communities bordering the Irish Sea.
- There is a reduced potential for environmental impact on wildlife species, ensuring that it is unlikely that radionuclides discharged from Sellafield will lead to significant effects in the terrestrial and marine fauna and flora around Sellafield and the Irish Sea, including those in designated (European) sites.
- Government policy requirements are met by ensuring that headroom is minimised and that there is downward pressure on discharges, consistent with the UK Discharge Strategy and OSPAR commitments.
- The proposed limits will allow BNFL to meet its proposed business plans including, in particular, the retrieval and processing of legacy wastes and decommissioning plant (including the vitrification of high level waste).

5.26 It should be noted that these potential benefits are only relevant to a `maximum impact' assumption, namely that Sellafield discharges are made at the proposed site discharge limits compared to discharges made at the current site discharge limits. In practice, however, discharges in recent years have been relatively low, due to the relatively low operating performance achieved by BNFL, and certainly below the current site limits. Thus whilst the reduced site discharge limits will exert a downward pressure on discharges, it is quite possible that some radionuclide discharges from Sellafield will actually increase, at times above their current level, if BNFL is successful in achieving its business plans (see above). Therefore, whilst the potential maximum impact of authorised discharges has been reduced by the reduction in discharge limits, the actual impact of discharges may increase in the short-term (while always remaining less than the potential maximum impact).

Table 5.1 | Comparison of the Current and Proposed Site Liquid and Aerial Annual Discharge Limits

Radionuclide	Liquid Limits			Aerial Limits		
	Current Limit/ Effective Limit (TBq/year)	Proposed Decision Limits (TBq/year)	Proposed Reduction in Limits (%)	Current Limit/ Effective Limit (GBq/year)	Proposed Decision Limits (GBq/year)	Proposed Reduction in Limits (%)
Tritium	30,000	20,000	32	1,500,000	1,100,000	27
Carbon-14	21	21	0	7,300	3,300	55
Sulphur-35	Not specified	Not specified	n/a	210	210	0
Argon-41	Not specified	Not specified	n/a	3,700,000	1,600,000 (3,200,000)	57 (14)
Cobalt-60	13	3.6 (5.8)	72 (55)	0.92	No Limit	n/a
Krypton-85	Not specified	Not specified	n/a	590,000,000	440,000,000	25
Strontium-90	48	48	0	9.4	0.71 (0.68)	92 (93)
Zirconium-95 + Niobium-95	9	3.8 (2.2)	58 (76)	Not specified	Not specified	n/a
Technetium-99*	90	90	0	Not specified	Not specified	n/a
Ruthenium-106	63	63	0	56	28 (14)	50 (75)
Antimony-125	Not specified	25 (15)	New limit	5	2.3 (1.4)	54 (72)
Iodine-129	2	2	0	70	70	0
Iodine-131	Not specified	Not specified	n/a	55	55	0
Caesium-134	6.6	1.6 (1.3)	76 (80)	Not specified	Not specified	n/a
Caesium-137	75	34	55	18	5.8 (5.6)	68 (69)
Cerium-144	8	4.0 (2.7)	50 (66)	Not specified	Not specified	n/a
Neptunium-237	Not specified	1	New limit	Not specified	Not specified	n/a
Plutonium alpha	0.7	0.7	0	1.2	0.19 (0.16)	84 (87)
Plutonium-241	27	25 (18)	7 (33)	17	3.0 (2.9)	82 (83)
Americium-241	0.3	0.3	0	Not specified	Not specified	n/a
Curium-243+244	Not specified	0.069	New limit	Not specified	Not specified	n/a
Americium-241 + Curium-242	Not specified	Not specified	n/a	0.74	0.12 (0.11)	84 (85)
Total alpha	1	1	0	2.5	0.88 (0.50)	65 (80)
Total beta	400	220	45	340	42 (25)	88 (93)
Uranium (kg)	2000	2000	0	Not specified	Not specified	n/a

Values are given in brackets for the consultation proposals in the ED where they are different from the Agency's proposed decision.
Not specified: it is not practicable to limit every single radionuclide discharged from Sellafield. However, the use of total alpha and total beta limits ensures regulation of the discharges of a wide range of alpha and beta emitting radionuclides. When deciding which radionuclides to limit, the Agency has reviewed past discharges against a set of limit setting criteria which consider the magnitude of the discharge, the impact, the radioactive half-life and the accumulation in the environment. Limits have been set where future discharges have the potential to exceed these criteria and it should be noted that the radionuclide discharges exceeding the criteria are not the same for discharges made to the air and the sea. The application of these criteria consistently has led to the introduction of liquid limits for 3 new radionuclides and the removal of one of the existing radionuclide limits for aerial discharges.
* The technetium-99 liquid discharge limits has been the subject of a separate review (see Decision Document, September 2001).

Table 5.2 | The radiological impact to the most exposed members of the general public from discharges made at the current limits, the consultation proposals and the Agency decision values (see Appendix 6 Table A6.2 for more details).

	Dose at current limits (μSv/year)	Dose at limits proposed in consultation document (μSv/year)	Dose at limits proposed after consultation (μSv/year)
Aerial	140	110	92
Liquid	260	190	190

New Site Limits for the Principal Radionuclides Disposed of to Air and Sea

Decision: *Additional site limits will be introduced to ensure that all the principal radionuclides discharged to air and sea from Sellafield are covered. The site limits will apply to any period of 12 consecutive calendar months and are less than the aggregate of individual plant limits (see below).*

5.27 Annual limits for the discharge of radionuclides via the sea pipelines have been in existence for several years, whereas annual site limits for the discharges of radionuclides to air were introduced for a small number of radionuclides as recently as January 2000. As part of the current review the Agency proposed to expand the current site limits to cover the principal radionuclides disposed of to air and sea.

5.28 Few respondents commented on this specific proposal. One welcomed the introduction of additional overall site limits whilst a few respondents expressed concern that the aerial site limits are meaningless or inappropriate because the radiological impact is related to the stack height and such limits could encourage BNFL to discharge from lower stacks.

5.29 The Agency agrees that doses to the most exposed members of the public will vary with stack height and notes that the location of the stack is also important. However, collective dose is not affected by these factors. The existing authorisation groups stacks by height for the purposes of applying limits.

5.30 The Agency does not consider that the new site limits will encourage BNFL to discharge from low rather than high stacks as there are a number of regulatory controls to prevent this:

- It is likely that any such discharge would be unauthorised as the proposed authorisation will authorise specific stacks serving specific facilities.
- The new authorisation contains a condition which requires BNFL to use BPM to minimise discharges and their radiological effects on the environment and members of the public (see Annex 1, Schedule 1, Condition 2).
- The introduction of plant limits with a minimum of headroom restricts the ability to divert discharges without varying the authorisation.

5.31 The Agency considers that the regulation of overall site discharges, combined with the introduction of secondary plant (stack) limits (see below), will control the maximum discharges (and hence critical group and collective doses) from individual stacks, whilst also providing tighter and more transparent regulatory control of the overall aerial discharges from Sellafield.

5.32 The Agency has decided that the proposals to introduce new site limits remain appropriate and should be implemented. The introduction of the additional site limits will enable the total quantities of principal radionuclides disposed of to air and sea to be regulated and reported in a transparent manner and will maintain downward pressure on site discharges. The Agency sees the site limits as being the primary regulatory control in ensuring that the overall radiological impact of discharges to members of the public and the environment is minimised and is at acceptable levels.

New Site Limits for Liquid Discharges of Antimony-125, Neptunium-237 and Curium-243+244 to Sea

> ***Decision:*** *New site limits will be introduced for liquid discharges of antimony-125, neptunium-237 and curium-243+244 to sea.*

5.33 The Agency has developed a standard set of criteria to assess whether site discharges of specific radionuclides should be limited (see ED, Appendix 7). The application of these criteria to predictions of future Sellafield discharges led to the Agency proposing that new site limits should be introduced for liquid discharges of antimony-125, neptunium-237 and curium-243+244.

5.34 A number of respondents supported the introduction of these new site limits, whilst some respondents raised issues concerning the criteria used by the Agency for the purposes of limit setting. As a result of the public consultation, the Agency has made some changes to the limit setting methodology used (see Section 3 and Appendix 4). However, the changes made do not impact on the proposed decision to introduce new site liquid discharges limits for antimony-125, neptunium-237 and curium-243+244. BNFL raised concerns regarding the introduction of the antimony-125 (Sb-125) limit believing its introduction and numerical value to be inappropriate at this time. In summary BNFL believe that:

- Future discharges of Sb-125 from the site cannot be accurately predicted given current uncertainties.
- The proposed limit is close to current SIXEP Sb-125 discharge levels.
- SIXEP is not designed to abate Sb-125 discharges.

5.35 The use of a standard set of criteria, to assess whether specific radionuclides should be limited, ensures a consistent and transparent regulatory approach and focuses regulation on the principal radionuclides disposed of to the environment. Assessed future liquid discharges of antimony-125 meet some of the limit setting criteria, as do assessed future liquid discharges of neptunium-237 and curium-243+244. Consequently, the Agency has decided that new liquid limits will be set for these radionuclides. However, the Agency recognises BNFL's concerns regarding the numerical value of the new antimony-125 limit and has decided to set it at a higher level (67% higher) than that specified in the ED to ensure that the routine operations of SIXEP are not constrained (Table 5.1). It should be noted that the operation of SIXEP makes a very significant contribution to the abatement of liquid discharges from Sellafield.

Longer-Term Limits to reflect OSPAR Objectives

> ***Decision:*** *Year-on-year progressive reductions in discharge limits will not be introduced at this time.*

5.36 When formulating its consultation proposals, the Agency considered reducing the overall annual site limit for total beta radionuclide discharges to sea, by 5% each calendar year, starting in the second year of the proposed authorisation and continuing up to the time of the next review. This was in addition to an immediate 45% reduction to the limit (see decision on site limits above). The Agency had in mind the UK's OSPAR commitments to progressive and substantial reductions in discharges and the 2020 target (see ED Appendix 10).

5.37 The principle of year-on-year reduction in limits was discussed with HSE and the Department of Trade and Industry (DTI) prior to the consultation. Both expressed concern about the potential impact on BNFL's ability to deal with legacy waste at Sellafield. Consequently, through the public consultation, the Agency invited comment on the suitability of year-on-year progressive reductions in discharge limits and upon the scale of any progressive reductions, but made no specific proposals.

5.38 Whilst a minority of the consultation responses addressed this issue, the responses given covered a wide range of views. Some respondents felt that 5% year-on-year reductions were too small to meet OSPAR objectives, while others respondents believed such reductions were consistent with the OSPAR objectives and yet others felt that the OSPAR objectives had already been met and no further reductions in discharges were necessary. There was also a belief by some respondents that more information would be required to make an informed response on this issue. A number of parties expressed concerns that year-on-year reductions would inhibit BNFL's ability to deal with legacy wastes at Sellafield and that year-on-year reductions are arbitrary and do not reflect likely advances in best practicable means to minimise discharges.

5.39 In July 2002, the Government finalised the UK Discharge Strategy. This contains specific Strategy Targets that by 2020 the total beta and total alpha liquid discharges from spent fuel reprocessing are expected to be reduced to about 50 TBq per year and 0.2 TBq per year, respectively (see Section 3).

5.40 The Agency has decided that a substantial reduction (45%) in the site liquid annual total beta discharge limit will take place with immediate effect, once the new authorisation becomes effective (see decision on site limits above).

5.41 The Agency considers that there is merit in maintaining year-on-year increasing pressure on BNFL to minimise waste at source, optimise waste producing processes and improve the performance of abatement plant. However, the Agency considers that these pressures can continue to be applied through other regulatory requirements (see below) and that it is not appropriate to introduce year-on-year reductions in total beta liquid discharges at this time.

5.42 The liquid total beta discharges are currently dominated by the processing of medium active concentrate in EARP. The Agency has already made proposals relating to the diversion of medium active concentrate into a vitrified waste form which should allow the Agency to make a further significant reduction in the site liquid annual total beta discharge limit around 2006 (see Tc-99 Decision Document). In addition, the Agency will be requiring BNFL to provide an annual report giving details of the measures that have been introduced to reduce discharges over the previous 12 months (see Appendix 5 and Annex 1). Furthermore, the Agency will also be requiring a detailed breakdown of future alpha liquid discharges from decommissioning projects and a justification that BPM is being used to minimise discharges. The Agency will assess these reports and consider whether it is appropriate to reduce any discharges limits further.

5.43 The Agency considers that this approach would deliver the Government's objectives relating to total alpha/beta discharges from Sellafield, as expressed in its UK Discharge Strategy, whilst recognising the concerns of HSE, RWMAC and others regarding the potential impact of year-on-year reductions in limits on BNFL's ability to deal with legacy waste. The Agency notes that BNFL's plans for the management of historical waste are currently being re-evaluated. This makes an assessment of the impact of reducing limits on a year-on-year basis particularly difficult at present.

Individual Plant Limits

Decision: *Annual discharge limits for individual plants will be introduced, replacing those for groups of plants as appropriate. If future changes in plant limits, which would not entail any increase in site discharge limits, are considered to be appropriate, the Agency would normally expect to implement such changes by variation to the authorisation, in consultation with HSE and FSA only.*

5.44 Annual discharge limits in the existing liquid and aerial discharge authorisations refer to discharges to the environment from either individual plants or groups of plants. The Agency considers that, in some cases, this approach does not facilitate any assessment of whether BPM is being applied at a plant level, because discharges from one plant are obscured by discharges from other plants in the group. Consequently, in the draft authorisation prepared for public consultation, the Agency proposed to remove annual discharge limits for groups of plants, where reasonably practicable, and to introduce additional annual limits for individual plants. The requirement for a plant limit was assessed by considering the significance of predicted future discharges against a set of criteria covering:

- most exposed group dose;
- collective dose;
- quantity discharged;
- the quantity discharged relative to the overall site discharge; and
- use of the radionuclide discharged as a plant performance or process control indicator or for effective regulatory control and enforcement.

5.45 Based on predicted future discharges of radionuclides which met these criteria, the Agency proposed 129 plant limits to replace the existing 55 plant (or groups of plant) limits. It should be noted that compliance with these current 55 plant (or group of plant) limits is achieved by measuring or assessing some 165 radionuclide plant (or group of plants) discharges. As with site limits, when proposing numerical values for plant limits the Agency used the constraint that there would be no increases in the current limits. Within this constraint, plant limits were proposed at the assessed worst case plant discharge with an operating margin of 25-100%. BNFL had argued that it is not practicable to operate plants up to the limits. These operating margins are waste stream specific. However, generally speaking the margins for liquid and gaseous volatile radionuclides are in the range 25-50%, whilst margins for aerial discharges of particulate radionuclides are 100%.

5.46 In the ED, the Agency noted that within the new proposed framework of site and plant discharge limits, individual plant limits are considered to be appropriate for regulatory control and to ensure that the BPM is used to minimise discharges. The site limits ensure that the overall site discharges are transparent and the radiological/environmental impact is minimised and within acceptable levels, taking account of Government policy and statutory requirements. The Agency also highlighted that, if changes in plant limits, which do not affect site limits, were considered appropriate in the future, the Agency would normally expect to implement such changes by means of variations to the authorisation, in consultation with HSE and FSA.

5.47 Some respondents welcomed this tighter regulation as a means of demonstrating compliance with BPM and believed this would ensure tighter regulatory control of individual plants and would help to minimise discharges from the site as a whole.

5.48 A large majority of respondents, many in the form of standard letter responses, expressed concerns regarding the proposals for plant limits. The concerns can be summarised as follows:

- Limits would be complex, resource intensive, and would encourage limit watching rather than environmental improvement.
- There would be too many compliance limits and levels.
- HSE had reservations regarding the merit of setting liquid plant discharge limits, in particular if the discharges feed into another plant for processing or treatment and not into the environment. HSE considered that this could result in a loss of flexibility for BNFL to manage its operations in a safe manner and that the additional operating instructions and monitoring required by Sellafield staff could overload plant operators with additional responsibilities and hence distort BNFL's focus on operational safety.

- There would be additional sampling and monitoring requirements.
- The reductions in the numerical value of limits would result in a reduction in plant production levels in order to stay within limits and retrieval/decommissioning would be delayed (BNFL provided specific examples of where it believes that plant limits would delay its work programme).
- Plant limits might be seen as representing the boundary between safe and unsafe discharges and therefore any breach may be perceived as unsafe.
- It is inappropriate to set plant limits where the discharges cannot be controlled at the plant concerned.
- There would be a loss of flexibility in BNFL's management of discharges.
- Concern was expressed regarding the numerical value of certain criteria used by the Agency to determine whether to set plant limits.

5.49 The Agency considers that there is a widespread misconception over the sampling and monitoring requirements, resource requirements and number of plant limits. It is a fact that in nearly every case the necessary sampling and monitoring equipment and techniques required to comply with the proposed plant limits are already in place and have been for many years. Thus, the Agency considers that BNFL should already have in place suitable internal arrangements. An audit of these BNFL arrangements in 2000 highlighted certain deficiencies, resulting in enforcement action by the Agency. BNFL has subsequently met the conditions of this enforcement action. The Agency continues to work with BNFL to ensure that suitable arrangements are in place.

5.50 A BNFL draft assessment appears to be the source of the notion expressed in the consultation responses (many in the form of standard letters) that the proposals represent 6,000 limits and compliance points. BNFL has used the term "compliance point" to mean each time the company is accountable for compliance with a limit (i.e. the number of times per year BNFL would have to report on each limit multiplied by the number of limits). The Agency considers the assessment to be misleading on two counts:

- Comparing the number of COGEMA, Cap La Hague limits with the number of "compliance points" at Sellafield is not comparing like with like (i.e. limits and compliance points are not the same thing).
- The majority of BNFL's compliance points contained within their draft assessment arose from complying with plant limits which the Agency had not in fact specified in the ED proposals, since they did not meet the plant limit setting criteria.

5.51 Regarding the last bullet above, the Agency considers that this misunderstanding may have developed because BNFL was unclear about how compliance with site limits would be achieved. The Agency has since written to BNFL to clarify this matter (see Supporting Information, letter Agency to BNFL, dated 27 March 2002).

5.52 However, the Agency acknowledges that there are concerns regarding the increase in the number of limits and the criteria used to determine whether a plant limit is required. Consequently, the Agency has reviewed the criteria, taking account of respondents' views (see Section 3) and has decided that the number of plant limits can be slightly reduced without impacting significantly on its regulatory objectives (see Appendix 4). These changes, together with revisions to the quarterly notification level proposals, represents an increase of less than 10% in the number of times BNFL are accountable for compliance with the limits and levels specified in the proposed authorisation when compared to the existing authorisations.

5.53 It is important to note that when setting both plant and site limits the Agency has not set limits at the boundary between a safe and unsafe discharge. For many years, the Agency has set limits at a lower level than this boundary to ensure that under no circumstances are discharges permitted which would result in the legal dose limit or the dose constraint being exceeded. This cautious approach is in keeping with the radiological principles of the ICRP and Government policy.

5.54 The Agency does not accept the consultation comment that plant limits should not be set for radionuclide discharges which cannot be controlled at the plant. The Agency considers that operator has control of the upstream plant and process and hence the feed to the downstream plant and consequently the site operator should have control of all plant discharges at all times. The Agency also notes that, with the exception of Calder Hall liquid limits, no liquid limits are proposed where the discharges feed into another plant for processing or treatment and not into the environment. In the case of Calder Hall, the limits are proposed to ensure consistency with the regulation of all other Magnox power stations in England and Wales.

5.55 The Agency acknowledges that plant limits could reduce BNFL's flexibility to manage discharges. This is why the Agency made the consultation proposal that if changes in plant limits, which do not affect site limits, are considered to be appropriate in the future, the Agency would normally expect to implement such changes by means of variations to the authorisation in consultation with HSE and FSA only. The Agency considers that its statutory powers of variation can provide the necessary flexibility whilst also ensuring that the headroom allowed for in plant limits is kept to an absolute minimum in keeping with the objectives of this review.

5.56 As with this review of the Sellafield authorisations, the Agency normally passes any proposed decision to Ministers before implementation, to allow them the opportunity to exercise their statutory powers of intervention if they so wish. Given the Agency's acknowledgement of BNFL's need to manage discharges from individual plants and the concerns expressed by BNFL and HSE about a potential safety need to amend plant limits quickly, DEFRA has notified the Agency that: *"it should not be necessary to consult Ministers routinely about changes that affected plant limits alone but, of course, you will keep Ministers informed of the changes that you make, in recognition of the fact that Ministers do have powers to intervene in the Agency's decisions at any stage, if they think fit, and those powers would remain unchanged by your proposals."* (Letter, Rt. Hon. M Meacher to Sir J Harman (Environment Agency Chairman), dated 14 May 2002 - see Supporting Information).

5.57 BNFL provided specific examples of where it believed that the plant limits proposed in the ED would delay its work programme. The Agency has assessed this information and revised the plant limits appropriately to allow BNFL to undertake its future work programme. Additional allowances have been given for a number of liquid and aerial plant limits whilst some liquid and aerial plant limits have been reduced (see Appendix 4). This included revision to the vitrification plant limits to ensure that there is no constraint on BNFL meeting its programme to process high level waste, which is subject to a HSE/NII Specification. These changes have resulted in some minor changes to the proposed site limits (see above). However, it should be noted there will be no increase in any existing plant limits above its current value (nor indeed any increase in site limits - see above). In future, if BNFL can substantiate a need for changes to plant limits, which do not result in increases in plant limits, for safety reasons, or to allow decommissioning or the retrieval and processing of legacy wastes, the Agency would normally expect to implement such changes, in consultation with HSE and FSA only, using its RSA 93 powers.

5.58 The Agency considers that the plant limits will:

- ensure tighter regulatory control of the discharges from individual plants exerting pressure on BNFL to minimise discharges at source;
- ensure that BNFL manages discharges from individual plants in compliance with BPM; and
- help to minimise discharges from the site.

5.59 BNFL has cited specific examples of plant limits, which may lead to prolonging the operational life of facilities leading to significant costs (ranging from £120M-£~1000M). The Agency considers that subsequent changes to the plant limits have covered the issues raised by BNFL and consequently additional costs associated with the decision on plant limits will be small and restricted to implementing new compliance reporting arrangements and minor additional sampling and monitoring costs.

Plant Throughput Related Limits

> ***Decision:*** *Throughput related discharge limits will be retained for THORP and new throughput related discharge limits will be introduced for the Magnox Reprocessing Plant, ensuring that strict regulatory control of discharges is maintained when fuel throughput is less than the plant design.*

5.60 The existing aerial and liquid discharge authorisations include calendar year limits for specific radionuclide discharges from THORP (e.g. krypton-85) which are linked to specific bands of plant fuel throughput. The Agency consulted on a proposal to retain these throughput related discharge limits for THORP and to introduce new throughput related discharge limits for the Magnox Reprocessing Plant. In addition, in order to strengthen regulation of fuel throughput related limits, the Agency:

- made more detailed proposals to modify the current calendar year fuel throughput limits to rolling 12 month annual limits;
- considered the option of introducing throughput limits per tonne of fuel reprocessed rather than continuing with the current approach which applies limits to specific bands of fuel throughput; and
- proposed some reductions to the existing throughput limits based on the relationship established between discharges and throughput when considering the option of introducing limits per tonne of fuel reprocessed.

5.61 A minority of consultation responses provided views on throughput limits. Generally these supported the retention of THORP throughput limits and the extension of throughput limits to the Magnox Reprocessing Plant. BNFL and some other respondents raised concerns regarding the added complexity of complying with rolling 12 month throughput limits, the reductions in existing throughput limits (in particular the THORP iodine-129 and tritium aerial limits) and the utility of the proposed Magnox throughput limits. They also considered that account should be taken of discharges from reprocessing that are unlikely to be related to throughput and increases in fuel performance. In particular, BNFL believed that the proposals would potentially restrict fuel throughput in THORP and prolong its operational lifetime, at a minimum cost of around £100M.

5.62 BNFL also argued that the average burn-up of Magnox fuel will increase towards the end of Magnox reprocessing and further, that uranium-enriched fuel may be used in Magnox reactors to increase fuel reactivity. The company considered that the proposed tritium throughput related limit could restrict Magnox throughput towards the end of the Magnox reprocessing programme and believed that the associated costs could be of the order of £100Ms. However, the BNFL Management of the Magnox power stations has recently advised the Agency that the average fuel burn-up will decrease towards the end of the Magnox reactors programme by about one third to one half its current value. This would appear to be the result of the closure of Wylfa and Oldbury earlier than at one time projected and the fact that the fuel remaining in Magnox reactors on closure possesses a range of burn-ups.

5.63 More recently, BNFL has argued that the Agency's proposals for the Magnox Reprocessing Plant throughput related limits are more restrictive than those applied to THORP. When determining throughput related limits for the Magnox Reprocessing Plant and THORP, the Agency scaled the plant annual limit to the relevant throughput and added an additional allowance equal to the plant limit scaled for 100 tonnes of uranium (teU) throughput. This 100 teU allowance was allowed for to take account of the fact that discharges of throughput related radionuclides may not be zero at zero fuel throughput, because discharges may still be occurring from liquors held in the plant. BNFL has argued that due to the higher design throughput of the Magnox Reprocessing Plant this allowance is more restrictive for this plant, and it should be a 133 teU allowance to be consistent with THORP.

5.64 The Agency has decided that throughput related discharges limits will be retained for THORP and that new throughput related discharge limits will be introduced for the Magnox Reprocessing Plant. However, the Agency accepts the concerns of some respondents that rolling 12-month throughput limits add complexity to compliance. The Agency also accepts that there may be circumstances where the combination of reductions in aerial throughput limits for THORP iodine-129 and tritium discharges and the change to rolling limits could restrict THORP throughput. Consequently, the Agency has decided that all existing and new throughput related limits should be calendar year limits and that the proposed reductions in the THORP gaseous throughput limits are not appropriate at this time. The Agency also accepts that a 133 teU throughput allowance for the Magnox Reprocessing Plant throughput related limits at zero discharges is consistent with the 100 teU allowance for THORP, taking into account the different design throughputs of the plant. Consequently, the Agency has revised the new Magnox throughput related aerial limits accordingly.

5.65 Given the conflicting information regarding the future burn-up of Magnox fuel, the Agency considers no changes, as a result of this issue, are important at this time. If changes to throughput related limits, which do not affect site discharge limits, were considered to be appropriate in the future the Agency would normally expect to implement such changes by means of variations to the authorisation in consultation with HSE and FSA only.

5.66 Retaining the THORP fuel throughput limits and introducing new fuel throughput limits for the Magnox reprocessing plant means that lower discharge limits apply when fuel throughput is lower than the maximum. Consequently, this decision takes account of variations in the operational performance of the reprocessing plants and thereby ensures that strict regulatory control of discharges is maintained when fuel throughput is low.

Decision: *The annual discharge limits will be capped relative to the annual fuel throughput for Magnox reprocessing and THORP at 1600 tonnes uranium and 1200 tonnes uranium, respectively.*

5.67 The Agency proposed to cap the annual discharge limits relative to the annual fuel throughput for Magnox reprocessing and THORP of 1600 tonnes uranium and 1200 tonnes uranium, respectively. This proposal was consistent with BNFL's future work programmes and within design throughputs. A few consultation responses were received that related to this proposal. Some related to the justification of reprocessing and these have been referred to DEFRA (see Section 6). One related to early closure of the Magnox stations, which is a commercial decision for the BNFL Management of the Magnox nuclear power stations. One respondent believed that the Agency needs to provide substantiation for such capping of discharge limits.

5.68 After due consideration of these responses, the Agency's decision is that its consultation proposal should nevertheless be implemented. The limits allow for BNFL's business plans for reprocessing of higher burn-up/shorter cooled fuel. These limits would thus permit BNFL to achieve annual fuel throughputs for Magnox reprocessing and THORP greater than 1600 tonnes uranium and 1200 tonnes uranium respectively, when reprocessing lower burn-up/longer cooled fuel.

5.69 The Agency acknowledges that for Magnox reprocessing an annual fuel throughput of 1600 tonnes uranium is below BNFL's stated upper bound (highest foreseeable) annual fuel throughput of 2000 tonnes uranium. However, BNFL's maximum projected fuel throughput in any period of 12 consecutive months is 1600 tonnes uranium. The Agency notes that BNFL's resource impact assessment of the additional costs associated with the new authorisation (see Section 4) concluded that there are no costs associated with the discharge limits which effectively cap the annual Magnox fuel throughput at 1600 tonnes uranium. As noted above, due to allowances for higher burn-up/shorter cooled fuel (see ED, Appendix 7), there is the potential for BNFL to achieve annual fuel throughputs of lower burn-up/longer cooled fuel in excess of 1600 teU whilst still remaining within the discharge limits. The total quantity of Magnox fuel required for reprocessing from February 2001 up to the target shutdown date for B205 of 2012 is around 12000 teU. This total is likely to be somewhat lower, following the announced early closure of Calder Hall and Chapelcross power stations. This means that annual reprocessing of 1000 tonnes uranium, or less, are likely to be required to meet the B205 target shutdown in 2012, although reprocessing rates in any 12 months period may need to be significantly higher due to planned plant shutdowns. The Agency considers that 1600 tonnes uranium in any 12 month period provides adequate flexibility for BNFL to manage the storage and reprocessing of Magnox fuel in a manner that applies BPM to minimise discharges whilst also meeting the planned closure date for Magnox reprocessing of 2012.

Segregation of Discharges

5.70 Due to the historical development of the Sellafield site, discharges are in many cases not sampled and monitored separately for each of the major activities conducted there. A number of proposals were consulted on which, if implemented, would take significant steps towards separating discharges according to the major activities.

5.71 The Agency proposed at the consultation stage, and has now decided, to replace group plant limits by individual plant limits in situations where suitable sampling and monitoring arrangements are already in place (see section on individual plant limits above). The implementation of this proposal will make a significant contribution to the objective of being able to separately account for discharges arising from the major activities conducted on the Sellafield site.

Decision: *Liquid discharge limits for Calder Hall nuclear power station will be introduced for the purpose of extra regulatory control of discharges at source. This will bring the regulation of discharges from Calder Hall in line with other nuclear power stations in England and Wales.*

5.72 The Agency proposed new liquid discharge limits for Calder Hall nuclear power station. A number of respondents welcomed the segregation of Calder Hall liquid discharges. One respondent argued that Calder Hall is not like other nuclear sites, being co-located with other nuclear operations, and that protection of the public is adequately achieved by limiting the total discharges from the sea pipeline. This respondent considered that the proposal amounts to an attempt to influence the operation of the site and goes beyond protection of the public.

5.73 The Agency acknowledges that the routing of liquid discharge from Calder Hall and its co-location with other nuclear operations are differences compared to other Magnox power stations. However, it considers that these are not sufficient reasons why Calder Hall should be treated as a special case. The introduction of liquid discharge limits from the power station will introduce a level of regulatory control consistent with that applied to other nuclear power station operators in England and Wales.

Decision: *BNFL will be required to develop a methodology to estimate the discharges from the major activities on the Sellafield site and to report estimated discharges on a calendar year basis.*

5.74 The decisions regarding individual plant limits and the introduction of liquid limits for Calder Hall (see above) make some progress towards the separation and limitation of discharges by major activity, the Agency came to the view, prior to the public consultation, that the costs associated with the additional sampling and monitoring that would be required to achieve total separation outweighed the benefits. Consequently, the Agency proposed to require BNFL to develop a methodology to estimate (using assessment where sampling and monitoring is not available) the discharges from individual major activities at Sellafield.

5.75 One respondent specifically supported the proposal, whilst a number of respondents generally supported the principle of separation of discharges. On the other hand, BNFL questioned the proportionality of this proposed requirement, taking into account the environmental benefits of doing this work using BNFL staff who would otherwise be engaged in other environmental and/or safety related data acquisition and analysis.

5.76 The Agency considers that knowledge of the discharges associated with a particular activity and its component processes is fundamental to the application of BPM to minimise the waste produced and the waste discharged. Without it, there is no benchmark against which to measure improvement. Ideally, such knowledge should be based on direct measurement. However, the Agency accepts that where no monitoring arrangements currently exist for individual major activities at Sellafield, the benefits in terms of improved operator and regulatory control and public transparency are insufficient to justify the estimated expenditure and worker radiation dose which would result from the installation of new monitoring equipment. Given this situation, assessment of discharges is the preferred choice.

5.77 The Agency notes that BNFL has already made progress towards estimating discharges by site activities, as published under the Environment Council stakeholder dialogues. In addition, the provision of estimates of future discharges by BNFL to the Government for the development of the UK Discharge Strategy, will have already considered the reduction of discharges which will result from the cessation of certain activities. Furthermore, as part of the current review BNFL has provided factors to the Agency which allow the contribution from each activity to combined discharge streams to be assessed on the basis of plant throughput. Consequently, the Agency considers that BNFL has already made significant progress towards the development of this methodology, with benefits to the operator, the regulators and other interested parties.

Decision: *BNFL will be required to consider the segregation of discharges when undertaking modifications to existing plant and in the design of new facilities.*

5.78 When consulting, the Agency noted that future developments at Sellafield involving modifications to existing plant aerial discharge systems and new waste treatment plants may allow further progress to be made in separating discharges. Consequently, the Agency proposed to require BNFL to consider the separation of discharges when undertaking modifications to existing plant and in the design of new facilities.

5.79 Whilst respondents did not comment on this specific proposal a number generally supported the principal of separating discharges.

5.80 The Agency has decided that its proposal should be retained as its decision. This will ensure that the objective of separation of discharges is considered in future developments at Sellafield and that physical separation and/or separate sampling/monitoring arrangements are put in place where appropriate. Over time, this should reduce the reliance on more complex, and possibly less reliable, methods of assessment to estimate the discharges associated with the major activities undertaken on the site.

Miscellaneous Outlets

Decision: *Subject to HSE agreement BNFL will be required to report monthly discharges from a number of individual aerial discharge outlets and to investigate, monitor and report on aerial discharges from open fuel ponds.*

5.81 In the current authorisation, minor aerial discharges (i.e. some stacks and plant/building engineered ventilation outlets) from a number of facilities at Sellafield are currently grouped together and regulated as "approved places." Discharges from approved places are estimated by calculation using information from continuous air sampling at a number of locations at the site perimeter and data from monitored stack discharges. The Agency considers this to be less satisfactory than direct measurement of discharges. Consequently, the Agency consulted on proposals requiring BNFL to report monthly discharges from a number of minor discharge outlets as a first step in the consideration of whether the assessment of discharges from approved places could be improved.

5.82 Few people responded specifically on this issue. A few respondents supported the proposals whilst others raised concerns. Firstly there was concern as to whether the benefits of the requirement would outweigh the impact that diversion of effort might have on health and safety. Secondly there was concern that little useful information is likely to be obtained and it could be alarmist because it is likely to be at limit of detection of the measurement technique used (i.e. reported discharges may appear higher than they actually are).

5.83 As part of the routine regulation of the Sellafield site, the Agency has recently required BNFL to monitor discharges from the B30 open fuel storage pond (which is currently defined as an approved place) close to the pond rather than at the site perimeter. A provisional assessment of the discharges from this single source suggests that actual discharges from approved places are greater than the current monitoring arrangements would suggest. The Agency considers that this recent information reinforces its view that the current monitoring arrangements are less satisfactory than direct measurement of discharges. The Agency considers that where the necessary sampling/monitoring arrangements are already in place and suitable information is already being generated it can be reported to the Agency. Consequently, the Agency does not consider that this will impact on resources currently being applied to health and safety. Accordingly, the Agency has decided not to change its consultation proposal, and so its decision is to require BNFL to report discharges from the following approved places:

- Mixed Oxide Demonstration Facility Stack, B33
- Waste Storage Facility (including waste retrieval) Stack, B41
- Waste Treatment Complex Stack, B80
- Highly Active Storage Tanks, Cell Ventilation, B215
- Decontamination Centre Stack, B259
- Caustic Scrubber Stack, B268
- Plutonium Finishing Plant Stack, B299
- Salt Evaporator, Cell Ventilation, B803
- Segregated Effluent Treatment Plant, Main Stack, B384
- Mixed Oxide Plant, C5 Glovebox Ventilation, B572
- Enhanced Actinide Removal Plant, Main Stack, B804
- Waste Packaging and Encapsulation Plant, Main Stack, B805.

5.84 In addition, subject to HSE agreement, the Agency has decided to require BNFL to develop and implement monitoring arrangements for the discharges from the B30, B27, B29 & B310 open fuel ponds. Monitoring will be required for a period of at least six months and the results reported to the Agency together with an assessment of the uncertainty associated with the results. BNFL will also be required to consider the monitoring arrangements and make recommendations, if appropriate for improvements. The Agency will consider the findings of this report and decide whether it is appropriate to conduct routine monitoring of the discharges from open fuel ponds close to the source in future. The Agency considers that the requirement will also generate useful information on worker doses. HSE's Nuclear Installations Inspectorate has asked BNFL to measure airborne activity levels from specific ponds and supports the Agency's decision to require the company to measure activity from ponds.

5.85 The Agency considers that the decision on minor outlets will provide valuable information for the next authorisation review. This information will allow consideration as to whether the current monitoring arrangements for minor outlets represent BPM and also ensure that aerial plant limits are applied to the most significant discharges.

Short-Term Limits/Advisory Levels

Decision: The regulation of short-term discharges will be unified by replacing the current daily and weekly discharge limits with weekly discharge limits or advisory levels and strengthened by the introduction of a few new limits/advisory levels in order to restrict doses to the most exposed members of the public from short-term releases.

5.86 The Agency uses yearly limits as the primary means to ensure that radiation doses to people are within the annual dose limit and relevant annual dose constraints. Elevated discharges over shorter periods, e.g. hours, days or weeks, may increase the dose received per unit discharge. The effects depend on factors such as meteorological conditions, the state of crop growth and local harvesting patterns pertaining at the time of discharges and occupancy, which may vary with the time of year.

5.87 The existing authorisations contain a small number of short-term limits (daily and weekly) and the Agency proposed to unify and simplify the regulation of these short-term limits by having only weekly short-term limits. In addition, it was proposed to introduce weekly advisory levels for the Calder Hall nuclear power station, consistent with the regulation of other Magnox power stations in England and Wales. A small increase in the number of short-term limits/advisory levels was also proposed, determined on the basis of the dose to the most exposed group from a short-term release. It should be noted that an exceedance of an advisory level is not in itself a breach of the authorisation.

5.88 A few respondents supported the proposals for short-term limits/advisory levels whilst a couple of respondents raised issues. One felt that there is a need to recognise that discharges from plants vary as operating phases change, and that the aim should be protection of the public not the control of plant operations. BNFL proposed what they felt were better values for the tritium and carbon-14 Calder Hall weekly advisory levels, based on the observation that weekly discharges are unevenly distributed. BNFL also considered that the B204 stack iodine-129 weekly limit should be a notification level rather than a limit and that a higher iodine-131 weekly limit for B6 Cell vent would provide greater flexibility to reprocess Magnox fuel.

5.89 The Agency has decided that regulation of short-term limits should be unified and simplified by replacing the existing daily and weekly limits with weekly limits. However, the Agency has revised the Calder Hall advisory levels for tritium and carbon-14 to the values put forward by BNFL in its consultation response. These values are somewhat higher than the consultation proposals (25% higher, or less) but still meet the Agency's regulatory objective of ensuring that significant short-term releases are reported to the Agency and FSA.

5.90 With regard to the B204 stack iodine-129 weekly limit, the Agency considers that the application of a weekly limit to this situation is consistent with the approach taken in other situations (i.e. that limits rather than advisory levels are applied where effective plant control can manage the level of discharge). However, the Agency has re-assessed the numerical value of the B204 stack iodine-129 weekly limit against past monthly discharges and considers that there are foreseeable circumstances where this weekly limit might restrict the amount of fuel that BNFL can reprocess in a week to below design throughput. Consequently, the Agency has decided that a higher weekly limit of 2 GBq/week is reasonable.

5.91 In the case of the B6 cell vent iodine-131 weekly limit, the Agency has decided that a higher limit of 0.5 GBq/week, in line with BNFL's request is reasonable. The limit proposed within the ED represented one tenth of the annual plant limit. This annual limit has been capped in order to ensure that there is no increase in the current schedule 2 iodine-131 gaseous discharge limit. The Agency accepts that the cap on the annual limit does not need to apply to the weekly limit, particularly as the proposed limit of 0.5 GBq/week is considerably lower than the weekly limit in the current authorisation.

5.92 In setting short-term limits and advisory levels, the Agency considers that account has been taken of changes in the phases of plant operation. The Agency considers that short-term limits ensure the protection of the public by placing a control (a limit) on specific plants. The Agency does not consider that these controls will constrain BNFL's operations as long as BPM is used to minimise discharges.

5.93 Short-term limits or weekly advisory levels are set on a plant basis. In future, if BNFL can provide substantiation for changes to short-term limits or weekly advisory levels for safety reasons, or to allow decommissioning or the retrieval and processing of legacy wastes, the Agency, in consultation with HSE and FSA, has the statutory power to vary the limits and levels. Provided that the proposed change would not entail any increase in a site limit, the Agency would not normally expect to carry out wider consultation.

5.94 In all cases, the calculated doses resulting from a discharge at the proposed weekly limits or advisory levels are less than the dose limit and dose constraint and are lower than those resulting from the relevant short-term discharge limits in the current authorisation. The FSA has advised that it's assessment indicates that European Community Food Intervention Levels (CFILs) would not be exceeded as a result of elevated short-term discharges at the weekly limits or advisory levels (see Appendix 4).

Quarterly Notification Levels (QNLs)

Decision: Rolling QNLs will be set for all site limits allowing for variations in plant operations.

5.95 Quarterly Notification Levels (QNLs) are included in the existing aerial and liquid discharge authorisations in order to provide early indication of potentially enhanced discharge trends and to ensure that discharges which approach or exceed a significant fraction of the annual limits will be reported promptly to the Agency.

5.96 The Agency consulted on a proposal to standardise and strengthen QNLs for aerial and liquid discharges by setting them all at a quarter of the relevant annual site or plant limit and applying them to any rolling period of three consecutive months.

5.97 This proposal received a limited but mixed response. It was supported by some but others felt that it did not take account of practical plant operational issues such as plant shutdowns, washout and transient retrieval operations. As stated in the plant limits section above, a large majority of respondents, many in the form of standard letter responses, expressed general concerns regarding the number of limits/compliance points, and that compliance would be resource intensive and would encourage limit watching rather than environmental improvement.

5.98 The Agency accepts that the combination of changing QNLs to rolling levels and the implementation of plant limits significantly increases the number of times that BNFL has to assess and report discharges against limits and levels. The Agency also accepts that the use of a standard approach, whilst simplifying regulation does not take account of predictable variations in plant operations. Consequently the Agency has re-assessed the framework of QNLs and decided to implement the following:

- Rolling QNLs for all site limits.
- QNLs set to take account of variations in plant operations (e.g. batch processes).

5.99 This framework of QNLs will ensure that discharges which exceed a significant fraction of the site annual limits will be reported promptly to the Agency. These changes, together with revisions to the plant limit proposals, represents an increase of less than 10% in the number of times BNFL are accountable for compliance with the limits and levels specified in the proposed authorisation when compared to the existing authorisations. It should be noted that as a result of the Agency's proposed decision on QNLs there is no increase on the value of any of the QNLs in the current authorisation however, there is a reduction in the number of QNLs because the Agency has decided not to implement QNLs at a plant level. It should be noted that a QNL is not a limit and any exceedance of it would therefore not normally initiate enforcement or prosecution by the Agency provided that BNFL was able to demonstrate that BPM had been applied to minimise discharges.

5.100 Should changes to the QNLs be appropriate prior to the next authorisation review, the Agency has statutory powers to vary the QNL requirements, in consultation with HSE and FSA only.

Additional Components

Decision: *The additional components to existing limits for the Salt Evaporator Plant and WAMAC will be removed. The additional component to the annual discharge limits for SIXEP will be reduced.*

5.101 The existing authorisations contain "additional components" to specific annual discharge/disposal limits. These can be invoked by the operator only in the event of reported malfunctions of the Salt Evaporator Plant, the Site Ion Exchange Plant (SIXEP) and the Waste Monitoring and Compaction Plant (WAMAC). The additional components permit potentially higher discharges/disposals. During the period covered by this review (1994-2001) there have been no reported malfunctions of the plants which have interrupted their operation and required the additional components to the limits to be invoked.

5.102 In recent years, BNFL has installed extra evaporator capacity in the Salt Evaporator Plant which provides contingency against plant breakdown. BNFL advised the Agency that it is not seeking to retain the additional component to the limit for WAMAC. BNFL also informed the Agency that in the event of a prolonged malfunction of SIXEP, liquid waste normally fed to SIXEP from safety-related operations in other plants (e.g. water sprays preventing ignition of Magnox swarf and fuel in the Fuel Handling Plant), would continue to be discharged and potentially require a reduced additional component.

5.103 In the light of this information, the Agency proposed to remove the additional components for the Salt Evaporator Plant and WAMAC and to reduce the SIXEP additional component to the level of BNFL's stated requirements.

5.104 Few consultation responses regarding these proposals were received. Some respondents favoured the proposals and believed them to be reasonable. One respondent expressed concerns over the wisdom of removing safety margins.

5.105 The Agency's decision remains unchanged by the consultation. The Agency considers that the changes to the additional components take account of the safety issues highlighted by BNFL (see above) and do not remove required safety margins and should therefore be implemented. The changes are considered to be consistent with the objective of the review that any headroom allowed between actual discharges and discharge limits should be minimised. The changes reduce the amount of radioactivity, which is allowed to be discharged to sea, and the potential radiological and environmental impact associated with such discharges. Furthermore, the removal of the additional components represents a simplification of the authorisations.

Drigg Transfer Limits

Decision: *The calendar year limits relating to the transfer of low level solid waste to Drigg for disposal will be retained, and in the case of iodine-129, tritium and volume limits will be reduced. The existing activity concentration limits for waste transfers to Drigg will be retained.*

5.106 In the consultation document, the Agency proposed to retain, and in some cases reduce, the calendar year limits relating to the transfer of low level solid waste to Drigg for disposal. Reductions in the limits for iodine-129, tritium and waste volume and the retention of all other existing limits at their current levels were proposed.

5.107 A few respondents raised concerns that the limits should not delay decommissioning work, prevent the early disposal of waste at the Drigg site or foreclose waste management options. There was general support for the proposal to limit waste transfers between nuclear sites. However, the view was also expressed, regarding waste transfers in general, that limits should be demonstrably linked to the objective of protecting the public and not used to control BNFL's activities.

5.108 The Agency considers that transfer limits are important to the objective of protecting of the public and the environment, and provide appropriate regulatory controls over BNFL's activities. Limits and conditions will:

- ensure that transfers of solid radioactive waste are properly managed and their radioactive content is fully accounted for;
- promote waste minimisation (by focussing operator attention on the need to comply with limits);
- promote early safe disposal of accumulated waste;
- provide transparency of the solid waste transfers which are occurring (by requiring reporting against limits); and
- ensure compatibility with requirements for waste storage/treatment and authorisations for waste disposal at the Drigg site.

5.109 The Agency agrees that transfer limits should not prevent or delay disposals at Drigg where this option represents the best practicable environmental option. In a number of situations, BNFL business requirements of estimates of future transfers from Sellafield exceed the current Drigg limits. However, in these cases the Agency has decided that the transfer limits will be set equal to the Drigg disposal limits. This represents no change from the consultation proposals and BNFL has not highlighted concerns with these proposed limits, or applied for any increase to these limits. In other cases, the Agency has decided that the current transfer limits should be reduced to twice BNFL's estimate of the worst case future annual transfers to Drigg. Whilst BNFL has argued that such reductions are inappropriate (see above), the Agency considers that its decision will not constrain BNFL's current business plans, including plans for decommissioning. It should be noted that generally decommissioning wastes represent a small percentage of the low-level wastes arising on the Sellafield site, with operational wastes from Magnox and THORP being the dominant sources. The Agency does not consider that the decision on transfer limit forecloses future waste management options. If BNFL's business plans change, BNFL will need to apply for a variation to the transfer limits. It is not practicable for the Agency to foresee what these changes might be in the absence of appropriate information from BNFL.

5.110 The Agency intends to review the Drigg authorisation commencing in late 2003, following review of the BNFL Post-Closure Safety Case for Drigg commencing in October 2002. This review will reconsider the acceptability of radioactive waste disposals on the Drigg site. Should disposal conditions and limitations change as a result of the Drigg authorisation review, the Agency will consider whether it is appropriate to amend the conditions and limitations relating to the transfer of waste from Sellafield to Drigg by variation to the Sellafield authorisation.

5.111 In summary, the Agency has decided that limits on transfers of waste to Drigg should be implemented unchanged from the consultation proposals.

Inter-Site Transfer Limits

Decision: The generic inter-site authorisation that permits BNFL to transfer radioactive solid waste from Sellafield to any of its other sites and to any UKAEA sites will be revoked and instead authorisation to transfer waste to UKAEA at Winfrith and Windscale will be granted.

Decision: New Calendar year limits for solid waste transfers to other nuclear sites (Winfrith and Windscale) will be introduced.

5.112 In the ED, the Agency proposed to revoke the generic inter-site authorisation that permits BNFL to transfer radioactive solid waste from Sellafield to any of its other sites and to any UKAEA sites and instead, to authorise transfers to two named sites (Windscale and Winfrith) with new calendar year limits.

5.113 General consultation responses to waste transfers have been noted under Drigg Transfer Limits (see above). BNFL expressed concerns that:

- only those transfers which involve waste being sent for final disposal require an inter-site transfer authorisation and hence numerical limits;
- the waste volume transfer limits to Winfrith are too low;
- the Agency decision on waste transfers from Sellafield to Windscale should reflect that the transfers will contain mixed low and intermediate level waste for characterisation and segregation;
- the Agency proposals do not take account of some emerging BNFL plans to transfer additional waste between Sellafield and Windscale, including proposals to use AEAT to compact backlog waste from Drigg on the Windscale site; and
- negotiations are underway which could bring ownership of B13 (a facility on the Windscale site to which the Sellafield waste is transferred for characterisation and processing) into BNFL ownership and onto the Sellafield site.

5.114 The Agency considers that the Radioactive Substances Act 1993 requires the authorisation of any disposals of radioactive waste on or from the premises. This includes disposals by transfer to another nuclear site. The definition within the Act of "disposal" in relation to waste, includes its removal.

5.115 The Agency has decided that the consultation proposals should be implemented unchanged, with two exceptions. Firstly, following further clarification from BNFL, the Agency is satisfied that the waste transfer volume limits to Winfrith should be higher in order to permit BNFL's planned waste transfers to Winfrith. Secondly, BNFL has clarified that the transfers of waste to the Windscale site will contain mixed low-level and intermediate-level waste for characterisation and segregation. Consequently, the Agency considers that it is not practicable to place separate waste transfer limits on low and intermediate level waste. It has decided therefore that these mixed wastes transfers should be classified and limited as intermediate level transfers (see Appendix 4).

5.116 When proposing transfer limits for waste from Sellafield to Windscale, the Agency used information provided by UKAEA regarding the transfers from Windscale to Sellafield of Sellafield waste. This was because BNFL did not provide detailed information, despite this being requested by the Agency on a number of occasions. In reaching its decision, the Agency has not taken account of BNFL's emerging plans/proposals such as compacting backlog waste from Drigg at Windscale or the negotiations regarding the ownership of B13. UKAEA has advised the Agency that it has not agreed to BNFL plans to compact backlog wastes on the Windscale site and UKAEA has no knowledge of the negotiations regarding the ownership of B13 and has no intention of agreeing to the transfer of B13 ownership at this time.

5.117 The Agency recognises that BNFL has a major programme to undertake decommissioning of redundant facilities and retrieval and processing of legacy wastes, which is the subject of a major BNFL internal review and likely to be influenced by the creation of the Liabilities Management Authority. Whilst no detailed plans are currently available, the Agency will consider any future application from BNFL to vary the limits in the authorisation to meet the company's future requirements under its statutory powers of variation, in consultation with HSE and FSA.

Soil Disposals

Decisions:

- *In-situ burial will not be subject to RSA93 authorisation.*
- *The Agency will revoke the existing Sellafield in situ burial authorisation arrangements. All radioactively contaminated ground will be regulated by the HSE whether or not the material is covered by buildings or concrete. The Agency will continue to regulate disposals of radioactive waste from the Sellafield site, to landfills on and off the site, in accordance with RSA 93.*
- *New calendar year limits for solid waste disposals to landfill on the Sellafield site will be introduced and the existing activity concentration limits retained.*
- *The disposal of contaminated concrete and rubble arising from the decommissioning of on site facilities and buildings, will be authorised for disposal to landfill on the Sellafield site within annual limits related to the volume and radioactivity concentration.*
- *Part of the remaining capacity of the Calder Floodplain Extension Landfill Tip will become a segregated area for the disposal of non-hazardous radioactive wastes including non-hazardous putrescible wastes. The existing activity concentration limits for the South Landfill will be applied to this area. BNFL will be required to line this segregated area and to manage the leachate.*
- *BNFL will be required to provide a post closure radiological and environmental safety assessment for the disposal of waste on the South Landfill and the Calder Floodplain Landfill (including the segregated area).*

5.118 In the consultation document, the Agency made proposals to tighten the regulation of on-site disposal of radioactive waste by:

- introducing new limits;
- recognising that 'in-situ burial' is not a disposal of radioactive waste and does not therefore require authorisation under RSA 93;
- requiring a post closure radiological and environmental assessment for the landfill sites; and
- authorising the disposal of contaminated concrete and rubble arising from decommissioning work within annual limits related to volume and radioactivity concentration and to allow a limited extension to the existing landfill area on the site.

5.119 These proposals were designed to encourage the appropriate use of the on-site disposal facilities at Sellafield in preference to Drigg in order to increase the longevity of Drigg as a national asset. They were also intended to provide tighter regulatory control of disposals made and to provide additional information.

5.120 There were only a few consultation responses, which referred specifically to the proposed changes to the soil disposal authorisation arrangements. Most considered that the proposed changes represented improved regulation. One respondent expressed concern for unspecified reasons about the practice of disposing of radioactive waste to the on-site landfills, whilst another felt the arrangements required some clarification. BNFL also considered some of the wording regarding the authorised waste categories to be unclear and ambiguous. FSA considered that HSE and the Agency should be required to liaise with them regarding impact on the foodchain via the potential offsite migration of radioactivity associated with contaminated earth and disposals at the site landfills. RWMAC considered that it is difficult to discern a holistic overall strategy for the management of low level waste at Sellafield.

5.121 The Agency's proposals regarding disposals at the on-site landfills remain essentially unchanged by the consultation process, with one exception. This concerns the matter of authorising the extension to the existing landfill area as a segregated area for the disposal of non-hazardous radioactive wastes. It should be noted that the consultation proposal "to allow a limited extension to the existing landfill area" is better described as allowing the use of an undeveloped area of the existing the Calder Floodplain Extension Landfill as a segregated area for the disposal of non-hazardous radioactive wastes, including non-hazardous putrescible wastes. The existing activity concentration limits for the South Landfill will be applied to this area. BNFL will be required to line this area of the landfill and manage the leachate in accordance with the technical requirements of the Landfill Directive (99/31/EC), as implemented in the UK by the Landfill Regulations 2002. Whilst the Regulations 2002 are not applicable to disposals of radioactive waste (which is not classed as controlled waste), the Agency considers it appropriate to apply relevant principles from this legislation so as to improve environmental protection, from non-radioactive properties of the waste in particular. These controls will be implemented through an improvement requirement. The Agency considers that these decisions will, through the segregated lined area, provide a waste disposal facility for non-hazardous radioactive putrescible wastes, which meets modern standards.

Decision: *Engineering, management and monitoring controls for the Calder Floodplain Landfill Extension - Segregated Area will be submitted to the Agency for approval prior to the first deposit of waste being made.*

5.122 The segregated area represents about 10% of the total capacity of the Calder Floodplain Landfill Extension and about 50% of the remaining capacity for disposal. The remaining capacity of the Calder Floodplain Landfill Extension and the South Landfill will be authorised for the disposal of inert waste only (in the past the unlined South and Calder Floodplain Extension Landfills have been authorised for the disposal of non-hazardous waste and inert waste, respectively).

5.123 As regards 'in-situ burial', this refers to the construction of buildings or other structures over ground which has some radioactive contamination. On consideration, the Agency has concluded that this is not a disposal of radioactive waste and that no RSA 93 authorisation is required. It is, however, a matter which falls within the NII's remit, being on a licensed nuclear site, and HSE has agreed to take over regulatory control.

5.124 The Agency decisions are based on BNFL's future disposal requirements to 2008. The Agency considers that these decisions coupled with the requirement for a post closure safety and environmental assessment of the on-site landfill provides an appropriate regulatory strategy for the future management of such waste. If the post closure safety and environmental assessment continues to demonstrate the acceptability of future disposals, the Agency would encourage the use of the on-site disposal facility at Sellafield in preference to Drigg in order to increase the longevity of Drigg as a national asset. In particular, the Agency considers that authorising the disposal of contaminated concrete and rubble from decommissioning work, and the use of the segregated area for the disposal of radioactive non-hazardous putrescible radioactive wastes, are measures which extend the longevity of Drigg and provide an appropriate disposal route for putrescible radioactive wastes.

5.125 The Agency will liaise with FSA over issues related to the offsite migration of radioactivity from the site landfills. BNFL is being required to provide a post closure safety and environmental assessment of the site landfills. This will be placed on the public registers and the Agency will consider any issues raised by FSA. The Agency considers that liaison between FSA and HSE over contaminated ground issues is a matter for these organisations.

New BPM Conditions

Decisions: A revised BPM condition will be introduced into the authorisation requiring best practicable means to be used to minimise the activity of radioactive waste produced that will require disposal under the authorisation. In addition, a new condition will be introduced requiring best practicable means to be used to dispose of radioactive waste at times, in a form and in a manner so as to minimise the radiological effects on the environment and members of the public (see Annex 1). In consideration of BPM cases, the Agency will consult HSE on aspects of health, safety and waste management in line with the Memorandum of Understanding between the organisations.

5.126 The Agency included in the ED a proposal to introduce a revised BPM condition that requires best practicable means to be used to minimise the activity of radioactive waste produced that will require disposal under the authorisation. It was proposed also that a new condition be introduced requiring the use of best practicable means to dispose of radioactive waste at times, in a form and in a manner so as to minimise the radiological effects on the environment and members of the public (see paragraph 6.65 and Appendix 1 of the ED).

5.127 The Agency notes the consultation response by COMARE that all relevant factors should be addressed when assessing BPM for radioactive discharges and that focussing solely on minimisation of impact on the public and on the environment from disposals may result in an increased potential for occupational exposure and for accidents (see Appendix 5). Similar comments were expressed by HSE that the new BPM conditions may potentially conflict with BNFL's legal duty to ensure the safety of the public and the workforce. HSE also commented that in enforcing the conditions the Agency should take account of the need to consult HSE (see Appendix 5).

5.128 The Agency accepts that any consideration of what is BPM for discharge reduction should not only take into account the radiological effect on the environment and members of the public but also a number of other factors, including the health and safety of the Sellafield workforce. In consideration of BPM cases, the Agency will consult HSE on aspects of health, safety and waste management in line with the Memorandum of Understanding between the organisations. Accordingly, the Agency decided to introduce revised BPM conditions into the authorisation.

5.129 It should be noted that the BPM conditions in the authorisation (Annex 1) form part of a standard template for Schedule 1 which is progressively being introduced in all nuclear site authorisations including that for Sellafield. The new BPM conditions will improve the regulatory framework by requiring waste minimisation at source and will maintain pressure on operators to minimise disposals.

5.130 The Agency will monitor BNFL's compliance with the BPM conditions in the authorisation by means of frequent plant inspections and planned audits of specific aspects of operations on the site. The specific information requirements in the authorisation relating to the assessment of BPM for all new waste streams and the regular review of developments in best practice for minimising all waste disposals will provide further information which the Agency will use to regulate compliance with BPM.

New Management Condition

Decision: *A new condition will be introduced which requires BNFL to have a management system, organisational structure and resources sufficient to achieve compliance with the limitations and conditions of the authorisation (see Annex 1).*

5.131 The Agency proposed in the ED to introduce a new condition in the authorisation (Annex 1) requiring BNFL to have a management system, organisational structure and resources sufficient to achieve compliance with the limitations and conditions of the authorisation (see also paragraph 6.67 and Appendix 1 of the ED)

5.132 The Agency notes comments on this proposal from respondents to the public consultation, in particular RWMAC. The comments were concerned with the need to ensure that the condition is compatible with the corresponding condition(s) contained in the Sellafield nuclear site licence issued by HSE and that BNFL is not put in a position of having to comply with incompatible requirements of two regulatory bodies (see Appendix 5).

5.133 The Agency has taken care to ensure that there is no conflict between the new management condition in the authorisation and the corresponding conditions in the nuclear site licence issued by HSE. Discussions on this matter have been held with HSE and it has been agreed that there is no conflict.

5.134 The new condition will require BNFL to have written arrangements specifying how compliance with each limitation and condition will be achieved. The condition will also require BNFL to identify suitable Radiation Protection Advisers (RPAs) or other qualified experts as approved by the Agency, written environmental operating rules and operating instructions, a written maintenance schedule and instructions and internal audit and review of the management system.

5.135 The Agency considers that introduction of the new management condition will strengthen its regulation of Sellafield. The condition specifies clearly the requirements on the management of the site to ensure that there are adequate provisions in terms of management systems, organisational structure and resources to comply with the authorisation. Routine inspections and environmental audits will check compliance with this authorisation condition.

Regulation Under Other Legislation

Decision: *The conditions in the current RSA 93 authorisation for the discharge of liquid waste to sea that refer to the control of discharges of tributylphosphate and other organic solvents will be removed. Future discharges of TBP and other organic solvents will be regulated under existing IPC authorisations for Magnox and oxide fuel reprocessing, removing the need to regulate such discharges separately from other chemical discharges.*

5.136 The Agency referred in the ED to the conditions in the current liquid discharge authorisation relating to discharges of tributylphosphate (TBP) and other organic solvents. Such discharges, although essentially chemical in nature, were included in the RSA 93 authorisation because in early 1994 when the authorisation came into effect no EPA 90 Integrated Pollution Control (IPC) authorisation existed for Sellafield. It was recognised during the review and subsequently proposed in the ED that such discharges were more appropriately regulated under the IPC authorisations issued to BNFL in 1996 for Magnox and oxide fuel reprocessing (see paragraph 6.68 of the ED).

5.137 Comments received on this proposal from respondents to the public consultation welcomed it (see Appendix 5).

5.138 The decision will mean that all conventional chemical discharges from Sellafield will be regulated under the same legislation. The Agency will ensure that the regulation of discharges of TBP and other organic solvents is covered by the site IPC authorisations when introducing the new RSA 93 authorisation.

Improvement and Additional Information Requirements

5.139 A number of respondents to the public consultation expressed support for all the improvement and information proposals but did not comment specifically on any individual proposal.

BPEO/BPM Assessments for New Waste Streams

> ***Decision:*** *BNFL will be required to introduce appropriate management arrangements and written procedures that require BPEO/BPM assessments to be carried out for all new waste streams requiring disposal (see Annex 1).*

5.140 The Agency proposed in the ED to require BNFL to introduce appropriate management arrangements and written procedures to carry out BPEO/BPM assessments for all new waste streams requiring disposal (see paragraph 6.70 and Appendix 1 of the ED). The objective is to ensure that BPEO assessments become part of BNFL's routine operating framework.

5.141 COMARE was the only respondent to the public consultation to make a specific comment on this proposal (see Appendix 5). COMARE considered that the absence of an agreed disposal route for many of the solid waste streams undermines the value of BPEO assessments.

5.142 The Agency considers it is important that the disposal of new radioactive waste is assessed in terms of BPEO. The fact that no disposal route currently exists for certain categories of solid waste should not deter such assessments. The Agency recognises that a disposal route for such waste will have to be developed at some time in the future and that capacity currently exists on the Sellafield site for storing solid waste. The Agency notes the comment made by COMARE and would point out that the issue relating to the provision of a disposal route for solid radioactive waste is a matter for the Government (see Section 6). The Government has recently carried out a public consultation on its proposals for developing a policy for managing solid radioactive waste.

5.143 Notwithstanding the issue of solid waste disposal, the Agency considers its decision will help to ensure that disposals of radioactive waste are based on and reflect the waste management option providing the lowest impact on the environment at an acceptable cost, in the long as well as the short term. BNFL has already gone some way to implementing this requirement and its inclusion in the authorisation will ensure that BPEO assessments are routinely undertaken.

Assessment of BPEO for Individual Radionuclides

Decision: *BNFL will be required to provide a report of a comprehensive review of whether current disposal routes for all radionuclides subject to disposal limits continue to represent the best practicable environmental option (see Annex 1). The report will include a programme for carrying out any necessary changes identified by the review. The report will be placed on the appropriate public registers (see Annex 2).*

5.144 The Agency proposed in the ED that BNFL would be required to carry out periodically a comprehensive review of whether current disposal routes for all radionuclides subject to disposal limits continue to represent the best practicable environmental option. In addition, BNFL would be required to establish a programme of research and development in conjunction with this requirement (see paragraph 6.86 and Appendix 1 of the ED).

5.145 The Agency notes the comments made by respondents to the public consultation in support of this proposal (see Appendix 5). In particular, RWMAC expressed support for the requirements for BPEO and BPM assessments with a view to reducing discharges, notably through the use of improved technology.

5.146 The decision will ensure that BPEO assessments are carried out on those radionuclides that the Agency considers are significant in terms of discharges from Sellafield (i.e. those radionuclides for which limits have been set in the authorisation) and that future developments in abatement technology are considered for application at Sellafield.

Independent Monitoring of Discharges

Decision: *As a result of safety considerations, BNFL will not be required to install additional sampling/monitoring equipment at B204 stack to enable particulate radionuclides discharges from Magnox reprocessing facilities to be independently monitored. Alternatively, BNFL will be required to provide liquid bubbler samples for independent analysis of tritium and carbon-14 by the Agency.*

5.147 The Agency proposed in the ED that BNFL should be required to install sampling/monitoring equipment to enable gaseous discharges from the Magnox reprocessing facilities, via B204 stack, to be independently monitored (see paragraph 6.71 and Appendix 1 of the ED)

5.148 One respondent questioned whether the Agency had assessed the benefits and detriments of independent monitoring of gaseous discharges. It was suggested that the proposal would increase operator radiation dose and create additional solid low level waste arisings and that the requirement should be subject to the same BPM/BPEO tests as the application of abatement technology (see Appendix 5).

5.149 Several years ago the Agency began independent analysis of selected BNFL samples of liquid discharges from Sellafield in order to provide assurance that actual discharges were consistent with the discharge information provided to the Agency (and hence the public) by BNFL. At that time, it was considered impracticable to carry out a similar procedure for samples taken from gaseous discharges.

5.150 The Agency has held discussions with BNFL to establish whether spare sampling points, pipework and equipment exists on the THORP discharge stack and the Magnox reprocessing discharge stack at B204 for independent sampling of gaseous discharges. BNFL confirmed that existing spare equipment was available for independent monitoring of particulate radionuclides at the THORP stack. BNFL also confirmed that aliquots of BNFL's liquid bubbler samples could be provided from THORP and B204. This would enable the Agency to carry out independent analyses for tritium and carbon-14. However, BNFL informed the Agency that new sample lines and equipment would be required in order to obtain independent samples of particulate radionuclides at the B204 stack.

5.151 The Agency therefore requested BNFL to make appropriate arrangements for routine independent sampling of particulate radionuclides at the THORP stack and to provide liquid bubbler samples from the THORP stack and the B204 stack. The Agency decided that it would be appropriate to include a requirement in the draft authorisation (see Appendix 1 of the ED) for BNFL to install a sampling system for independent checks of particulate radionuclide discharges from the B204 stack.

5.152 Since publishing the ED, the Agency has carried out a further inspection of the area (situated between the inner stainless steel flue and the outer concrete chimney) in the B204 stack that contains BNFL's sampling equipment. The area is very restricted in terms of available space and existing equipment would have to be relocated to enable independent sampling equipment to be installed. In addition, scaffolding would have to be erected to a height of about 20 metres within the area to enable sampling pipework to be installed. The Agency considers that the installation of independent sampling equipment for particulate radionuclides at the B204 stack is not justifiable because of concerns over the safety of the workforce.

5.153 Alternatively the Agency will increase the frequency of sampling audits and witnessing of sampling operations and establish whether it is practicable to carry out checks on BNFL's particulate radionuclide accountancy samples.

5.154 In addition to independent monitoring of gaseous discharges, the Agency is making arrangements for independent monitoring of the ambient air around the Sellafield site to be carried out.

5.155 The Agency considers the main benefit from independent checks of discharges is that they provide re-assurance to members of the public, interested groups and external organisations of the authenticity of reported discharges from Sellafield. The checks could also provide a benefit to BNFL in confirming the integrity of the company in its monitoring and reporting of discharges.

Environmental Monitoring Programme

> ***Decision:*** *BNFL will be required to undertake a programme of improvements to its monitoring arrangements in the environment around the Sellafield site. The improvements will include modifications to documentation and procedures and to the reporting and assessment of results. Minor changes to the scope of environmental sampling and radiochemical analysis will be required.*

5.156 The Agency proposed in the ED that BNFL should be required to undertake a programme of improvements to its monitoring programme in the environment around the Sellafield site (see paragraphs 6.73 and A6.76 - A6.82 of the ED).

5.157 A small number of respondents to the public consultation made specific comments on this proposal. One respondent supported the proposal whilst another considered that the Agency needed to demonstrate how the protection of the public would benefit from the proposal and queried whether the benefit was proportionate to the cost (see Appendix 5).

5.158 The Agency notes these comments but still considers that the improvements should be required. The proposal arose from recommendations made by an independent consultant engaged by the Agency during the review of the authorisations (see paragraphs A6.76-A.6.82 of the ED). The consultant's recommendations have been discussed with BNFL and it was agreed that the proposed additions to the programme would be appropriate. The Agency will include the detailed requirements of the environmental monitoring programme in the document 'Compilation of Environment Agency Requirements' (CEARs) which specifies the detailed compliance requirements of the authorisation. The CEARs will be placed on appropriate public registers (see Annex 2) with the certificate of authorisation.

5.159 This decision will ensure that the environmental monitoring programme provides improved data on the uptake of radionuclides in the environment close to the Sellafield site and that the programme is consistent with current best practice.

Cobalt-60 Abatement at THORP

> ***Decision:*** *Subject to HSE agreement, BNFL will be required to implement the use of an ion exchange material to abate discharges of cobalt-60 when enhanced levels of this radionuclide occur in the THORP fuel ponds, if plant trials are proven to be successful (see Annex 1). BNFL will be required to provide progress reports on the development of this abatement technique and these will be placed on appropriate public registers (see Annex 2).*

5.160 The Agency proposed in the ED that BNFL should be required to implement the use of an ion exchange material in the THORP fuel ponds to abate discharges of cobalt-60 when enhanced levels of the radionuclide occur in pond water, if plant trials are proven to be successful (see paragraph 6.75 and Appendix 1 of the ED).

5.161 There were no specific comments from respondents on this proposal other than the general support for all the proposed improvement requirements (see Appendix 5).

5.162 BNFL has carried out research and development in recent years to identify an ion exchange material that is effective in removing cobalt-60 from THORP fuel pond water. This work has led to the development of a suitable ion exchange material (Co-treat). Laboratory trials have achieved a high efficiency (decontamination factor) for the removal of cobalt-60 from THORP fuel pond water. However, in plant trials with the material as a pre-coat on existing particulate filters in the THORP fuel ponds much lower decontamination factors have been achieved which have varied considerably. BNFL has provided information indicating that in most cases cobalt-60 removal efficiency has been very low.

5.163 BNFL has satisfied the Agency that further work is necessary to achieve removal efficiencies and confirm whether Co-treat can be used routinely in the THORP fuel pond (see Appendices 4 and 5 and Supporting Information). The Agency will continue to monitor closely BNFL's progress in this work and if appropriate, will require the company to use Co-treat routinely in the THORP fuel pond.

5.164 Before requiring BNFL to implement cobalt-60 abatement, the Agency will consult HSE on aspects of health, safety and waste management in line with the Memorandum of Understanding between the organisations.

5.165 If plant trials are successful, this decision will ensure that the main source of cobalt-60 discharges to sea from the Sellafield site is significantly reduced. At present, cobalt-60 contributes around 20% of the radiation dose to the most exposed members of the public from marine discharges.

Re-routing Pond Purge Water at B27

> ***Decision:*** *Subject to HSE agreement, BNFL will be required to re-route, where reasonably practicable, B27 pond purge water from SETP to SIXEP at times when biocide is not added to the pond water (see Annex 1).*

5.166 The Agency proposed in the ED that BNFL should be required to ensure that, where reasonably practicable, purge water from B27 Fuel Pond is transferred in future to the Site Ion Exchange Plant (SIXEP). This would enable strontium-90 and caesium-137 to be removed and would also enable the current practice of discharging the pond water to sea via the Segregated Effluent Treatment Plant (SETP) to be discontinued (see paragraph 6.75 and Appendix 1 of the ED).

5.167 A small number of respondents to the public consultation commented on this proposal. Those who responded expressed support for the proposal (see Appendix 5).

5.168 The Agency notes the comments made by respondents. The Agency refers to the information provided by BNFL in correspondence with the Agency during the review (see paragraph 6.77 in the ED) in which BNFL stated, "*The presence of biocides within the pond purge from B27 can have an adverse effect on the ion exchange process within SIXEP. Thus, the B27 pond purge can be discharged to either SETP or SIXEP to accommodate seasonal biocide dosing of the B27 pond.*" The Agency recognises this issue associated with treating B27 purge water in SIXEP and therefore included the words "where reasonably practicable" to take account of situations when biocide is used in the pond water.

5.169 The Agency considers that the public consultation has not raised any issues that would influence the Agency to modify or change its proposal.

5.170 Before requiring BNFL to implement the re-routing of B27 pond water to SIXEP, the Agency will consult HSE on aspects of health, safety and waste management in line with the Memorandum of Understanding between the organisations.

5.171 The re-routing of B27 pond purge water to SIXEP provides a further reduction in discharges of radionuclides, mainly strontium-90 and caesium-137, into the Irish Sea.

Re-routing of Pond Purge Water at B29

> ***Decision:*** *Subject to HSE agreement, BNFL will be required to re-route, where reasonably practicable, B29 pond purge water, arising during post operational clean out, pond desludging and other work producing enhanced levels of radionuclides, from SETP to SIXEP before discharge to sea, if the pond water is confirmed to be compatible with the ion exchange process in SIXEP (see Annex 1).*

5.172 The Agency proposed in the ED to require BNFL to re-route, where reasonably practicable, purge water from the B29 Fuel Pond from SETP to SIXEP before discharging it to sea. The proposal included a proviso that the chemistry of the pond water should be compatible with the ion exchange process in SIXEP (see paragraph 6.75 and Appendix 1 of the ED).

5.173 A small number of respondents to the public consultation commented on this proposal. Some respondents supported it whilst others thought the proposed re-routing was not the BPEO and was "*a clear example of over regulation*" (see Appendix 5).

5.174 The Agency notes the comments made by respondents. The Agency refers to the information provide by BNFL in correspondence with the Agency during the review (see paragraph 6.76 of the ED) in which BNFL stated clearly that currently the pond purge water contains low levels of radionuclides and is discharged to sea via SETP. BNFL further stated that in the future post operational clean out (POCO), pond de-sludging and other work within the pond would produce enhanced radionuclide levels in the pond water and that it was intended to route the pond water to SIXEP for treatment. BNFL has confirmed that the use of this discharge route would necessitate the construction of a new pipeline between B29 and SIXEP.

5.175 The Agency considers that the public consultation has not raised any issues that would influence the Agency to change its proposal, although the decision includes more explanation of what is being required.

5.176 The Agency refers to the information provided by BNFL in correspondence with the Agency during the review (see paragraph 6.76 of the ED) in which BNFL stated, "*It is believed that pond water chemistry is compatible with SIXEP and the flowrate increase is likely to become acceptable in future when other current feeds are reduced or removed.*" The Agency recognises the uncertainty associated with treating B29 pond water in SIXEP and has therefore included the words "where reasonably practicable" to take account of this situation.

5.177 Before requiring BNFL to implement the re-routing of B29 pond water to SIXEP, the Agency will consult HSE on aspects of health, safety and waste management in line with the Memorandum of Understanding between the organisations.

5.178 The future re-routing of B29 pond purge water to SIXEP during POCO and associated operations would reduce discharges of radionuclides, mainly strontium-90 and caesium-137, into the Irish Sea.

Iodine-129 Abatement at THORP

> ***Decision:*** *BNFL will be required to provide progress reports to the Agency on the plant trials with the addition of iodic acid to the fuel dissolution process in THORP and on its review of plant operational parameters. The reports will be placed on the appropriate public registers (see Annex 2). If the trials are successful in reducing gaseous discharges of iodine-129, BNFL will be required to provide a programme for the implementation of this abatement technique or justify why it is inappropriate to do so (see Annex 1).*

5.179 The Agency proposed in the ED that BNFL should be required to report the results of plant trials with the addition of iodic acid to the fuel dissolution process in THORP. The Agency proposed also that if the plant trials were successful in reducing gaseous discharges of iodine-129, then BNFL would be required to provide a programme for the routine use of iodic acid or justify why it is inappropriate to do so (see paragraph 6.75 and Appendix 1 of the ED).

5.180 The small number of respondents to the public consultation who commented on this proposal supported it (see Appendix 5).

5.181 The Agency is currently monitoring the progress of plant trials involving the addition of iodic acid to the THORP fuel dissolvers. BNFL has recently informed the Agency (see Appendix 7) that: *"The data during the 2nd trial period and at periods before and after the trial have been reviewed. This indicated that iodine-129 discharges varied markedly and this could not be attributed to iodic acid additions alone. (As expected there were so many complex variations in many different plant operational parameters ongoing during the 4 weeks of the trials). It has been decided to put the trials on hold while a review of operational data is carried out, seeking to discover the dominant source(s) of the observed variations in iodine-129 discharges. Physical parameters with the most potential to significantly effect discharges will be determined with the aim of collecting historical data and looking for correlations during 2002/03 financial year.*

Once this is completed the need for further iodic acid trials will be re-assessed. It may be that if strong links between vessel vent aerial I-129 discharges and particular physical parameters are found to exist then these parameters could be optimised to have a more significant effect in reducing discharges. The potential to optimise these parameters will be examined considering possible effects on plant performance, safety and other environmental discharges. In the meantime the modifications to enable iodic acid to be added to dissolver A will remain in place anticipating a requirement for future trials. BNFL will continue to keep the Agency informed of progress on this issue."

5.182 If the trials are successful, the Agency will require BNFL to implement the use of iodic acid routinely on the plant. However, it should be noted that the results of the initial trials have indicated that there is at present significant uncertainty whether the technique will prove effective at enhancing the volatilisation of iodine into the dissolver off-gas treatment system, and so reduce iodine-129 gaseous discharges.

5.183 The Agency will continue to closely monitor BNFL's progress in developing the use of iodic acid and, will require the company to carry out further investigations to improve its knowledge of THORP process parameters and, if necessary, to investigate alternative measures for reducing iodine-129 gaseous discharges in accordance with BPM.

5.184 Before requiring BNFL to implement the use of iodic acid in THORP, the Agency will consult HSE on aspects of health, safety and waste management in line with the Memorandum of Understanding between the organisations.

5.185 THORP is the main single source (around 45%) of gaseous iodine-129 discharges from Sellafield (see Appendix 6 of the ED). Iodine-129 contributes around 20% of the radiation dose to the most exposed members of the public from gaseous discharges. Improving the abatement of gaseous discharges of iodine-129 from THORP could therefore significantly reduce the radiation dose to the most exposed members of the public.

Krypton-85 Abatement at THORP

Decision: *The current practice of discharging krypton-85 to air is considered at present to be the best practicable environmental option. However, the economics of krypton-85 abatement in THORP gaseous discharges could be influenced by the potential commercial value of non-radioactive xenon gas that is technically recoverable from such discharges. BNFL will be required to justify its claim of around 7 years to develop a krypton-85 cryogenic abatement plant and examine fully the commercial aspects of xenon recovery. This work should proceed forthwith unless the company is able to satisfy the Agency that the currently projected lifetime of THORP is unlikely to be extended for a significant period beyond 2016 that would make krypton-85 abatement and xenon recovery uneconomic (see Annex 1). BNFL will be required to provide a detailed report to the Agency fully justifying its current position regarding this abatement option and confirm on the basis of firm business commitments any extension of THORP operations beyond 2016. The report will be placed on the appropriate public registers (see Annex 2).*

5.186 The Agency requested in the ED that respondents to the public consultation put forward views on whether krypton-85 abatement for THORP gaseous discharges should be implemented. The Agency has considered such views (see Appendix 5) and has concluded that they do not alter the initial conclusion in the ED that the potential disbenefits of a krypton-85 abatement plant outweigh the potential benefits.

5.187 The Agency discussed in detail in the ED the current situation with regard to the development of krypton-85 abatement for THORP gaseous discharges. It is recognised universally that low temperature (cryogenic) separation is the only feasible means of removing krypton-85 gas from gaseous discharges. Considerable uncertainty exists at present as to whether a full-scale separation plant could be designed that is capable of safely handling the volume (around 500 cubic metres/day) of the gaseous discharges.

5.188 The Agency considers that the safety of a krypton-85 cryogenic separation process and the long term safe storage of the radionuclide are paramount in determining the BPEO for disposing of the radionuclide (see Appendix 6 of the ED). The Agency also considers that there are currently major uncertainties in respect of both these issues. The Agency notes that substantial research and development would be needed to confirm the safety of the process design and storage of the gas.

5.189 However, the Agency became aware during the review that the potential commercial value of non-radioactive xenon gas which could be recoverable from such discharges, could affect the economics of krypton-85 abatement. The Agency considered that the potential for recovering xenon gas from THORP aerial discharges should be investigated to establish whether BNFL's estimated lifetime cost (£300-400 million) of a krypton-85 abatement plant could be offset by the commercial value of recoverable xenon gas. The Agency therefore let a contract with a firm of independent consultants to carry out a technical feasibility study of the cryogenic separation of xenon from reprocessing plant off-gas.

5.190 The study investigated the feasibility of re-routing product streams from a cryogenic plant in such a way as to separate and recover xenon as a by-product, in parallel with krypton-85 abatement. It included a review of UK and international developments in the field of cryogenic gas separation technology and a review of the range of industrial applications for xenon and the extent of commercial markets available world-wide (see Appendix 7 and Supporting Information).

5.191 The study showed that the quantity of xenon that could be recovered from THORP off-gas represents a significant proportion of the estimated current world production. It also showed that cryogenic separation of xenon from reprocessing plant off gas is technically possible as part of a krypton-85 abatement process. The results of the market survey indicated that there is an expanding market for xenon, with growth driven by research in high technology industries.

5.192 The Agency requested BNFL to comment on the findings of the consultants' report. A number of specific questions were raised by the Agency concerning BNFL's awareness of the potential commercial value of xenon gas and why it had not been considered in the economic assessment of a krypton-85 abatement process. BNFL's comments on the consultants' report and its response to the questions raised by the Agency were in a letter that is included in the Supporting Information (see Appendix 7).

5.193 BNFL's comments on the consultants' report included:

- *"The document makes a number of claims, which could be used to optimise the costs of a liquid air type plant. These claims are largely speculative at this stage and it is not clear whether the thrust of the arguments made (that there is a growing market for xenon as a speciality gas) would either:*
  - *materialise as claimed in the report,*
  - *be attractive to BNFL, for which this would only ever be an untested non-core venture, in an unfamiliar market dominated by speciality gas producers.*
- *BNFL doubt whether xenon gas obtained from a radioactive source would be acceptable to the public. A very high decontamination factor would have to be assured and consistently achieved."*

5.194 The Agency requested BNFL to confirm when it became aware of the potential commercial value of xenon gas and why subsequent annual progress reports submitted to the Agency on krypton-85 abatement technology did not mention the potential commercial value of xenon gas (see Appendix 7). BNFL responded:

"Information available via archived records, indicates BNFL has been aware of the possible commercial value of xenon gas since the end of 1994.

The possible commercial value of xenon gas was not recognised in the krypton-85 separation retention programme and progress reports because:

- *The commercial recovery of xenon gas and krypton-85 gas removal are two separate issues, which should not be mixed up. Even if BNFL could efficiently recover xenon and sell it at current market prices, krypton-85 recovery, storage and immobilisation presents major safety problems (the time lag alone ~7 years) between building and commissioning the abatement plant makes cost recovery estimates from xenon gas sales speculative.*
- *It would have been misleading of BNFL to give the impression that possible commercial value of any recovered xenon gas, would have any influence on the decision making process with regard to building a krypton-85 abatement plant. As previously communicated to the Agency, BNFL's decision not to build a krypton-85 abatement plant was mainly based on the absence of any technical way forward with regard to the safe immobilisation and storage of krypton-85, as well as concerns regarding the safe, reliable operation of THORP."*

5.195 The Agency notes BNFL's comments regarding the decontamination of xenon gas and the doubt expressed as to whether the source of the gas would be acceptable to the public. The Agency considers that BNFL's comments amount to speculation although it is recognised that uncertainty in the market for the gas will exists as it does for any speciality product. The Agency considers however that there are genuine safety concerns relating to a cryogenic separation process and the storage of krypton-85. The Agency also considers that a number of years would be needed to develop the process and to resolve its safety issues and the design and construction of the abatement plant at THORP would take several more years.

5.196 The Agency also notes that the economics of krypton-85 abatement in THORP gaseous discharges could be influenced by the potential commercial value of non-radioactive xenon gas that is technically recoverable from such discharges. The Agency considers that BNFL needs to justify its claim of around 7 years to develop a krypton-85 cryogenic abatement plant and examine fully the commercial aspects of xenon recovery. Alternatively, the company needs to satisfy the Agency that the currently projected lifetime of THORP is unlikely to be extended for a significant period beyond 2016 that would make krypton-85 abatement and xenon recovery uneconomic.

5.197 The Agency considers that BNFL should continue to keep abreast of developments in the technology for abating krypton-85. A general requirement has been included in the authorisation for BNFL to provide periodically a full report of a comprehensive review of national and international developments in best practice for minimising all waste disposals (see Annex 1). BNFL will be required to address in the review all principal radionuclides including krypton-85.

Carbon-14 Abatement in Liquid Discharges

Decision: A timescale of at least five years would be required for the design, construction, and commissioning of a carbon-14 abatement plant for treating liquid waste arising from the Magnox Reprocessing Plant. It is therefore considered that an abatement plant would be operating by 2007 at the earliest. It is a key objective for BNFL to achieve closure of B205 by about 2012 (ref. UK Strategy for Radioactive Discharges 2001-2020). An abatement plant would therefore operate for a maximum of 5 years only. It is considered that the disbenefits of the cost of the abatement plant, its projected short period of operation, potential worker safety implications and the increase in solid waste requiring disposal outweigh any potential benefits in terms of the assessed collective dose saving and dose saving to the most exposed members of the public.

5.198 The Agency identified in Appendix 6 of the ED potential benefits and disbenefits that would result from the provision of a carbon-14 removal plant for treating liquid waste arising from the Magnox Reprocessing Plant, B205. BNFL informed the Agency that a lifetime expenditure of £44-62 million (i.e. £22 million capital cost and £22-40 million for operating, maintenance, solid waste disposal and plant decommissioning) would be incurred, if the Agency required this abatement to be implemented. The Agency therefore sought advice from an independent consultant who considered that:

"The BNFL cost estimate of £22 million, for the carbon-14 removal plant, is based on a fully developed engineering design, supported by a high level of documentation, with the majority of costs derived from quotations provided by contractors and equipment vendors familiar with the requirements of the Sellafield site.

The capital costs indicated by BNFL are therefore considered to be reliable and the methods applied to derive the cost estimate comply with accepted industry practice.

The costs estimated for operation & maintenance, and for decommissioning of the plant, are based on previous experience obtained from similar facilities at the Sellafield site. It would therefore seem reasonable to assume that these costs are sufficiently reliable for the intended purpose.

The total cost of operation and maintenance will depend on the project completion date. With a scheduled closure date of 2012 for the Magnox facility and a typical project lead-time of 8 years, the carbon-14 removal plant would only operate for 3-4 years.

A relatively high degree of uncertainty (particularly as a disposal facility will not be available for at least 30 years), appears to be attached to the costs associated with disposal of the waste product to Nirex, which (together with encapsulation) form approximately 30% of the total cost.

In the absence of more detailed information, and without further investigation and study, it is not possible to comment further on the cost indicated for Nirex disposal."

5.199 A timescale of at least five years (see 8 years above) would be required for the design, construction, and commissioning of a carbon-14 abatement plant for treating liquid waste arising from the Magnox Reprocessing Plant and an abatement plant would be operating by 2007 at the earliest. It is a key objective for BNFL to achieve closure of B205 by about 2012 (ref. UK Strategy for Radioactive Discharges 2001-2020). An abatement plant would therefore operate for a maximum of 5 years only.

5.200 Based on an abatement plant lifetime of 5 years, the Agency assessed (see Appendix 6 of the ED) the maximum potential collective dose saving to the world population at around 1000 man Sv that could result if B205 liquid waste were treated to reduce carbon-14 discharges to sea. Using the NRPB recommended figure of £20,000 per man Sv (and accounting for around 30% inflation since 1993 - see Section 3) this dose is equivalent to a monetary value of around £25 million (cf. BNFL's estimated lifetime cost of £44-62 million for the abatement plant). The Agency also assessed the maximum potential dose saving to the most exposed members of the public at around 10 μSv/year.

5.201 In addition, the Agency noted in the ED that the operation and subsequent decommissioning of the abatement plant would increase the amount of solid waste requiring ultimate disposal. The Agency requested respondents to the public consultation to provide views on this abatement option to enable all relevant factors to be taken into account in formulating its decision. The Agency received no comments on this potential abatement option.

Environmental Performance

> ***Decision:*** *BNFL will be required to monitor its environmental performance and to submit an annual environmental management report (see Annex 1). The annual report will be placed on the appropriate public registers (see Annex 2).*

5.202 The Agency proposed in the ED that BNFL should be required to monitor its environmental performance and to submit an annual environmental performance report (see paragraph 6.80 and Appendix 1 of the ED).

5.203 Only two respondents to the public consultation, in addition to BNFL, commented specifically on this proposal (see Appendix 5). Both respondents supported the proposal. BNFL welcomed the publication and assessment of environmental performance but considered that many of the performance indicators (see Table A6.2 of the ED) proposed by the Agency were "negative indicators". BNFL suggested that some indicators could be devised to reflect the environmental improvements and benefits of operating to BPM; they might reflect the advantages of nuclear power generation and operations at Sellafield, such as avoidance of carbon dioxide generation and other non-radiological discharges from fossil fuel power generation and chemical plant.

5.204 The Agency notes BNFL's comments on the proposed environmental performance indicators. The Agency has reconsidered the performance indicators and has made minor changes to its proposals. The revised list will be included in the CEARs for Sellafield.

5.205 The Agency considers that it is appropriate for BNFL to submit an annual environmental management report for the Sellafield site. This requirement will facilitate the Agency's task of monitoring the overall environmental performance of the site and will place additional pressure on BNFL's management to show continuous improvement demonstrating the company's stated commitment to environmental protection.

Measures to Reduce Discharges

> ***Decision:*** *BNFL will be required to submit an annual report of the measures that have been introduced to reduce discharges over the past 12 months (see Annex 1). The annual report will be placed on the appropriate public registers (see Annex 2).*

5.206 The Agency proposed in the ED that BNFL should be required to submit an annual report that provides details of the measures that have been introduced to reduce discharges over the preceding 12 months (see paragraph 6.83 and Appendix 1 of the ED).

5.207 The majority of respondents to the public consultation who commented on this proposal supported it. One respondent however, considered that an annual report was too frequent and belied the reality of operating and improving even non-nuclear chemical plant (see Appendix 5).

5.208 The Agency notes the comments made by respondents. The Agency has given the issue of reporting frequency further consideration but has concluded that the proposal for BNFL to provide an annual report is reasonable and will maintain pressure on the company to ensure that priority is given to investigating all potential options for discharge reduction. This reporting requirement supports the government policy aim of progressive reductions in discharges.

5.209 The decision will augment other requirements in the authorisation for the assessment of BPEO and BPM and will provide the Agency with further information to facilitate the regulation of the Sellafield site.

Review of Developments in Best Practice

> ***Decision:*** *BNFL will be required to continue to undertake regular reviews of developments worldwide in best practice for minimising all waste disposals (see Annex 1). Details of the reviews will be included in reports to the Agency which will also have to include a strategy for achieving reductions in discharges. The reports will be placed on the appropriate public registers (see Annex 2).*

> ***Decision:*** *BNFL will be required to establish and carry out a programme of research and development focusing on waste disposal minimisation, improved measurement and sampling of discharges and improvements in discharge abatement techniques (see Annex 1). BNFL will be required to submit the programme and reports of the research and development work to the Agency. The programme and the reports will be placed on the appropriate public registers (see Annex 2).*

5.210 The Agency proposed in the ED that BNFL should be required to continue to undertake regular reviews of developments world-wide in best practice for minimising all waste disposals (see paragraph 6.84 and Appendix 1 of the ED). In addition, the Agency included in Appendix 1 of the ED that BNFL should be required to carry out a programme of research and development into radionuclide abatement, waste minimisation and the means used to assess the activity of radionuclides in disposals.

5.211 Only three respondents made specific comments on this proposal and all supported it (see Appendix 5). COMARE considered that the proposal to undertake regular reviews of developments worldwide in best practice for minimising all waste disposals should be extended to require BNFL to do research in this area, particularly on abatement techniques, and to report on the outcomes and implications of this research. Another respondent considered *"...reviewing developments and providing annual reports does not commit BNFL itself to any research; reviewing means for assessing radioactivity does not appear to be deadlined."*

5.212 The Agency notes the comments made by respondents in relation to the need for BNFL to be required to carry out research and development into waste minimisation and the setting of deadlines for providing information. The Agency has included appropriate requirements in the proposed authorisation (see Annex 1)

5.213 The Agency considers that these decisions will keep the Agency and the public informed of the latest developments in discharge abatement technology and ensure that BNFL keeps abreast of developments worldwide in radionuclide abatement technology and carries out a programme of research into waste minimisation and radionuclide measurement in disposals.

Effect of Discharges on Ecosystems and Wildlife

Decision: *The existing requirement to report annually on research into the effects of discharges on the sustainability of ecosystems and communities of wildlife species will be replaced by the following expanded requirement (see Annex 1):*

BNFL will provide an annual report that includes detailed findings of research on the behaviour in the environment of radionuclides discharged from Sellafield. The objective is to improve understanding of the effect of Sellafield discharges on:

- *the sustainability of ecosystems and communities of wildlife species, and*
- *the radiation exposure of humans via the foodchain and other exposure pathways including novel or unusual pathways.*

The annual report will be placed on the appropriate public registers (see Annex 2)

Decision: *BNFL will be required to carry out appropriate monitoring related to Natura 2000 sites and Sites of Special Scientific Interest in West Cumbria. The company will also be required to carry out a comprehensive assessment of the impact of its radioactive discharges on ecosystems and wildlife species in such sites. The assessment will have to consider a full range of habitats including relevant Natura 2000 sites and Sites of Special Scientific Interest in West Cumbria and use the most up to date assessment framework together with the results of relevant environmental monitoring. BNFL will be required to submit a report covering the monitoring and assessment to the Agency (see Annex 1). The report will be placed on the appropriate public registers (see Annex 2).*

5.214 The Agency proposed in the ED that BNFL should be required to provide an annual report that includes detailed findings of research on the behaviour in the environment of radionuclides discharged from Sellafield. The objective of the proposal was to improve the understanding of effects on the sustainability of ecosystems and communities of wildlife species (see paragraph 6.85 and Appendix 1 of the ED).

5.215 The Agency notes the comments made by respondents, a majority of whom supported the proposal (see Appendix 5). In particular, the Agency notes the comments raised by COMARE for the proposal to include:

- consideration of the implications on the effects on ecosystems for human exposure; and
- consideration of the re-concentration of radionuclides in the environment and any associated changes in ecosystems that could result in the appearance of novel or unusual pathways for human exposure.

5.216 The Agency also notes the request by the Food Standards Agency to extend the proposal to include research carried out on the incorporation into and transfer of radionuclides in the foodchain.

5.217 In response to these comments, the Agency has amended its ED proposal (see the first Decision box in this sub-section, above), to require BNFL to include in its report the findings of research to assess the effects of radionuclide discharges from Sellafield on the radiation exposure of humans via the foodchain and other exposure pathways including novel or unusual pathways.

5.218 The Agency also notes the comment by English Nature that the current emphasis in environmental monitoring appears to be on organisms relevant to the human food chain and that monitoring should be sufficient to enable estimation of exposure in all relevant environmental compartments, including all aspects of the marine environment. English Nature considered that greater emphasis should be placed on monitoring those species that are *"ecologically important"*.

5.219 Although there is no evidence at the present time of a significant impact on non-human species, the Agency is well aware of the developing European framework for such assessments (FASSET) (see Appendix 6). The Agency has therefore decided that BNFL should also be required to undertake appropriate monitoring of Natura 2000 sites and Sites of Special Scientific Interest in West Cumbria. The Company will be required to carry out a comprehensive assessment of the impact of its radioactive discharges on ecosystems and wildlife species in such sites (see second Decision box in this sub-section, above).

5.220 The Agency will assess the design and the results of BNFL's additional monitoring in consultation with English Nature. BNFL will be required to use the results of the monitoring in a comprehensive assessment of radiation dose and risk to sensitive ecosystems in West Cumbria, and if appropriate further afield. The Agency will require BNFL to use the most up to date assessment methodology available, which is likely to be the FASSET framework due for publication in October 2003 (see second Decision box in this sub-section, above). The Agency will review the results of this work to decide whether any additional ecosystem-oriented monitoring should be added to the monitoring requirements.

5.221 In its decision to place these requirements on BNFL, the Agency has taken into account its legal duties and responsibilities in relation to conservation (see Appendix 10 of the ED and Section 3 of this DD) in regulating the disposal of radioactive waste on and from the Sellafield site.

Assessment of Radionuclides in Disposals

Decision: *BNFL will be required to provide a report of a comprehensive review of the means used to assess the activity of radionuclides in waste disposals and the environment (see Annex 1). The report will include:*

- *the results of investigations to determine whether the accuracy, precision and limits of detection of the methods used in radiochemical analysis of discharges and environmental monitoring can be improved; and*
- *a review of gaseous and liquid waste sampling/monitoring systems and associated procedures and a consideration of consistency across the Sellafield site.*

The report will be placed on the appropriate public registers (see Annex 2).

5.222 The Agency proposed in the ED that BNFL should be required to provide a report of a comprehensive review of the means used to assess the activity of radionuclides in waste disposals and the environment (see paragraph 6.86 and Appendix 1 of the ED).

5.223 A small number of respondents commented specifically on this proposal. One respondent considered that the proposal hinted at the Agency requiring what is technically the best, instead of considering whether the assessment techniques in current use are adequate (see Appendix 5).

5.224 The Agency notes this comment, however, it considers that BNFL should use BPM for assessing radionuclides in waste disposals, and the aim of the proposal is to establish whether the current assessment techniques are consistent with its use.

5.225 The decision will ensure that BNFL carries out an in-depth review of its current radionuclide assessment techniques and identifies whether it is reasonably practicable to improve current methods. The outcome of the review may be improvements to the accuracy of methods to determine the radionuclide content of waste discharges from Sellafield.

Carbon-14 Content of Spent Magnox Fuel

> **Decision:** *BNFL will be required to provide a report of an investigation to determine whether it is practicable to minimise the carbon-14 content of spent Magnox fuel by reducing the nitrogen impurity level in the fuel during manufacture (see Annex 1). The report will be placed on the appropriate public registers (see Annex 2).*

5.226 The Agency proposed in the ED that BNFL should be required to carry out an investigation to determine whether it is practicable to minimise the carbon-14 content of spent Magnox fuel, by reducing the nitrogen impurity level in the fuel during manufacture. A reduction in the carbon-14 content of spent fuel would ensure overall there was a smaller amount of the radionuclide for disposal (see paragraph 6.86 and Appendix 1 of the ED).

5.227 Only one respondent, COMARE, commented specifically on this proposal. COMARE welcomed the proposal and stressed the importance of minimising discharges by careful design, operation and quality control at all stages of the nuclear fuel cycle. In addition, COMARE suggested that, notwithstanding the separate proposal on waste minimisation generally, consideration should be given to generalising this proposal to cover all aspects of fuel manufacture, handling, etc., that could lead directly or indirectly to unnecessary radionuclide production (see Appendix 5).

5.228 The Agency concurs with the comments made by COMARE and will be pursuing this matter further under its separate regulation of BNFL's Magnox fuel manufacturing operations.

5.229 If reductions in nitrogen impurity levels can be achieved, the effect will be to reduce the amount of carbon-14 formed during irradiation of the fuel in a reactor and hence the amount of the radionuclide that is released to the environment during reprocessing operations.

Re-routing of Borehole Water

> **Decision:** *BNFL will be required to provide a report of an investigation to determine whether it is practicable to transfer groundwater from Borehole 68 to SIXEP for abatement of caesium-137 rather than discharging it to sea via SETP (see Annex 1). The investigation will be required to be sufficiently detailed to determine whether the transfer and abatement represents the best practicable means for minimising discharges to sea. The report will be placed on the appropriate public registers (see Annex 2).*

5.230 The Agency stated in Appendix 6 of the ED that it was not satisfied that BNFL had addressed all the potential means for transferring borehole 68 groundwater to SIXEP and that it may be possible to identify a relatively low cost option. The Agency therefore proposed to require BNFL to carry out an investigation to determine whether it is reasonably practicable to transfer groundwater from borehole 68 to SIXEP rather than continuing to use the current route of discharging it to sea via SETP (see paragraph 6.86 and Appendix 1 of the ED). Treatment of the groundwater in SIXEP would reduce discharges of strontium-90 and caesium-137 to sea.

5.231 A small number of respondents commented on this proposal. Some supported it but one respondent considered that the proposal was *"a clear example of attempted over regulation"* and that valuable BNFL resources would have to be diverted in order to comply with it (see Appendix 5).

5.232 The Agency considers that BNFL's existing liquid discharge authorisation would effectively require the company to investigate whether the discharge of borehole 68 groundwater via SETP to sea is consistent with BPM for minimising discharges of radioactivity. The decision simply makes the requirement explicit. There is thus no additional regulatory impact.

5.233 The decision will ensure that BNFL investigates thoroughly the potential options for transferring to SIXEP for treatment groundwater that is currently extracted from borehole 68 on the Sellafield site. If a practicable option is identified, the re-routing of the groundwater to SIXEP should further reduce discharges of strontium-90 and caesium-137 to sea.

Use of THORP for Magnox Fuel Reprocessing

> ***Decision:*** *BNFL will be required to provide a report describing current work and any future provisions for the reprocessing of spent Magnox fuel in the Thermal Oxide Reprocessing Plant (THORP) (see Annex 1). The report will be placed on the appropriate public registers (see Annex 2).*

5.234 The Agency proposed in the ED that BNFL should be required to report on current work on, and any future provisions for, the reprocessing of spent Magnox fuel in THORP (see paragraph 6.86 and Appendix 1 of the ED).

5.235 A number of respondents supported the Agency's overall proposals requiring further information from BNFL (see above) but no respondent commented specifically on this proposal (see Appendix 5).

5.236 BNFL informed the Agency during the current review that development work for a small capacity route for the reprocessing of Magnox fuel in THORP was planned which would allow a decision on this option to be made in 3-4 years' time. The Agency's decision will ensure that BNFL reports progress in this area and confirm whether or not the option of reprocessing Magnox fuel in THORP is a real possibility.

Alpha Radionuclide Discharges from Decommissioning

> ***Decision:*** *BNFL will be required to provide a report covering a detailed breakdown of the alpha radionuclide discharges resulting from individual decommissioning projects and a substantiation that the proposed disposals represent best practicable means (see Annex 1).*

5.237 The Agency proposed in the ED that BNFL should provide a detailed breakdown of the alpha radionuclide discharges resulting from individual decommissioning projects and should provide a substantiation that the disposals represent BPM (see paragraph 6.86 and Appendix 1 of the ED).

5.238 Only the Foods Standards Agency commented specifically on this proposal, giving its support (see Appendix 5).

5.239 BNFL's predictions of alpha radionuclides in liquid discharges from decommissioning projects is that they will represent around 70% of total alpha discharges from SETP into the Irish Sea in the period up to 2008. This decision will ensure that BNFL assesses whether such discharges to sea via SETP are consistent with BPM for minimising the activity of waste disposals.

6.0 Matters for Government

6.1 Respondents to the public consultation raised a number of issues that the Agency considers are outside its regulatory remit, and which are properly matters for the Government. These are summarised as follows:

- The issue of justification of the practices at Sellafield which give rise to exposure to ionising radiation (in particular, spent fuel reprocessing), including the implications, if any, of the proposed creation of a Liabilities Management Authority).
- Policy on spent fuel management, and possible alternatives to reprocessing.
- National energy policy and the future role of nuclear power generation and renewable energy sources in meeting the UK's energy needs.
- The development of policy on the management of solid radioactive waste in the UK, including the ultimate route for solid waste arisings being stored at Sellafield, and the location of any waste repository.
- Whether there should be a mechanism to include local authorities in formulating proposals, alongside the Operator and the regulators.
- Resolution of the meaning of terms in the OSPAR Strategy such as "close to zero".
- The security of nuclear sites, and the safe transport of radioactive waste and materials.

6.2 The Agency has ensured that the Government is made aware of such issues raised by respondents to the public consultation.

7.0 Conclusions

7.1 The Agency considers that the aims of the review as set out in the ED and in Section 2 have been achieved.

7.2 The Agency considers that its decisions on the future regulation of radioactive waste disposal from Sellafield will:

- reduce permitted radioactive discharges and consequently reduce the potential prospective doses to the most exposed members of the general public by 25-35% for discharges made at the proposed limits. The Agency recognises that current annual discharges for certain radionuclides are significantly less than the existing limits (see 7.4 below);
- lead to potential savings in collective doses, average doses to members of the public and to the most exposed members of the public living in coastal communities bordering the Irish Sea;
- reduce the potential environmental impact of discharges on ecosystems and wildlife species by ensuring that it is unlikely that radionuclides discharged from Sellafield will lead to significant effects in the terrestrial and marine fauna and flora around Sellafield and the Irish Sea, including those in designated (European) sites;
- minimise the headroom between discharges and limits ensuring that the proposed decisions are consistent with the Government's draft Statutory Guidance to the Agency on the regulation of radioactive discharges into the environment from nuclear sites;
- reduce the overall radionuclide limit for liquid discharges as a first step toward the progressive reduction in such discharges into the Irish Sea consistent with the Government's finalised UK Strategy for Radioactive Discharges 2001-2020;
- provide a more transparent approach to the regulation of the site;
- facilitate and improve the routine regulation of the site;
- strengthen the BPM conditions by requiring waste minimisation at source, which will maintain downward pressure on waste disposals below the limits imposed by the authorisation and will minimise the environmental and radiological impact; and
- bring the regulation of radioactive discharges from individual plants at Sellafield in line with the regulation of discharges from facilities on other nuclear sites and non-radioactive discharges from plants on major industrial sites in England and Wales.

7.3 The Agency considers that its decisions will:

- not constrain the operation of the Magnox reprocessing plant and hence BNFL's ability to meet the projected date of 2012 for the closure of the plant;
- not constrain the operation of THORP;
- not constrain BNFL's progress in treating historic legacy wastes into a safe passive form suitable for long-term storage and ultimate disposal;
- not constrain BNFL's decommissioning programmes for redundant plants; and
- not involve disproportionate cost to BNFL in implementing the decisions.

7.4 The Agency's decisions on limit setting will in most cases reduce the amount of headroom between actual discharges and authorised limits. However, this will not necessarily lead to reduced discharges from the site in the short term in comparison with discharges in recent years. Discharges from Magnox reprocessing and THORP have been relatively low over recent years. This has been due to extended maintenance shutdowns of the Magnox reprocessing plant resulting in relatively low fuel throughput. Similarly, fuel throughput in THORP has been well below design since the plant began operating in 1994, but is planned to continue to increase up to the design level in the future to meet BNFL's commercial contracts for reprocessing foreign fuels.

7.5 BNFL has recently announced that Calder Hall nuclear power station will cease operating in March 2003. The Agency expects, therefore, major reductions in radionuclide discharges from the power station, in particular argon-41 which should at that time be reduced to a minimal level consistent with zero power output from the four reactors. The Agency would anticipate varying the authorisation at such time in order to reflect this. Further discharge reductions are anticipated with the planned cessation of Magnox reprocessing in 2012.

7.6 The Agency recognises there may be a need for BNFL to increase discharges from particular plants as a consequence of, for example, measures to increase the safety of operations (these may, of course, require prompt implementation). The Agency has the statutory power to vary any plant limit if necessary but would require BNFL to provide a fully substantiated case for any such increase. Provided that the proposed change would not entail any increase in a site limit, the Agency would not normally expect to consult beyond the statutory consultees (HSE and FSA). The Agency would inform Ministers of variations in appropriate circumstances.

7.7 As a result of some changes to discharge limits, the Agency considers that the total additional costs to BNFL associated with the Agency's decisions have been reduced substantially compared to the estimated cost of its consultation proposals. The resulting cost estimates are considered not to be disproportionate when set against the potential benefits of the major changes in the regulation of discharges from Sellafield. Furthermore, the estimated cost of the decisions is considered to be a similar order of magnitude to the costs of recent requirements by HSE for improvements in safety management systems on the site.

7.8 The Agency will carry out future reviews of the authorisation at appropriate times, having regard to Government policy guidance on timescales.

8.0 Next step

8.1 Before implementing its decisions the Agency will send this DD to the Secretary of State for Environment, Food and Rural Affairs and the Secretary of State for Health. This will enable Ministers to determine whether they wish to exercise their statutory powers to give direction to the Agency on the decisions.

8.2 Subject to any such direction, and subject to Government consideration of the question of justification of the practices at Sellafield, the Agency would implement its decisions by revoking the existing authorisations issued under RSA 60 and RSA 93. It would at the same time issue BNFL with a new authorisation under RSA 93 in the form of the draft set out in Annex 1.

8.3 The Agency will complete the document `Compilation of Environment Agency Requirements' (CEARs), specifying the detailed compliance requirements of the authorisation e.g. environmental monitoring programme, environmental performance indicators etc., that will be issued to BNFL with the new authorisation and placed with it on appropriate public registers.

Annex 1

ENVIRONMENT AGENCY

Radioactive Substances Act 1993

Certificate of Authorisation
and
Introductory note

Disposal of radioactive waste
from nuclear site

British Nuclear Fuels Plc

Sellafield Site
Seascale,
Cumbria CA20 1PG

Authorisation Number XXXXXX

Introductory Note

IN 1. The following Certificate of Authorisation is issued by the Environment Agency under the provisions of section 13 of the Radioactive Substances Act 1993 ("the Act"). The Authorisation permits the disposal of the specified radioactive wastes from the specified site, subject to limitations and conditions.

IN 2. The Act is concerned with the control of radioactive material and accumulation and disposal of radioactive waste. The requirements of the Act relating to control of radioactive material and accumulation of radioactive waste do not apply to sites licensed under the Nuclear Installations Act 1965 because these matters are regulated under the terms of the site licence. The conditions attached to this Authorisation are, therefore, concerned only with matters that relate to the disposal of radioactive waste from the Operator's Nuclear Site at BNFL, Sellafield, Seascale, Cumbria.

IN 3. The main undertakings to which this certificate relates are:

- Reprocessing of Magnox spent fuel
- Reprocessing of Oxide spent fuel (THORP)
- Processing of backlog liquid wastes
- Solid waste storage/retrieval
- Decommissioning of redundant plant
- Calder Hall nuclear power station
- Research and development.

Radioactive wastes are produced as by-products of these undertakings in gaseous, aqueous and solid waste forms. A small amount of waste oil is also produced. Gaseous wastes are generally subject to abatement (e.g. using filtration, precipitation or scrubbing) before being discharged to the atmosphere via stacks. Aqueous wastes are generally treated in effluent treatment plant (e.g. using precipitation or ion-exchange) prior to being discharged to the Irish Sea. Very low-level solid wastes (e.g. soil) are disposed of to designated landfill locations on the Sellafield site. Other low-level solid wastes are subject to compaction and encapsulation before being disposed of by transfer to BNFL Drigg for burial. Intermediate level wastes are also processed using compaction and encapsulation and are stored on site awaiting a suitable disposal facility. High level solid wastes are vitrified (encapsulated in glass) and are also stored on the Sellafield site awaiting a suitable disposal facility. Small quantities of waste oil are burnt on the site to reduce their volume and the resulting ash residues are disposed of as low-level solid waste. The radioactive waste contains a wide range of fission and activation product radionuclides together with fuel residues (i.e. uranium).

IN 4. The Certificate of Authorisation comprises a signed certificate together with 9 schedules. Schedule 1 contains general conditions that are applicable to all authorised waste types. Schedule 2 specifies the categories of radioactive waste and the disposal routes that are authorised. Schedules 3 to 8 include limitations and conditions on the radionuclides in the waste and the physical nature of the waste streams. Schedule 9 specifies information to be supplied and improvements to be carried out.

IN 5. The Authorisation allows the Agency to place requirements on the Operator to carry out various actions. Details of current requirements, associated specifications and approvals are placed on relevant public registers. Certain information provided by the Operator in response to Certificate requirements will also be placed on the registers.

IN 6. This note does not form part of the Certificate of Authorisation.

ENVIRONMENT AGENCY

Radioactive Substances Act 1993

Authorisation to Dispose of Radioactive Waste
from the premises of BNFL on the Nuclear Site at Sellafield, Seascale, Cumbria.

BNFL, Sellafield

<<Reference Number>>

This certifies that the Environment Agency in exercise of its powers under sections 16(2) and 16(8) of the Radioactive Substances Act 1993 ("the Act") has authorised

British Nuclear Fuels plc (BNFL)

(Company Registration No 1002607)

("the Operator")

whose Registered Office is
Risley, Warrington,
Cheshire WA3 6AS

under sections 13(1) and 13(3) of the Act to dispose of radioactive waste from its premises which are on the Nuclear Site at

Sellafield Site,
Seascale,
Cumbria CA20 1PG

subject to the limitations and conditions in the Schedules to this Certificate of Authorisation.

This Authorisation shall come into effect on <<DD/MM/YY>>

Signed .....

I W PARKER

Authorised to sign on behalf of the Environment Agency

Dated the .....

Schedule 1

General limitations and conditions

Disposal

1. The Operator shall use the best practicable means to minimise the activity of radioactive waste produced that will require disposal under this Authorisation.

2. The Operator shall use the best practicable means to:

   (a) minimise the activity of gaseous and aqueous radioactive waste disposed of by discharge to the environment;

   (b) minimise the volume of radioactive waste disposed of by transfer to other premises;

   (c) subject to paragraph 5 in this Schedule, dispose of radioactive waste at times, in a form, and in a manner so as to minimise the radiological effects on the environment and members of the public;

   where the relevant waste types and disposal routes are specified in the Table in Schedule 2.

3. The Operator shall maintain in good repair the systems and equipment provided:

   (a) to meet the requirements of paragraphs 1 and 2 in this Schedule;

   (b) for the disposal of radioactive waste.

4. The Operator shall check, at an appropriate frequency, the effectiveness of systems, equipment and procedures provided:

   (a) to meet the requirements of paragraphs 1 and 2 in this Schedule;

   (b) for the disposal of radioactive waste.

5. If required by the Agency, the Operator shall only dispose of radioactive waste at such times, in such a form and in such a manner as the Agency specifies.

Management

6. The Operator shall:

   (a) have a management system, organisational structure and resources which are sufficient to achieve compliance with the limitations and conditions of this Authorisation and which include:

      (i) written arrangements specifying how the Operator will achieve compliance with each limitation and condition of this authorisation, to include arrangements for control of modifications to the design and operation of systems and equipment;

      (ii) provision for consultation with such suitable RPAs, or other such qualified experts approved by the Agency in writing, as are necessary for the purpose of advising the Operator as to compliance with the limitations and conditions of this Authorisation and, in particular, on the matters addressed in paragraphs 1, 2, 4, 12 and 13 in this Schedule;

      (iii) written Environmental Operating Rules and operating instructions;

      (iv) a written maintenance schedule and instructions;

      (v) adequate supervision of the disposal of radioactive waste by suitably qualified and experienced persons, whose names shall be clearly displayed with each copy of the Certificate of Authorisation that is posted on the premises as required by section 19 of the Act;

(vi) adequate supervision by suitably qualified and experienced persons of the operation and maintenance of the systems and equipment provided to meet the requirements of paragraphs 1 and 2 in this Schedule and for the disposal of radioactive waste;

(vii) internal audit and review of the Operator's management system;

(b) inform the Agency in writing, at least 28 days or such shorter period agreed by the Agency before the first disposal of radioactive waste is made under the terms of this Authorisation, of the organisational structure and resources, together with such parts of the management system as the Agency specifies, provided to achieve compliance with the limitations and conditions of the Authorisation;

(c) inform the Agency, at least 28 days in advance or, where this is not possible, without delay, of any change in the management system, organisational structure or resources, which might have, or might reasonably be seen to have, a significant impact on how compliance with the limitations and conditions of this Authorisation is achieved.

Sampling, Measurements, Tests, Surveys and Calculations

7. The Operator shall take samples and conduct measurements, tests, surveys, analyses and calculations to determine compliance with the limitations and conditions of this Authorisation.

8. The Operator shall use the best practicable means when taking samples and conducting measurements, tests, surveys, analyses and calculations to determine compliance with the limitations and conditions of this Authorisation, unless particular means are specified in this Authorisation.

9. If required by the Agency, the Operator shall take such samples and conduct such measurements, tests, surveys, analyses and calculations, including environmental measurements and assessments, at such times and using such methods and equipment as the Agency specifies.

10. If required by the Agency, the Operator shall, as the Agency specifies:

(a) keep samples;

(b) provide samples;

(c) dispatch samples for tests at a laboratory and ensure that the samples or residues thereof are collected from the laboratory within three months of receiving written notification that testing and repackaging in accordance with the appropriate transport regulations are complete.

11. The Operator shall maintain in good repair systems and equipment provided for:

(a) carrying out any monitoring and measurements necessary to determine compliance with the limitations and conditions of this Authorisation;

(b) measuring and assessing exposure of members of the public and radioactive contamination of the environment.

12. The Operator shall have and comply with appropriate criteria for the acceptance into service of systems, equipment and procedures for:

(a) carrying out any monitoring and measurements necessary to determine compliance with the limitations and conditions of this Authorisation;

(b) measuring and assessing exposure of members of the public and radioactive contamination of the environment.

13. The Operator shall carry out:

(a) regular calibration, at an appropriate frequency, of systems and equipment provided for:

(i) carrying out any monitoring and measurements necessary to determine compliance with the limitations and conditions of this Authorisation;

(ii) measuring and assessing exposure of members of the public and radioactive contamination of the environment;

(b) regular checking, at an appropriate frequency, that such systems and equipment are serviceable and correctly used.

Records

14. The Operator shall, subject to paragraph 18 in this Schedule:

(a) make and retain records sufficient to demonstrate whether the limitations and conditions of this Authorisation are complied with;

(b) retain records made in accordance with any previous Authorisation issued to the Operator and related to the premises covered by this Authorisation;

(c) retain records transferred to the Operator by any predecessor operator which were made in accordance with any previous Authorisation related to the premises covered by this Authorisation.

15. The Operator, not later than 14 days after the end of each month or within such longer period as the Agency may approve in writing, shall in respect of all disposals of radioactive waste made during that month:

(a) make a record of each measurement, analysis, test and survey conducted for the purpose of this Authorisation in relation to those disposals;

(b) make a record which shows clearly and legibly:

(i) the type of waste and the disposal route;

(ii) the name of each radionuclide or group of radionuclides, specified in the relevant Table in the relevant Schedule, which is present;

(iii) the activity of each such radionuclide or group of radionuclides per cubic metre of the waste, unless otherwise agreed in writing by the Agency;

(iv) for Drigg waste, the activity of each such radionuclide or group of radionuclides per tonne of the waste, unless otherwise agreed in writing by the Agency;

(v) the total activity of each such radionuclide or group of radionuclides;

(vi) the total volume in cubic metres, unless otherwise agreed in writing by the Agency;

(vii) for Drigg waste, the total mass in tonnes;

(viii) the date and time on which or period during which the disposal took place;

(ix) any other information the Agency may specify.

16. If the Operator amends any record made in accordance with this Authorisation it shall ensure that the original entry remains clear and legible.

17. The Operator shall keep the records referred to in paragraph 15 in this Schedule in a manner and place approved by the Agency.

18. The Operator shall retain the records referred to in paragraphs 14 and 15 in this Schedule until notified in writing by the Agency that the records no longer need to be retained.

Provision of Information

19. The Operator shall supply such information in such format and within such time as the Agency may specify.

20. The Operator shall inform the Agency in writing, at least 14 days before the first disposal of radioactive waste is made under the terms of this Authorisation, of the techniques being employed to determine the activity of radioactive waste disposals and shall inform the Agency in writing in advance of any modifications to those techniques.

21. The Operator shall inform the Agency without delay if the Operator has reason to believe that disposal of radioactive waste is occurring, has occurred or might occur which does not comply with the limitations and conditions of this Authorisation, and shall report the circumstances in writing to the Agency as soon as practicable thereafter.

Interpretation

22. (1) In this Certificate of Authorisation -

(a) except where otherwise specified, words and expressions defined in the Radioactive Substances Act 1993 shall have the same meanings when used in this Certificate of Authorisation as they have in that Act;

"activity", expressed in becquerels, means the number of spontaneous nuclear transformations occurring in a period of one second;

"the Agency" means the Environment Agency;

"aqueous waste" means radioactive waste in the form of a continuous aqueous phase together with any entrained solids, gases and non-aqueous liquids;

"Authorisation" means an authorisation issued under the Radioactive Substances Act 1993 or the Radioactive Substances Act 1960;

"best practicable environmental option" means the radioactive waste management option, for a given practice, that provides the most benefit or least damage to the environment as a whole in the long term as well as in the short term, taking into account operational doses and risks, and social and economic factors.

"Bq, kBq, MBq, GBq, TBq and PBq" are used as abbreviations meaning becquerels, kilobecquerels, megabecquerels, gigabecquerels, terabecquerels and petabecquerels respectively;

"BNFL" means British Nuclear Fuels plc;

"calendar year" means a period of 12 consecutive months beginning on 1 January;

"consignment" means an individual shipment of radioactive waste not greater in volume than 40 cubic metres or such lesser volume as specified in writing by the Agency;

"Drigg Waste" means solid radioactive waste, including any immediate package, intended by the Operator for final disposal at BNFL's site at Drigg;

"environment" means all, or any, of the media of air, water (to include sewers and drains) and land;

"Environmental Operating Rule" means a mandatory restriction on operation, established by the Operator, which is necessary to ensure compliance with this Authorisation;

"gaseous waste" means radioactive waste in the form of gases and associated mists and particulate matter;

"maintenance instructions" means instructions for carrying out any maintenance that may have an effect on compliance with this Authorisation;

"maintenance schedule" means a programme for maintenance of all systems and equipment that contribute to achieving compliance with this Authorisation;

"month" means calendar month (ie 1-31 January, 1-28/29 February, 1-31 March, etc);

"operating instructions" means instructions for carrying out any operation that may have an effect on compliance with this Authorisation;

"organic liquid waste" means radioactive waste in the form of liquid, not being aqueous waste, containing one or more organic chemical compounds;

"package" includes any sack, drum, container or wrapping;

"quarter" means any period of three consecutive months;

"RPA" means a Radiation Protection Adviser appointed under Regulation 13 of the Ionising Radiations Regulations 1999;

"samples" includes samples that have been prepared or treated to enable measurements of activity to be made;

"Schedule" means a Schedule forming part of this Certificate of Authorisation;

"week" means a period of 7 consecutive days commencing at a day and time to be notified in writing to the Agency by the Operator at least 14 days before any disposal of radioactive waste is made under the terms of this Authorisation, any subsequent change being notified in writing to the Agency at least 7 days in advance;

"year" and "annual" mean any period of 12 consecutive months.

(b) "UKAEA" means United Kingdom Atomic Energy Authority;

"Magnox dissolver" means the system in Magnox Reprocessing Plant (B205) in which spent fuel is dissolved;

"THORP dissolver" means the system in THORP in which spent fuel is dissolved.

(2) In this Certificate of Authorisation the Interpretation Act 1978 shall apply as it does to an Act of Parliament and in particular words in the singular include the plural and words in the plural include the singular.

(3) (a) In determining whether particular means are the "best practicable" for the purposes of this Authorisation, the Operator 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.

(b) Where reference is made to the use of "best practicable means" in this Certificate of Authorisation, the means to be employed shall include:

(i) the provision, maintenance and manner of operation of any relevant plant, machinery or equipment;

(ii) the supervision of any relevant operation.

Schedule 2

Authorised Radioactive waste types and disposal routes

1. Subject to paragraph 2 in this Schedule, the Operator is authorised to dispose only of the radioactive waste types identified in the Table 1 in this Schedule and only by the relevant disposal route(s) specified in the Table 1.

2. The Operator may dispose of radioactive waste, not being waste otherwise authorised to be disposed of, which is collected as a result of the user's participation in the National Arrangements for Incidents involving Radioactivity provided that the Operator:

   (a) transfers the waste to a person whom the Environment Agency has agreed in writing may receive that waste;

   (b) as soon as practicable provides available details in writing of the nature of the radioactive waste, the radionuclides present, their activities and the manner and date of disposal.

Table 1 | Authorised Radioactive Waste Types and Disposal Routes

Radioactive waste type	Disposal route
Gaseous Waste	Discharge to the environment
Aqueous Waste	Discharge to the environment
Organic Liquid Waste	Incineration on the premises
Solid Waste	Deposit on the premises
	Transfer to BNFL at Drigg for the purposes of final disposal
	Transfer to UKAEA at Windscale for the purposes of processing prior to ultimate disposal at Drigg
	Transfer to UKAEA at Winfrith for the purposes of processing prior to ultimate disposal at Drigg
	Transfer to UKAEA at Winfrith for the purposes of waste characterisation
	Transfer to UKAEA at Windscale for the purposes of processing prior to storage at Sellafield

Schedule 3

Limitations and conditions relating to disposal of Radioactive Gaseous waste by discharge to the environment

1. The Operator shall only discharge radioactive gaseous waste to the environment by means of the outlets identified in Table 1 in this Schedule and such other outlets as the Agency may approve in writing.

2. The Operator shall not in any year discharge gaseous waste in which the activity of any radionuclide or group of radionuclides specified in Table 2 in this Schedule exceeds the relevant Annual Limit.

3. The Operator shall not in any year, from any outlet or group of outlets specified in Table 3 in this schedule, discharge gaseous waste in which the activity of any radionuclide or group of radionuclides specified in Table 3 exceeds the relevant Annual Limit.

4. If, in any quarter, the activity in gaseous waste discharged of any radionuclide or group of radionuclides specified in Table 2 in this Schedule exceeds the relevant Quarterly Notification Level, the Operator shall provide the Agency with a written submission which includes:

   (a) details of the occurrence;

   (b) a description of the means used to minimise the activity of gaseous waste discharged;

   (c) a review of those means having regard to paragraphs 1 and 2 in Schedule 1;

   not later than 14 days from making the record which demonstrates such excess.

4. The Operator shall not in any week, from any outlet specified in Table 4 in this Schedule, discharge gaseous waste in which the activity of any radionuclide or group of radionuclides specified in Table 4 exceeds the relevant Weekly Limit.

5. If, in any week, the activity in gaseous waste discharged, from the group of outlets specified in Table 5 in this Schedule, of any radionuclide or group of radionuclides specified in Table 5 exceeds, or is likely to exceed, the relevant Weekly Advisory Level, the Operator shall:

   (a) without delay, inform the Agency and the Food Standards Agency;

   (b) as soon as reasonably practicable, advise the Agency and the Food Standards Agency of the circumstances at the site leading to the release and the possible impact of any deposition of radioactivity on pasture or crops in the vicinity of the site, including any measurements made.

6. The Operator shall not in any calendar year, taking account of the total mass of uranium in tonnes fed to the THORP dissolver, discharge from the B570 stack gaseous waste in which the activity of any radionuclide specified in Table 6 exceeds the relevant Annual Limit.

7. The Operator shall not in any calendar year, taking account of the total mass of uranium in tonnes fed to the Magnox dissolver, discharge from the B204 stack gaseous waste in which the activity of any radionuclide specified in Table 7 exceeds the relevant Annual Limit.

8. For the purposes of demonstrating compliance with the limitations and conditions of this Authorisation relating to "beta-emitting radionuclides associated with particulate matter" and "alpha-emitting radionuclides associated with particulate matter", the Operator shall measure the gross beta and alpha activity of all particulate samples collected for these purposes, after an appropriate period for decay of radon daughters, by using suitable sample preparation methods and suitable counting systems, which have been agreed in writing by the Agency.

9. The Operator shall ensure that consideration is given to the segregation of discharges, either by physical separation and/or the provision of separate sampling/monitoring arrangements, when undertaking modifications to existing plant and in the design of new facilities.

10. The provisions of paragraphs 2 and 4 in this Schedule shall not apply to discharges of radioactive gaseous waste from the oil burner stack(s) identified in Table 1 in this Schedule.

Table 1 | Authorised Gaseous Discharge Outlets

Authorised Gaseous Discharge Outlets

Very High discharge Points - the effective height of which exceeds 90 metres:

- B570 stack serving Thermal Oxide Reprocessing Plant (THORP) (Building B570) and Sellafield Mixed oxide fuel Plant (SMP) (Building B572)
- B803 stack serving Solvent Treatment Plant (Building B803)

High Discharge Points - the effective height of which exceeds 70 metres but is less than 90m:

- B204 stack serving Magnox Head End Plant (Building B205), Uranium Finishing Plant (Building B268), Monitoring tanks (B200), Purification Plant (B203), Redundant head end plant (B204), THORP miniature pilot plant (B206), Medium Active Concentrate Tank Farm (B211), Waste Solvent tank farm (B213), Pump House and Monitoring tanks (B275), Salt Evaporator plant (B303)
- B230 stack serving Research and Technical Facilities (Building B229) and Plutonium Finishing Plant (Building B209)

Intermediate Discharge Points - the effective height of which exceeds 30 metres but is less than 70 metres:

- B6 stack serving Magnox Reprocessing Plant Cell Ventilation Systems (Building B205 and Building B268) and Redundant Fuel Fabrication Plant (Building B277)
- B355 stack serving Waste Vitrification Plant (Lines 1 and 2 in Building B355 and line 3 in Building B868)
- B389 stack serving Magnox Encapsulation Plant (Building B389)
- B368 stack serving Waste Encapsulation Plant (Building B368)
- B38/3 stack serving Third Extension to Solid Waste Storage Facility (Building B38)

Low Discharge Points - the effective height of which does not exceed 30 metres:

- B30 stack serving Magnox Storage Pond and Decanning Facility (Building B30)
- B38/1&2 stack serving First and Second Extensions to the Waste Storage Facility (Building B38)
- B311 stack serving Fuel Handling Plant (Building B311)
- B331 stack serving Site Ion Exchange Plant (Building B331)
- B399 stack serving Miscellaneous Beta Gamma Waste Store (Building B399)
- B170 stack serving BNFL Technology Centre (Building B170)

Miscellaneous Outlets

- B33 Stack serving Mixed Oxide Demonstration Facility
- B41 Stack serving Waste Storage Facility (including waste retrieval)
- B80 Stack serving Waste Treatment Complex
- B215 Stack serving Highly Active Liquor Storage Tanks (HAST) Cell Ventilation
- B259 stack serving Decontamination Centre
- B268 Stack serving the caustic scrubber
- B299 Stack serving Plutonium Finishing Plant
- B303 Stack serving Salt Evaporator Cell Ventilation
- B384 Stack serving Segregated Effluent Treatment Plant
- B572 Stack serving Sellafield MOX Plant C5 Glovebox
- B804 Stack serving Enhanced Actinide Removal Plant
- B805 Stack serving Waste Packaging and Encapsulation Plant
- B27 Open Fuel Pond Surface
- B29 Open Fuel Pond Surface
- B30 Open Fuel Pond Surface
- B310 Open Fuel Pond Surface

Calder

- All stacks and outlets associated with Calder Hall Nuclear Power Station.

Oil Burner

- 9 metre stack associated with the oil fired standby steam boiler located in building B486.1

Table 2 | Gaseous Discharge Annual Limits

Radionuclide or Group of Radionuclides	Annual Limit, MBq	Quarterly Notification Level, MBq
Tritium (H)-3[1]	1.1E+09	2.8E+08
Carbon (C)-14[1]	3.3E+06	8.3E+05
Sulphur (S)-35[1]	2.1E+05	5.3E+04
Argon (Ar)-41[1]	1.6E+09	6.0E+08
Krypton (Kr)-85[1]	4.4E+11	1.3E+11
Strontium (Sr)-90[1]	7.1E+02	1.8E+02
Ruthenium (Ru)-106[1]	2.8E+04	7.0E+03
Antimony (Sb)-125[1]	2.3E+03	5.8E+02
Iodine (I)-129[1]	7.0E+04	1.8E+04
Iodine (I)-131[1]	5.5E+04	1.4E+04
Caesium (Cs)-137[1]	5.8E+03	1.5E+03
Plutonium (Pu)-Alpha[1,2]	1.9E+02	4.8E+01
Plutonium (Pu)-2411	3.0E+03	7.5E+02
Americium (Am)-241 }	-	-
& Curium (Cm)-242 } in total[1]	1.2E+02	3.0E+01
Alpha-emitting radionuclides associated with particulate material	8.8E+02	2.2E+02
Beta-emitting radionuclides associated with particulate material	4.2E+04	1.1E+04

[1] For the purpose of determining compliance with individual radionuclide limits specified in Table 2 of this Schedule, the operator may disregard the discharges of individual radionuclides from the Miscellaneous Outlets specified in Table 1 of this Schedule and from the approved outlets not specified in Table 1.

[2] Plutonium (Pu)-Alpha means the sum of plutonium-238, plutonium-239 and plutonium-240.

Table 3 | Gaseous Discharge Annual Limits for Individual Outlets/Groups of Outlets (Continued)

Radionuclide or Group of Radionuclides	Outlet Annual Limit, MBq								
	B38/3 Stack	B30 Stack	B38/1&2 Stack	B311 Stack	B331 Stack	B399 Stack	B170 Stack	Calder All Outlets	Minor Outlets
Tritium (H)-3	Not specified	Not specified	Not specified	Not specified	Not specified	6.3E+06	Not specified	7.7E+06	Not specified
Carbon (C)-14	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	4.7E+05	Not specified
Sulphur (S)-35	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Site Limit[2]	Not specified
Argon (Ar)-41	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Site Limit[2]	Not specified
Krypton (Kr)-85	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Strontium (Sr)-90	4.4E+02	1.4E+01	3.7E+02	2.0E+01	Not specified	Not specified	8.0E+01	Not specified	Not specified
Ruthenium (Ru)-106	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Antimony (Sb)-125	Not specified	Not specified	Not specified	Site limit[2]	Not specified	Not specified	Not specified	Not specified	Not specified
Iodine (I)-129	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Iodine (I)-131	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Caesium (Cs)-137	4.8E+03	7.5E+01	1.6E+03	1.6E+02	1.6E+02	Not specified	6.2E+01	Not specified	Not specified
Plutonium (Pu)-Alpha[1]	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	2.3E+01	Not specified	Not specified
Plutonium (Pu)-241	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Americium (Am)-241 } & Curium (Cm)-242 } in total	- Not specified	- Not specified	- Not specified	- Not specified	- Not specified	- Not specified	- Not specified	- Not specified	- Not specified
Alpha-emitting radionuclides associated with particulate material	- 1.5E+00	- 4.6E+00	- 2.8E+00	- 1.6E+00	- 5.3E-01	- 6.0E-02	- 4.8E+01	- Not specified	- 5.0E+02
Beta-emitting radionuclides associated with particulate material	- 3.5E+03	- 7.3E+01	- 2.7E+03	- 2.0E+02	- 3.9E+02	- 5.4E-01	- 2.7E+03	- 2.5E+02	- 1.3E+04

[1] Plutonium (Pu)-Alpha means the sum of plutonium-238, plutonium-239 and plutonium-240.

[2] Site limit means the relevant radionuclide, or group of radionuclides, gaseous discharge limit in Table 2 applies.

Table 3 | Gaseous Discharge Annual Limits for Individual Outlets/Groups of Outlets

Radionuclide or Group of Radionuclides	Outlet Annual Limit, MBq							
	B570 Stack	B204 Stack	B230 Stack	B803 Stack	B6 Stack	B355 Stack	B389 Stack	B368 Stack
Tritium (H)-3	4.3E+07	Site limit[2]	Not Specified	Not specified	Not specified	Not specified	Not specified	Not specified
Carbon (C)-14	7.6E+05	1.3E+06	Not specified	7.6E+05	Not specified	1.3E+06	Not specified	1.3E+05
Sulphur (S)-35	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Argon (Ar)-41	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Krypton (Kr)-85	Site limit[2]	1.2E+11	2.5E+08	Not specified	Not specified	Not specified	Not specified	Not specified
Strontium (Sr)-90	1.3E+02	5.8E+01	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Ruthenium (Ru)-106	1.4E+04	2.7E+02	Not specified	Not specified	Not specified	1.9E+04	Not specified	Not specified
Antimony (Sb)-125	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Iodine (I)-129	3.8E+04	1.1E+04	Not specified	2.1E+04	2.1E+03	1.4E+03	Not specified	4.8E+02
Iodine (I)-131	7.9E+03	3.8E+04	Not specified	7.0E+03	9.5E+02	9.1E+03	Not specified	Not specified
Caesium (Cs)-137	1.3E+02	6.3E+01	1.7E+02	Not specified	Not specified	1.2E+02	Not specified	Not specified
Plutonium (Pu)-Alpha[1]	1.9E+01	4.9E+01	Site limit[2]	Not specified	2.6E+00	2.4E+00	Not specified	Not Specified
Plutonium (Pu)-241	3.4E+02	2.4E+03	Not Specified	Not specified	Not specified	Not specified	Not specified	Not specified
Americium (Am)-241 } & Curium (Cm)-242 } in total	2.1E+01	7.2E+01	Site limit[2]	Not specified	Not specified	Not specified	Not specified	Not specified
Alpha-emitting radionuclides associated with particulate material	6.0E+01	3.3E+02	3.7E+02	3.7E-01	5.9E+00	7.5E+00	2.4E-01	6.4E+00
Beta-emitting radionuclides associated with particulate material	1.2E+04	6.4E+02	6.1E+02	3.9E+03	3.0E+01	1.2E+04	4.0E+01	7.9E+02

[1] Plutonium (Pu)-Alpha means the sum of plutonium-238, plutonium-239 and plutonium-240.

[2] Site limit means the relevant radionuclide, or group of radionuclides, gaseous discharge limit in Table 2 applies.

Table 4 | Gaseous Discharge Weekly Limits

Outlet	Radionulide or Group Radionuclides	Weekly Limit, MBq
B570 Stack	Iodine (I) - 129	3.8E+03
B204 Stack	Iodine (I) - 129	2.0E+03
	Iodine (I) - 131	4.3E+03
B6 Stack	Iodine (I) - 131	5.0E+02
B803 Stack	Iodine (I) - 129	2.1E+03

Table 5 | Gaseous Discharge Weekly Advisory Levels

Outlet	Radionulide or Group Radionuclides	Weekly Advisory Limit, MBq
All outlets connected with	Tritium (H) - 3	4.0E+05
CalderHall Nuclear	Carbon (C) - 14	1.5E+04
Power Station	Sulphur (S) - 35	2.5E+04

Table 6 | Gaseous Calendar Year Throughput Related Limits for B570 Stack (THORP)[1]

Radionulide or Group Radionuclides	Annual Limit, MBq
Limits for THORP uranium throughput less than 100 tonnes	
Tritium (H) - 3	7.2E+06
Carbon (C) - 14	1.5E+05
Krypton (Kr) - 85	7.7E+10
Iodine (I) -129	7.4E+03
Limits for THORP uranium throughput 100 tonnes or more but less than 400 tonnes	
Tritium (H) - 3	2.2E+07
Carbon (C) - 14	4.4E+05
Krypton (Kr) - 85	2.3E+11
Iodine (I) -129	2.2E+04
Limits for THORP uranium throughput 400 tonnes or more but less than 800 tonnes	
Tritium (H) - 3	3.3E+07
Carbon (C) - 14	6.5E+05
Krypton (Kr) - 85	3.5E+11
Iodine (I) -129	3.3E+04

[1] If THORP uranium throughput exceeds 800 tonnes the outlet limits for B570 stack in Table 3 apply.

Table 7 | Gaseous Calendar Year Throughput Related Limits for B204 Stack (Magnox Reprocesing Plant)[1]

Radionulide or Group Radionuclides	Annual Limit, MBq
Limits for Magnox Reprocessing Plant, uranium throughput less than 100 tonnes	
Tritium (H) - 3	1.6E+08
Carbon (C) - 14	1.9E+05
Krypton (Kr) - 85	1.7E+10
Limits for Magnox Reprocessing Plant, uranium throughput 100 tonnes or more but less than 400 tonnes	
Tritium (H) - 3	3.7E+08
Carbon (C) - 14	4.3E+05
Krypton (Kr) - 85	4.0E+10
Limits for Magnox Reprocessing Plant, uranium throughput 400 tonnes or more but less than 800 tonnes	
Tritium (H) - 3	6.4E+08
Carbon (C) - 14	7.6E+05
Krypton (Kr) - 85	7.0E+10
Limits for Magnox Reprocessing Plant, uranium throughput 800 tonnes or more but less than 1200 tonnes.	
Tritium (H) - 3	9.2E+08
Carbon (C) - 14	1.1E+06
Krypton (Kr) - 85	1.0E+11

[1] If Magnox reprocessing uranium throughput exceeds 1200 tonnes the outlet limits for B204 stack in Table 3 apply.

Schedule 4

Limitations and conditions relating to disposal of radioactive Aqueous waste by discharge to the environment

1. The Operator shall only discharge radioactive aqueous waste to the environment through the systems specified in Table 1 in this Schedule and such other systems as the Agency may approve in writing.

2. The Operator shall use the best practicable means to exclude all entrained solids, gases and non-aqueous liquids from radioactive aqueous waste prior to discharge to the environment.

3. Subject to paragraph 10 in this Schedule, the Operator shall not in any year discharge aqueous waste through any system specified in Table 2 in this Schedule in which the activity of any radionuclide or group of radionuclides specified in Table 2 exceeds the relevant Annual Limit.

4. Subject to paragraph 11 in this Schedule, the Operator shall not in any year, from any plant specified in Table 3 in this Schedule, discharge aqueous waste into an Authorised Aqueous Discharge System in which the activity of any radionuclide or group of radionuclides specified in Table 3 exceeds the relevant Annual Limit.

5. If, in any quarter, the activity in aqueous waste discharged through any system specified in Table 2 in this Schedule of any radionuclide or group of radionuclides specified in the relevant Table exceeds the relevant Quarterly Notification Level (where specified), the Operator shall provide the Agency with a written submission which includes:

   (a) details of the occurrence;

   (b) a description of the means used to minimise the activity of aqueous waste discharged;

   (c) a review of those means having regard to paragraphs 1 and 2 in Schedule 1;

   not later than 14 days from making the record which demonstrates such excess.

6. The Operator shall not in any week discharge aqueous waste through the Sea Pipelines in which the activity of any radionuclide or group of radionuclides specified in Table 4 in this Schedule exceeds the relevant Weekly Limit.

7. The Operator shall not in any calendar year, taking account of the total mass of uranium in tonnes fed to the THORP dissolver, discharge aqueous waste through the Sea Pipelines in which the activity of any radionuclide specified in Table 5 in this Schedule exceeds the relevant Annual Limit.

8. The Operator shall not in any calendar year, taking account of the total mass of uranium in tonnes fed to the Magnox dissolver, discharge aqueous waste through the Sea Pipelines in which the activity of any radionuclide specified in Table 6 in this Schedule exceeds the relevant Annual Limit.

9. If the Operator has reasonable grounds for believing that a malfunction of the Site Ion Exchange Plant has occurred, such that it will dispose of aqueous waste in which the activity of any radionuclide or group of radionuclides specified in Table 2 in this Schedule will exceed the relevant Annual Limit specified for the Sea Pipelines in Table 2, it shall report the circumstances in writing to the Environment Agency without delay. The report will advise the Environment Agency in writing of the means the Operator proposes to use to limit the activity of the relevant waste discharged.

10. If the Operator has reported and advised the Environment Agency in accordance with paragraph 9 of this Schedule, the Operator shall not in any year discharge aqueous waste through the Sea Pipelines in which the activity of any radionuclide or group of radionuclides specified in Table 2 in this Schedule exceeds the sum of the relevant Annual Limit specified in Table 2 and the relevant Additional Component to the Annual Limit (if any) specified in Table 7 in this Schedule.

11. If the Operator has reported and advised the Environment Agency in accordance with paragraph 9 of this Schedule, the Operator shall not in any year discharge aqueous waste from the Site Ion Exchange Plant in which the activity of any radionuclide or group of radionuclides specified in Table 3 in this Schedule exceeds the sum of the relevant Annual Limit specified in Table 3 and the relevant Additional Component to the Annual Limit (if any) specified in Table 7 in this Schedule.

12. For the purposes of demonstrating compliance with the limitations and conditions of this Authorisation relating to "beta-emitting radionuclides" and "alpha-emitting radionuclides", the Operator shall measure the gross beta and alpha activity of all samples collected for these purposes by using suitable sample preparation methods and suitable counting systems, which has been agreed in writing by the Agency.

13. The Operator shall ensure that consideration is given to the segregation of discharges, either by physical separation and/or the provision of separate sampling/monitoring arrangements, when undertaking modifications to existing plant and in the design of new facilities.

Table 1 | Authorised Aqueous Discharge Systems

Authorised Aqueous Discharge Systems
The 3 Sea Pipelines, utilised for the discharge of aqueous radioactive waste, which are manifolded to the Effluent Break Pressure Tanks (B316) and discharge to the Irish Sea 2km offshore from the Sellafield beach at or about NGR NX998021
The Factory Sewer, utilised for the discharge of treated sewage effluent and other aqueous effluent which discharges to the Ehen Estuary, at the confluence with the R Calder at or about NGR NY023030

Table 2 | Aqueous Discharge Annual Limits for Discharge Systems

Radionuclide or group Radionuclides	Discharge System			
	Sea Pipelines		Factory Sewer	
	Annual Limit, GBq	Quarterly Notification Level, GBq	Annual Limit, GBq	Quarterly Notification Level, GBq
Tritium (H)-3	2.0E+07	5.0E+06	6.8E+01	1.7E+01
Carbon (C)-14	2.1E+04	5.0E+03	Not specified	Not specified
Cobalt (Co)-60	3.6E+03	9.0E+02	Not specified	Not specified
Strontium (Sr)-90	4.8E+04	1.2E+04	Not specified	Not specified
Zirconium (Zr)-95 & Niobium (Nb)-95 in total	3.8E+03	9.5E+02	Not specified	Not specified
Technetium (Tc)-99	9.0E+04	5.0E+04	Not specified	Not specified
Ruthenium (Ru)-106	6.3E+04	1.6E+04	Not specified	Not specified
Antimony (Sb)-125	2.5E+04	6.3E+03	Not specified	Not specified
Iodine (I)-129	2.0E+03	5.0E+02	Not specified	Not specified
Caesium (Cs)-134	1.6E+03	4.0E+02	Not specified	Not specified
Caesium (Cs)-137	3.4E+04	8.5E+03	Not specified	Not specified
Cerium (Ce)-144	4.0E+03	1.0E+03	Not specified	Not specified
Neptunium (Np)-237	1.0E+03	2.5E+02	Not specified	Not specified
Plutonium (Pu)-Alpha[1]	7.0E+02	1.8E+02	Not specified	Not specified
Plutonium (Pu)-241	2.5E+04	6.3E+03	Not specified	Not specified
Americium (Am)-241	3.0E+02	7.5E+01	Not specified	Not specified
Curium (Cm)-243+244	6.9E+01	1.7E+01	Not specified	Not specified
Alpha-emitting radionuclides	1.0E+03	1.9E+02	3.0E-01	7.5E-02
Beta-emitting radionuclides	2.2E+05	5.5E+04	6.1E+00	1.5E+00
Uranium (Kilograms)	2.0E+03	5.0E+02	Not specified	Not specified

[1] Plutonium (Pu)-Alpha means the sum of plutonium-238, plutonium-239 and plutonium-240.

Table 3 | Aqueous Discharge Annual Limits for Plants Discharges into an Authorised Discharge System

Radionuclide or Group of Radionuclides	Plant Discharge Annual Limit GBq							
	Calder Hall	Segregated Effluent Treatment Plant	EARP Bulks	EARP Concentrates	SIXRP	Laundry and Lagoon	THORP Reciept and storage	THORP Carbon-14 Removal Plan
Tritium (H)-3	9.6E+03	Site limit[2]	6.3E+05	2.6E+04	1.1E+05	Not specified	Not specified	3.6E+03
Carbon (C)-14	Not specified	Site limit[2]	1.1E+02	1.4E+03	4.3E+02	Not specified	Not specified	5.0E+02
Cobalt (Co)-60	Not specified	Not specified	7.0E+02	Not specified	Not specified	Not specified	Site Limit[2]	Not specified
Strontium (Sr)-90	Not specified	8.9E+03	3.0E+03	Site limit[2]	6.8E+03	Not specified	Not specified	Not specified
Zirconium (Zr)-95 } in & Niobium (Nb)-95 } total	Not specified	Site limit[2]	Not Specified	Not specified	Not specified	Not specified	Not specified	Not specified
Technetium (Tc)-99	Not specified	Not specified	1.2E+04	Site Limit[2]	Not specified	Not specified	Not specified	Not specified
Ruthenium (Ru)-106	Not specified	1.5E+04	6.7E+03	6.0E+04	Not specified	Not specified	Not specified	Not specified
Antimony (Sb)-125	Not specified	Not specified	Not specified	Not specified	Site limit[2]	Not specified	Not specified	Not specified
Iodine (I)-129	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	1.7E+03
Caesium (Cs)-134	Not specified	1.1E+03	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Caesium (Cs)-137	Not specified	2.3E+04	Not specified	5.0E+03	1.7E+04	4.0E+01	1.7E+03	Not specified
Cerium (Ce)-144	Not specified	Site limit[2]	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Neptunium (Np)-237	Not specified	Site limit[2]	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Plutonium (Pu)-Alpha	Not specified	Site limit[2]	9.4E+00	1.1E+01	4.0E+02	1.7E+00	Not specified	Not specified
Plutonium (Pu)-241	Not specified	1.8E+04	Not specified	Not specified	1.5E+04	Not specified	Not specified	Not specified
Americium (Am)-241	Not specified	Site limit[2]	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Curium (Cm)-243+244	Not specified	Site limit[2]	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Alpha-emitting radionuclides	Not specified	Site limit[2]	1.2E+01	1.5E+01	Site limit[2]	5.1E+00	6.8E+00	8.5E-01
Beta-emitting radionuclides	3.5E+00	4.2E+04	1.5E+04	1.9E+05	9.5E+04	3.8E+03	4.2E+03	9.7E+02
Uranium (Kilograms)	Not specified	Site limit[2]	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified

[1] Plutonium (Pu)-Alpha means the sum of plutonium-238, plutonium-239 and plutonium-240.

[2] Site limit means the relevant radionuclide, or group of radionuclides, aqueous discharge limit in Table 2 applies.

Table 4 | Aqueous Discharge Weekly Limits for Sea Pipelines

Radionulide or Group Radionuclides	Weekly Limit, GBq
Alpha-emitting radionuclides	1.0E+02
Beta-emitting radionuclides	30.E+04

Table 5 | Aqueous Calendar Year Throughput Related Limit for Sea Pipelines (THORP)[1]

Radionulide or Group Radionuclides	Annual Limit, GBq
Sea Pipeline Limits for THORP uranium throughput less than 100 tonnes	
Tritium (H)-3	8.4E+06
Iodine (I)-129	0.8E+03
Sea Pipeline Limits for THORP uranium throughput 100 tonnes or more but less than 400 tonnes	
Tritium (H)-3	1.2E+07
Iodine (I)-129	1.1E+03
Sea Pipeline Limits for THORP uranium throughput 400 tonnes or more but less than 800 tonnes	
Tritium (H)-3	1.6E+07
Iodine (I)-129	1.6E+03

[1] If THORP uranium throughput exceeds 800 tonnes the Sea Pipelines limits in Table 2 apply.

Table 6 | Aqueous Calendar Year Throughput Related Limit for Sea Pipelines (Magnox Reprocessing Plant)[1]

Radionulide or Group Radionuclides	Annual Limit, GBq
Sea Pipeline Limits for Magnox Reprocessing Plant, uranium throughput less than 100 tonnes	
Carbon-14	7.8E+03
Sea Pipeline Limits for Magnox Reprocessing Plant, uranium throughput 100 tonnes or more but less than 400 tonnes	
Carbon-14	1.0E+04
Sea Pipeline Limits for Magnox Reprocessing Plant, uranium throughput 400 tonnes or more but less than 800 tonnes	
Carbon-14	1.4E+04
Sea Pipeline Limits for Magnox Reprocessing Plant, uranium throughput 800 tonnes or more but less than 1200 tonnes	
Carbon-14	1.7E+04

[1] If Magnox reprocessing uranium throughput exceeds 1200 tonnes the Sea Pipeline limits in Table 2 apply.

Table 7 | Additional Component to Sea Pipelines and SIXEP limits in the Event of a Reported Malfunction of the Site Ion Exchange Effluent Plant (SIXEP)

Radionuclide or Group of Radionuclides	Sea Pipelines Discharge System Additional Component to Annual Limit, GBq	SIXEP Additional Component to Annual Limit, GBq
Strontium (Sr)-90	Not Specified	7.0E+02
Caesium (Cs)-134	5.0E+02	5.0E+02
Caesium (Cs)-137	9.6E+03	9.6E+03
Beta emitting radionuclides	Not Specified	1.0E+04

Schedule 5

Limitations and conditions relating to disposal of radioactive waste by incineration on the premises

1. The Operator shall only incinerate radioactive waste of the categories specified in Table 1 in this Schedule and such other categories as the Agency may approve in writing.

2. The Operator shall only incinerate radioactive waste in the unit specified in Table 2 in this Schedule and such other units as the Agency may approve in writing.

3. The Operator shall use the best practicable means to remove suspended solids from waste oil prior to incineration.

4. The Operator shall not in any month incinerate waste in which the activity of any radionuclide or group of radionuclides specified in Table 3 in this Schedule exceeds the relevant Monthly Limit.

Table 1

Authorised waste categories
Waste oil

Table 2

Authorised incineration unit
Cochrane oil fired standby steam boiler rated at 2.5 MW with a maximum throughput of 250 litres of oil per hour located in building B486.1. Discharges are made via a 9m stack (effective stack height ground level).

Table 3

Radionulide or Group Radionuclides	Monthly Limit, MBq
Carbon-14 & Sulphur-35 in total	220
Alpha emitting radionuclides	0.7
Other radionuclides[1]	170

[1] "other radionuclides" means all beta emitting radionuclides except those specified individually in this table.

Schedule 6

Limitations and conditions relating to disposal of radioactive waste by trasfer to BNFL at Drigg for the purpose of final disposal at BNFL's site at Drigg

(Drigg Waste)

1. The Operator shall not:

   (a) transfer any consignment of Drigg Waste in which the activity of alpha emitting radionuclides exceeds 4 gigabecquerels per tonne or the activity of all other radionuclides exceeds 12 gigabecquerels per tonne;

   (b) in any calendar year transfer Drigg Waste in which, in total, the activity of any radionuclide or group of radionuclides listed in Table 1 in this Schedule exceeds the relevant Annual Limit;

   (c) in any calendar year transfer Drigg Waste in which, in total, the volume of the waste exceeds the Annual Limit specified in Table 2 in this Schedule.

2. The Operator shall not transfer Drigg Waste:

   (a) unless it has been treated or packaged in such a way as to render it, so far as is reasonably practicable, insoluble in water and not readily flammable;

   (b) which contains any of the following materials, unless otherwise agreed in writing by the Agency:

      (i) metals and other materials which readily react either with water or air with the evolution of heat or flammable gases;

      (ii) explosive materials;

      (iii) liquids with flashpoint less than 21°C absorbed on solid materials;

      (iv) strong oxidising agents;

      (v) pressurised gas cylinders or pressurised aerosol containers;

      (vi) materials which generate or are capable of generating toxic gases, vapours or fumes harmful to persons handling the waste;

      (vii) chemical complexing or chelating agents.

3. The Operator shall ensure that the transfer of Drigg Waste is in accordance with the directions of the person to whom the waste is transferred.

4. The Operator shall:

   (a) ensure that the person to whom Drigg Waste is transferred receives at the time of transfer of each consignment a clear and legible note signed on the Operator's behalf stating:

      (i) that the activity of alpha emitting radionuclides in the consignment does not exceed 4 gigabecquerels per tonne and that the activity of all other radionuclides does not exceed 12 gigabecquerels per tonne;

      (ii) the total activity in the consignment of each radionuclide or group of radionuclides listed in Table 1 in this Schedule;

   (b) obtain a record signed on behalf of the person to whom Drigg Waste is transferred, at the time of transfer, stating that the transfer has taken place.

5. If required by the Agency, the Operator shall ensure that any consignment or part of any consignment of Drigg Waste found, following transfer, not to be in accordance with the limitations and conditions of this Authorisation:

(a) is packaged in accordance with the appropriate transport regulations;

(b). is returned as soon as is reasonably practicable to the Sellafield site.

Table 1 | Drigg Waste Disposal Activity Limits

Radionulide or Group Radionuclides	Annual Limit, TBq
Uranium	0.3
Radium (Ra)-226 plus Thorium (Th)-232	0.03
Other alpha emitters [1]	0.3
Carbon (C)-14	0.05
Iodine (I)-129	0.00022
Tritium (H)-3	1.4
Cobalt (Co)-60	2
Other radionuclides [2]	15

[1] "other alpha emitters" means alpha-emitting radionuclides with half-lives greater than three months excluding uranium, radium-226 and thorium-232

[2] "other radionuclides" means:
(a) iron-55 and beta-emitting radionuclides with half-lives greater than three months unless individually specified in this Table and
(b) any other radionuclides specified in writing by the Agency

Table 2 | Drigg Waste Disposal Volume Limit

Annual Limit, cubic meters[1]
34,000

[1] Volume means the net raw volume of the waste and its primary containment (immediate packaging).

Schedule 7

Limitations and conditions relating to disposal of radioactive waste by transfer to other premises

1. The Operator shall not in any calendar year transfer radioactive waste to a person specified in the Table 1 in this Schedule in which, in total:

   (a) the activity of any relevant radionuclide or group of radionuclides exceeds the relevant Annual Activity Limit; or

   (b) the volume of the waste and its immediate packaging exceeds the relevant Annual Volume Limit.

2. The Operator shall not transfer any consignment of radioactive waste to a person specified in Table 1 in this Schedule in which the activity of any relevant radionuclide or group of radionuclides per tonne of the waste exceeds the relevant Activity Concentration Limit (if any).

3. The Operator shall ensure that the transfer of radioactive waste is in accordance with the directions of the person to whom the waste is transferred.

4. The Operator shall:

   (a) ensure that the person to whom waste is transferred receives at the time of transfer of each consignment a clear and legible note signed on the Operator's behalf stating the total activity in the consignment of each relevant radionuclide or group of radionuclides listed in the Table in this Schedule;

   (b) obtain a record signed on behalf of the person to whom waste is transferred, at the time of transfer, stating that the transfer has taken place.

5. If required by the Agency, the Operator shall ensure that any consignment or part of any consignment of waste found, following transfer, not to be in accordance with the limitations and conditions of this Authorisation:

   (a) is packaged in accordance with the appropriate transport regulations;

   (b) is returned as soon as is reasonably practicable to the Sellafield nuclear site.

Table 1 | Authorised Transfer Routes and Limits

Person to whom waste may be transfered	Radionuclide or Group of Radionuclides	Annual Limit, GBq	Activity Concentration Limit, GBq/te	Annual Volume[4] Limit, cubic metres
Transfers of Low-level Waste				
UKAEA at Winfrith for the purpose of processing prior to final disposal at Drigg	Uranium	136		
	Radium (Ra)-226 plus Thorium (Th)-232	0.6		
	Other alpha emitters[1]	6.2		
	Tritium (H)-3	32		
	Carbon (C)-14	0.022		4000
	Iodine (I)-129	0.005		
	Cobalt (Co)-60	22		
	Other radionuclides[2]	360		
	Alpha emitting radionuclides		4	
	All radionuclides except alpha emitters		12	
UKAEA at Winfrith for the purpose of waste characterisation	Alpha emitting radionuclides		4	0.05[3]
	Other radionuclides		12	
Transfers of Intermidiate Level Waste				
UKAEA at Windscale for the purpose of characterisation, segregation and processing[5]	Alpha emitting radionuclides	1.6E+06		3500
	Beta emitting radionuclides	1.3E+08		

[1] "other alpha emitters" means alpha-emitting radionuclides with half-lives greater than three months excluding uranium, radium-226 and thorium-232.

[2] "other radionuclides" means:
(a) iron-55 and beta-emitting radionuclides with half-lives greater than three months unless individually specified in this Table; and
(b) any other radionuclides specified in writing by the Agency.

[3] Volume relates to the net raw volume of the waste excluding the volume of transport containers.

[4] Volume means the net raw volume of the waste and its primary containment (immediate packaging) unless otherwise specified .

[5] Waste will be segregated into low and intermediate level wastes. Once segregated on the Windscale site, intermediate level wastes will be transferred to Sellafield for storage and low level wastes will be transferred to Sellafield and on to Drigg for final disposal.

Schedule 8

Limitations and conditions relating to disposal of solid radioactive waste by deposit on the premises

1. The Operator shall only dispose, by deposit on the premises, radioactive waste of the categories specified in Table 1 in this Schedule and such other categories as the Agency may approve in writing.

2. The Operator shall only dispose of radioactive waste, by deposit, at the locations specified in Table 2 and Figure 1 in this Schedule.

3. The Operator shall not at any location specified in Table 3 in this Schedule:

   (a) dispose of, by deposit, any waste in which the average activity concentration, above natural background level, of any radionuclide or group of radionuclides specified in Table 3 exceeds the relevant Activity Concentration Limit;

   (b) in any calendar year dispose of, by deposit, waste in which, in total, the volume of the waste exceeds the relevant Annual Volume Limit.

Table 1 | Authorised Waste Categories

Authorised Waste Categories[1] - South Landfill and Calder Floodplain Landfill Extension -Main area and Segregated area

Naturally occurring rocks and sub-soils

- Rock and stone. Including - sand, gravel, sandstone, limestone, crushed stone, china clay. Clean building or demolition stone such as sandstone, limestone or slate but excluding mining wastes.
- Sub-soils including clays, but excluding organic soils such as topsoil or peat.

Ceramic and/or cemented materials

- Glass including fritted enamel but excluding glass fibre and glass reinforced plastic (GRP).
- Ceramics including bricks, tiles, clay ware, pottery, china, bricks and mortar but excluding bricks with plaster.
- Concrete and/or mortar, including concrete, reinforced concrete, concrete blocks, breeze blocks and thermalite blocks, but excluding unused cement, concrete washings and blocks with plaster.

Processed/prepared mineral materials which have not been used or contaminated

- Moulding sands and/or clays excluding sands containing organic binders.
- Clay absorbents, including fuller's earth and bentonite.
- Other mineral absorbents excluding sawdust and plastic.
- Man-made mineral fibres (MMMFs), including glass fibre, but excluding glass reinforced plastic (GRP) and asbestos.
- Silica
- Mica
- Abrasives

Authorised Waste Categories[1] - Calder Floodplain Landfill Extension - Segregated Area

- Authorised waste categories for the South Landfill and Calder Floodplain Landfill Extension - Main area and Segregated area (see above)
- Bird and small mammal carcasses
- De-watered sewage cake
- De-watered cooling tower sludges
- Roof wastes
- Timber
- De-watered road sweepings
- De-watered surface water drainage system sludges
- Vegetation

[1] All categories of authorised waste exclude contamination with non-authorised waste.

Table 2 | Authorised Disposal Locations

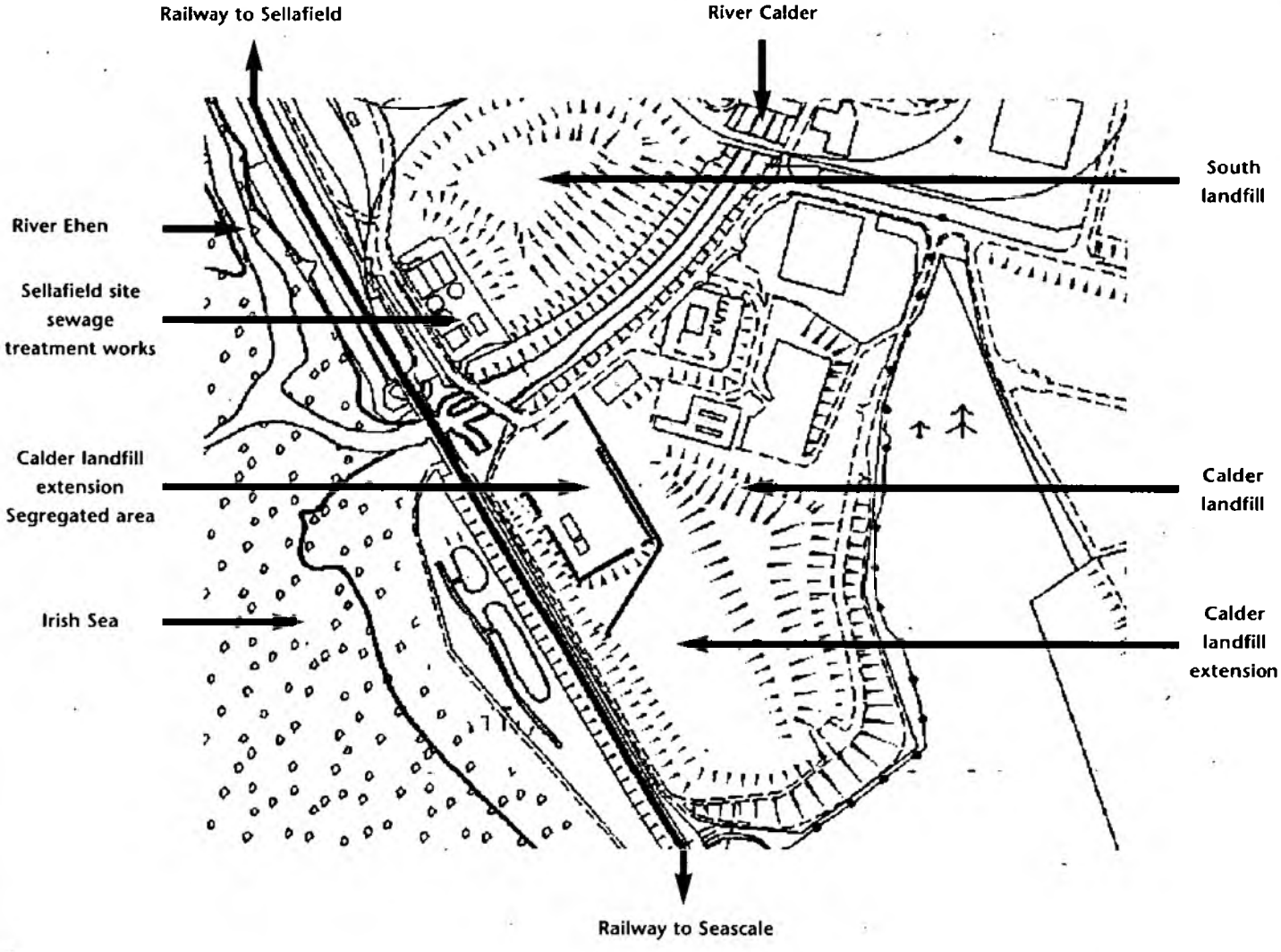
Authorised Disposal Locations
South Landfill
Calder Floodplain Landfill Extension - Main area
Calder Floodplain Landfill Extension - Segregated area

Table 3 | Disposal limits for the Calder Floodplain Landfill Extension and the South Landfill

Location/Radionuclide or Group of Radionuclides	Activity Concentration Limit, Bq/g	Annual Volume Limit, cubic metres
Calder Floodplain Landfill Extension - Main area	3.7[1]	24000
Alpha-emitting radionuclides }		
Beta-emitting radionuclides } in total		
South Landfill and Calder Floodplain Landfill Extension - Segregated area	37[1]	36000
Alpha-emitting radionuclides }		
Beta-emitting radionuclides } in total		

[1] The activity concentration of alpha emitting radionuclides shall not exceed more than one half of the total activity concentration limit.

Figure 1 | Authorised Disposal Locations



It should be noted that all landfill sites are referred to as "tips" under the previous Radioactive Substances Act authorisation and Waste Management Licences arrangements.

Schedule 9

Improvement and additional information requirements

1. The Operator shall complete the requirements specified in the Table in this Schedule, and as specified in more detail by the Agency in writing, by the relevant completion date and, where relevant, shall notify the Agency, in writing, within 14 days of the completion of each of those requirements.

Table | Improvement and Additional Information Requirements

Requirement		Completion Date
1.	The Operator shall submit a written full report of a comprehensive review of whether the current disposal routes for all limited radionuclides continue to represent the best practicable environmental option. The report shall include a programme for carrying out any necessary changes identified by the review.	Report to be submitted 3 years from the effective date of this Authorisation and at such intervals thereafter as the Agency specifies in writing.
2.	The Operator shall submit a written full report of a comprehensive review of national and international developments in best practice for minimising all waste disposals, together with a strategy for achieving reductions in discharges.	Report to be submitted 3 years from the effective date of this Authorisation and at such intervals thereafter as the Agency specifies in writing.
3.	The Operator shall submit a written full report of a comprehensive review of the means used to assess the activity of radionuclides in disposals and the environment and to determine compliance with this Authorisation including consideration of national and international developments in best practice. The report shall include the results of investigations to determine whether the accuracy, precision and limits of detection of the methods used in radiochemical analysis of discharges and environmental monitoring can be improved. The report shall also include a review of aerial and liquid waste sampling/monitoring systems and associated procedures and shall consider consistency across the Sellafield site.	Report to be submitted 3 years from the effective date of this Authorisation and at such intervals thereafter as the Agency specifies in writing.
4.	The Operator shall establish and carry out a programme of research and development in support of items 1, 2 and 3 in this Table. The Operator shall submit the written programme and written progress reports on the research and development work carried out.	Initial programme to be submitted within 3 months of the effective date of this Authorisation. Programme updates and R&D reports to be submitted annually, thereafter.

Table | Improvement and Additional Information Requirements (continued)

Requirement		Completion Date
5.	The Operator shall submit a report detailing the performance of the site against a number of environmental indicators, as specified in writing by the Agency, and any proposals for improvements to existing management arrangements.	Report to be submitted 6 months after the first complete calendar year has elapsed from the effective date of this authorisation and annually thereafter.
6.	The Operator shall submit a written report that provides details of the measures that have been introduced to reduce discharges over the preceding 12 months. The report shall also include an assessment of the efficiency of installed abatement plant, other potential abatement techniques and the practicability of reducing the radionuclide inventory of oxide fuels by extending their storage periods. In addition, the report shall provide details of any strategy to improve current aerial discharge provisions by upgrading or replacing existing discharge systems for Magnox reprocessing and waste storage facilities.	Report to be submitted 12 months from the effective date of this authorisation and annually thereafter.
7.	The Operator shall carry out an investigation to determine whether it is practicable to minimise the carbon-14 content of spent Magnox fuel by reducing the nitrogen impurities level in the fuel during its manufacture. The Operator shall submit a written report of the investigation.	Report to be submitted 12 months from the effective date of this authorisation.
8.	The Operator shall carry out an investigation to determine whether it is practicable to transfer groundwater from Borehole 68 to SIXEP for abatement of caesium-137 rather than discharging it to sea via SETP. The investigation shall be sufficiently detailed to determine whether the transfer and abatement in SIXEP represents the best practicable means for minimising discharges to sea. The Operator shall submit a written report of the investigation.	Report to be submitted 12 months from the effective date of this authorisation.
9.	Subject to HSE agreement, the Operator shall develop and implement monitoring arrangements to measure the discharges from the pond surfaces of the open fuel ponds B27, B29, B30 and B310. The Operator shall carry out monitoring for a period of at least six months. The Operator shall submit a written report of the results of the monitoring including an assessment of their uncertainty. The report shall consider the effectiveness of the monitoring arrangements and make recommendations, if appropriate, for improvements.	An interim report detailing all available results to be submitted by the 31st March 2003 A final report to be submitted by the 30th September 2003.

Table | Improvement and Additional Information Requirements (continued)

Requirement		Completion Date
10.	The Operator shall submit a written report that includes detailed findings of research on the behaviour in the environment of radionuclide discharges from Sellafield. The objective shall be to improve the understanding of the effect of Sellafield discharges on: • the sustainability of ecosystems and communities of wildlife species, and • the radiation exposure of humans via the foodchain and other exposure pathways including novel or unusual pathways.	Report to be submitted annually from the effective date of the authorisation.
11.	The Operator shall submit to the Agency a report describing current work and future provisions for the reprocessing of spent Magnox Fuel in the Thermal Oxide Reprocessing Plant (THORP).	Report to be submitted annually from the effective date of the authorisation.
12.	The Operator shall submit a post closure radiological and environmental safety assessment for the disposal of waste on the South Landfill and the Calder Floodplain Landfill (including the extension). The safety assessment shall be based on existing information and shall include an assessment of the radiological impact and risks associated with all authorised disposals. It shall be set in the wider context of the impact and risk from all radioactivity in the ground derived from activities on the Sellafield site.	Post closure radiological and environmental safety assessment to be submitted 24 months from the effective date of this authorisation.
13.	Subject to HSE agreement, the Operator shall implement the use of an ion exchange material to abate the discharges of cobalt-60, when enhanced levels of the radionuclide occur in THORP fuel ponds, if plant trials are proven to be successful. The Operator shall submit progress reports on the development of this abatement technique.	Progress report to be submitted 3 months after the effective date of this authorisation and at such intervals thereafter as the Agency specifies in writing.
14.	Subject to HSE agreement, the Operator shall ensure that, where reasonably practicable, purge water from B27 Fuel Pond is transferred to SIXEP when biocide is not added to the pond water.	Transfers to SIXEP to begin within 3 months from the effective date of this authorisation.

Table | Improvement and Additional Information Requirements (continued)

	Requirement	Completion Date
15.	Subject to HSE agreement, the Operator shall, where reasonably practicable, during post operational clean-out when enhanced levels of radionuclides occur in B29 fuel pond, route purge pond water to SIXEP, if it is confirmed to be compatible with the ion exchange process in SIXEP.	Plans and justification for the routing and treatment of the purge pond water to be submitted 12 months prior to the start of post operational clean-out.
16.	The Operator shall submit a written report of the progress with plant trials using iodic acid addition to the fuel dissolution process in THORP and on its review of plant operational parameters. If the plant trials are proven to be successful, the Operator shall provide a programme for the implementation of this abatement technique or justify why it is inappropriate to do so.	Progress report to submitted 3 months after the effective date of this authorisation and thereafter at such intervals as specified by the Agency in writing. Programme to be submitted as specified in writing by the Agency.
17.	The Operator shall carry out appropriate monitoring related to Natura 2000 sites and Sites of Special Scientific Interest in West Cumbria. The Operator shall also carry out a comprehensive assessment of the impact of its radioactive discharges on ecosystems and wildlife species. The assessment shall consider a full range of habitats including relevant Natura 2000 sites and Sites of Special Scientific Interest in West Cumbria. The assessment shall use the most up to date assessment framework together with the results of relevant environmental monitoring. The Operator shall submit a written report covering the monitoring and assessment.	Report to be submitted by 31st July 2004.
18.	The Operator shall introduce appropriate management arrangements and written procedures that require BPEO/BPM assessments to be carried out for all new waste streams (arising from new or modified plant or operations) requiring disposal.	Arrangements and procedures to be in place 12 months from the effective date of this authorisation.
19.	The Operator shall develop a methodology to estimate the discharges from the major activities on the site. The Operator shall submit the methodology in a written report. The Operator shall submit annual estimates of discharges from major activities for the previous calendar year and each calendar year thereafter.	Methodology and estimates of discharges to be submitted 6 months after the first calendar year has elapsed from the effective date of this authorisation and estimates of discharges to be submitted annually thereafter.

Table | Improvement and Additional Information Requirements (continued)

	Requirement	Completion Date
20.	The Operator shall submit a written report that includes a detailed breakdown of the alpha radionuclide discharges resulting from individual decommissioning projects both current and planned and a justification that the proposed disposals represent best practicable means.	Report to be submitted 6 months from the effective date of the authorisation.
21.	The Operator shall submit in a written report the engineering, management and monitoring controls for the Calder Floodplain Landfill Extension - Segregated Area and obtain Environment Agency approval of these controls prior to the first deposit of waste being made.	Report to be submitted prior to the first deposit of waste.
22.	The Operator shall provide a written full report setting out its detailed plans for decommissioning of the Calder Hall nuclear power station. The report shall include the overall plan and for each of the first ten years of decommissioning: the proposals for annual discharges and disposals of radioactive waste; decommissioning activities giving rise to the waste; the means to be used to minimise waste to be disposed of; the means to be used to assess waste discharges and disposals.	Report to be submitted by 31st August 2004.
23.	The Operator shall justify the timescale to develop a krypton-85 cryogenic abatement plant and examine fully the commercial aspects of xenon recovery from THORP discharges. This work shall proceed forthwith unless the company is able to satisfy the Agency that the currently projected lifetime of THORP is unlikely to be extended for a significant period beyond 2016 that would make krypton-85 abatement and xenon recovery uneconomic. The Operator shall submit a detailed written report fully justifying its current position regarding this abatement option and confirm on the basis of firm business commitments any extension of THORP operations beyond 2016.	Report to be submitted 6 months from the effective date of the authorisation.

Annex 2

Addresses at which documents may be viewed

Environment Agency web site www.environment-agency.gov.uk

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