



Review of Radioactive Waste Management Policy

Final Conclusions

Presented to Parliament by
the Secretary of State for the Environment,
the Secretary of State for Scotland and
the Secretary of State for Wales
by Command of Her Majesty
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CHAPTER 1

INTRODUCTION

1. Radioactive substances can be used in many ways that are beneficial to man. These include the generation of electricity, medical diagnosis and therapy, scientific research and specialised industrial applications. However, most operations involving the use of radioactive material generate radioactive wastes, which need to be controlled appropriately. These wastes can occur as gases, liquids or solids. Air-borne and liquid waste may be discharged to the environment, after treatment if necessary, while solids are disposed of to appropriate sites or stored until a suitable disposal route becomes available.

2. Radioactivity also occurs naturally. Most of the radiation exposure of the UK population is from natural sources (including cosmic rays, gamma rays from the earth, radon and thoron decay products in the air, and various radionuclides in foodstuffs); very little of it (less than 0.1%) results from the discharge of air-borne or liquid radioactive waste. The volume of solid radioactive waste is small in comparison with other wastes, accounting for only 0.02% of the total annual waste production in the UK, and nearly four fifths of the radioactive waste that is produced contains only a relatively small amount of radioactivity. Nevertheless, radioactive waste has the potential to cause harm and needs to be carefully managed. Significant amounts of solid waste have accumulated from nuclear activities during the last 50 years, and arrangements for safe management continue to be needed for these, as well as for future arisings from the operation and decommissioning of existing plant, irrespective of decisions about future nuclear power generation.

3. This White Paper sets out the conclusions of the Government's review of radioactive waste management policy. The review was announced by the Secretary of State for the Environment on 19 May 1994 and preliminary conclusions were published in a consultation document the following August. The Government received some 250 responses to the consultation document itself and more than 5,000 letters from members of the public as a result of campaigns mounted by Greenpeace. These have been taken into account in reaching the final conclusions of the review.

4. The review of radioactive waste management policy has been carried out in parallel with the Government's review of the future prospects for nuclear power, the "nuclear review". The conclusions of that review were announced by the President of the Board of Trade on 9 May 1995 and were published in a White Paper, *The Prospects for Nuclear Power in the UK* (Cm 2860). On the same day, the Secretary of State for the Environment announced conclusions of the radioactive waste review about the timing of the proposed Nirex repository and about strategies for decommissioning nuclear plant (see Chapter 5). The implications for radioactive waste management of the restructuring of the nuclear industry following the nuclear review are discussed in Chapter 3.

5. The purpose of the radioactive waste review has been to examine current policy in the light of changes that have taken place since the *National Strategy* was published in 1984. The primary aim throughout has been to ensure that radioactive waste, irrespective of whether it is produced by public sector or private sector operations, is properly managed and that people and the environment are not exposed to unacceptable risks either now or in the future.

This White Paper will form part of the guidance given by the Government to the Environment Agency and Scottish Environment Protection Agency, which are due to be established next year. It will provide a clear policy framework for regulating the restructured and partially privatised nuclear industry. It will also inform the UK's approach to negotiations in bodies such as the International Atomic Energy Agency and Euratom, and will help determine the Government's research programme over the next few years.

CHAPTER 2

INTERNATIONAL GUIDELINES AND REGULATIONS

6. The Government's radioactive waste management policy is framed within the context of international guidelines and regulations. A number of different organisations are involved, each with a distinct role.

International Commission on Radiological Protection

7. . The International Commission on Radiological Protection (ICRP) is an independent body of experts. Originally established in 1928 as the International X-ray and Radium Protection Committee, the Commission was restructured and renamed in 1950 and provides guidance on a range of topics relating to the protection of man against radiation. The *1990 Recommendations of the International Commission on Radiological Protection* (ICRP 60) contain revised guidelines, which reflect a major reappraisal by the international scientific community of the health effects of exposure to radiation. The implications of this for radioactive waste management are discussed in Chapter 4.

International Atomic Energy Agency

8. The International Atomic Energy Agency (IAEA) is an autonomous inter-governmental organisation founded by the United Nations (UN) General Assembly in 1957. Its purpose is to foster research and development in the peaceful uses of nuclear energy and the exchange of scientific and technical information, to establish and administer safeguards against the diversion to military purposes of nuclear materials intended for use in civil nuclear programmes and to establish or adopt health and safety standards.

9. As a contribution to establishing and promoting, in a coherent and comprehensive manner, the basic safety philosophy for radioactive waste management and the steps necessary to assure its implementation, the IAEA is preparing a number of publications under its Radioactive Waste Safety Standards (**RADWASS**) Programme. The IAEA's Board of Governors recently adopted a safety fundamentals document, *The Principles of Radioactive Waste Management*, and a safety standard on *Establishing a National System for Radioactive Waste Management*. Further safety standards are being drafted on pre-disposal, management, near surface disposal, geological disposal, uranium and thorium mining and milling waste, and decommissioning.

10. The principles of radioactive waste management set out in the IAEA safety fundamentals document are:

- (1) radioactive waste shall be managed in such a way as to secure an acceptable level of protection for human health;
- (2) radioactive waste shall be managed in such a way as to provide an acceptable level of protection of the environment;
- (3) radioactive waste shall be managed in such a way as to assure that possible effects on human health and the environment beyond national borders will be taken into account;

- (4) radioactive waste shall be managed in such a way that predicted impacts on the health of future generations will not be greater than relevant levels of impact that are acceptable today;
- (5) radioactive waste shall be managed in such a way that will not impose undue burdens on future generations;
- (6) radioactive waste shall be managed within an appropriate national legal framework including clear allocation of responsibilities and provision for independent regulatory functions;
- (7) generation of radioactive waste shall be kept to the minimum practicable;
- (8) interdependencies among all steps in radioactive waste generation and management shall be appropriately taken into account;
- (9) the safety of facilities for radioactive waste management shall be appropriately assured during their lifetime.

These principles are fully reflected in the policies set out in this White Paper.

11. In addition to the **RADWASS** documents, which are advisory, negotiations have now begun on a legally-binding *IAEA Convention on the Safety of Radioactive Waste Management*. This follows the *IAEA Convention on Nuclear Safety* which was opened for signature in September 1994. The Government intends to make a positive contribution to the drafting of the new Convention and in doing so will draw on the experience gained in reviewing its domestic policy.

Nuclear Energy Agency

12. The Nuclear Energy Agency (NEA) of the Organisation for Economic Cooperation and Development (OECD) was created in 1956 to "further the development of the production and uses of nuclear energy, including applications of ionising radiations, for peaceful purposes by the participating countries, through cooperation between those countries and a harmonisation of measures taken at the national level." The NEA's Radioactive Waste Management Committee is publishing a collective opinion on *The Environmental and Ethical Basis of Geological Disposal of Long-Lived Radioactive Wastes*. This will complement their 1991 collective opinion on current scientific methods for conducting safety assessments of radioactive waste disposal systems.

Euratom

13. The Treaty of the European Atomic Energy Community (Euratom) gave the European Community the task of establishing uniform safety standards to protect the health of workers and the general public. The Euratom Basic Safety Standards Directive is currently being revised to take account of the changes in radiological protection criteria recommended by ICRP 60. When agreed, the revised Euratom Basic Safety Standards will be implemented in the UK and all other Member States of the European Union (EU). The Council of Ministers has recently adopted a resolution welcoming the European Commission's proposal for an EU radioactive waste management strategy. The Commission is also involved in research into radioactive waste management through the Nuclear Fission Safety element of its *1994-98 Framework Programme for the European Atomic Energy Community*.

International rules on sea disposal

14. The Government believes that sea disposal for low-level, solid radioactive wastes can be the best practicable environmental option for bulky low-level wastes arising from the decommissioning of power stations and other nuclear plant, as well as for tritiated wastes.

15. In September 1992, the UK signed the *Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR)* which, when ratified, will replace the 1972 Oslo and 1974 Paris Conventions. The Convention, agreed by all littoral states of the North-East Atlantic and by Switzerland, banned the disposal at sea of all radioactive wastes, but included an option for France and the UK to resume the practice, subject to certain conditions, after a period of 15 or 25 years. Although the UK has not yet formally ratified the Convention, its provisions are being applied to all UK waters.

16. In February 1994, the Government announced that it had accepted an indefinite ban on the sea disposal of low and intermediate-level radioactive wastes, which had been adopted at the Consultative Meeting of the global *London Convention 1972*. The announcement made clear that the UK would be ready to reopen discussion in the Convention at any time should the weight of opinion change, that it would continue its own programmes of monitoring and research and that it would contribute actively to the scientific re-evaluation to be carried out, in accordance with the decision, within 25 years. The disposal of high-level radioactive waste at sea was already prohibited by the Convention.

Sustainable Development and Agenda 21

17. In 1992, the UN held a Conference on Environment and Development in Rio de Janeiro (the "Earth Summit"), at which a series of actions was agreed as being necessary to achieve sustainable development, defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." These were set out in *Agenda 21* and include the need to promote the safe and environmentally sound management of radioactive wastes. In *Sustainable Development—the UK Strategy* (Cm 2426), published in January 1994 and submitted to the new UN Commission on Sustainable Development, the Government said that its policy was: "to ensure that radioactive waste is managed safely and that the present generation, which receives the benefit of nuclear power, meets its responsibilities to future generations." The Strategy was updated by the Government's White Paper, *This Common Inheritance, UK Annual Report 1995* (Cm 2822), which was published in March 1995; this reported on progress with the radioactive waste management review. Our responsibility to future generations, which is already recognised in the UK's policy on radioactive waste management, has been reinforced by the concept of sustainable development.

CHAPTER 3

THE NATIONAL FRAMEWORK

18. Responsibility for radioactive waste management is shared between the Government, the regulators and the producers of the waste. The Government decides on matters of overall policy; the regulators ensure that the policy is implemented; and the producers of the waste must manage it in ways which meet the regulatory requirements. In accordance with the "polluter pays" principle and accounting standards, waste producers must also ensure that adequate financial provision is made to cover their existing and future liabilities. The agenda for the development of radioactive waste management policy was set by the Royal Commission on Environmental Pollution's Sixth Report, *Nuclear Power and the Environment* (Cmnd 6618), the "Flowers" Report, which was published in 1976.

Policy Formulation

19. Radioactive waste management policy is the specific responsibility of the Secretaries of State for the Environment, Scotland and Wales, and the Department of the Environment for Northern Ireland, although other departments, such as the Department of Trade and Industry (DTI), the Ministry of Agriculture, Fisheries and Food (MAFF) and the Ministry of Defence (MOD), also have a close interest, as does the Health and Safety Executive (HSE). In deciding policy, the Government is advised by several independent committees, each of which has a remit to consider a different aspect of waste management or radiological protection.

20. **The Radioactive Waste Management Advisory Committee (RWMAC)** is an independent body of experts, drawn from a wide range of backgrounds including nuclear, academic, medical, research and lay interests. It was established in 1978 in response to a recommendation in the Flowers Report and is a source of independent advice to the Secretaries of State for the Environment, Scotland and Wales on matters of civil radioactive waste management.

21. As well as responding to the preliminary conclusions of the review, **RWMAC** has recently published an *Historic Review of Radioactive Waste Management Policy and Practices* and a *Forward Look*, identifying the strategic radioactive waste management issues which the Government will need to address in due course. Many of these issues were also raised in R WMAC's response to the preliminary conclusions of the review and have therefore been taken into account in formulating the policy contained in this White Paper. The White Paper has also been informed by R WMAC's advice on British Nuclear Fuels' (BNFL's) proposals for waste substitution, which was published as an annex to the preliminary conclusions, and by the report of a joint study group on site selection for radioactive waste disposal facilities, which was drawn from members of **RWMAC** and the Advisory Committee on the Safety of Nuclear Installations. Proposals for future studies by **RWMAC** are made in paragraphs 54, 110 and 147 of this White Paper.

22. **The Advisory Committee on the Safety of Nuclear Installations (ACSNI)** was set up in 1977 to advise the Health and Safety Commission (HSC) and, where appropriate, Secretaries of State on major issues affecting

the safety of nuclear installations. It is made up of an independent Chairman and 12 members appointed by the HSC, together with a number of members nominated by the Confederation of British Industry (CBI) and the Trades Union Congress (TUC). ACSNI is assisted by assessors from the nuclear industry, the Nuclear Installations Inspectorate (NII) and observers from Government departments as appropriate.

23. In 1995, the HSC established the **Ionising Radiations Advisory Committee (IR.AC)** to consider all matters concerning protection against exposure to ionising radiations that are relevant to the work of the HSC and to advise the Commission and its Executive. The Committee consists of 18 members from a wide cross-section of organisations including the CBI, TUC, local authorities, Government departments and professional bodies with an interest in radiation protection. The Committee's work includes consideration of standards of protection for workers and others (including the public) from work activity involving risks from ionising radiations. The work also includes monitoring the effectiveness of legislation and monitoring developments in technology.

24. **The National Radiological Protection Board (NRPB)** was created by the Radiological Protection Act 1970. The functions of the Board are to give advice, to conduct research, and to provide technical services in the field of protection against both ionising and non-ionising radiations. Since 1977, the Board has also been required to give advice on the acceptability to and the application in the UK of standards recommended by international or inter-governmental bodies. The Board issues advice in the *Documents of the NRPB* series.

25. **The Committee on Medical Aspects of Radiation in the Environment (COMARE)** was set up in 1985 in response to a recommendation in the report of the independent advisory committee chaired by Sir Douglas Black on the possible increased incidence of cancer in West Cumbria. Its terms of reference are to assess, and advise the Government on, the health effects of natural and man-made radiation in the environment and to assess the adequacy of the available data and the need for further research. Members of the Committee are appointed by the Chief Medical Officer of the Department of Health. The Secretariat of the Committee is provided jointly by the Department of Health and the NRPB. Meetings are attended by assessors from Government departments and institutions with related interests, such as the Medical Research Council. Reports to date have considered the incidence of childhood leukaemia in the vicinity of Sellafield, Dounreay and the Atomic Weapons Establishments at Aldermaston and Burghfield. In addition, COMARE has provided *Statements of Advice* on a number of issues.

26. The Government also takes advice from the regulatory bodies themselves and has consulted widely on the preliminary conclusions of the review of radioactive waste management policy.

Regulation

27. Subject to the successful passage of the Environment Bill, which is currently before Parliament, the regulation of radioactive waste under the Radioactive Substances Act 1993 (RSA 93) will become the responsibility of two new bodies, the Environment Agency and the Scottish Environment Protection Agency (SEPA), which will take over the functions of respectively

Her Majesty's Inspectorate of Pollution (HMIP) in England and Wales and Her Majesty's Industrial Pollution Inspectorate (HMIPI) in Scotland. At the same time, changes will be made to MAFF's functions in relation to the authorisation of radioactive discharges in England (see paragraph 29 below). It is proposed that the Environment Service of the Department of the Environment for Northern Ireland, which incorporates the Alkali and Radiochemical Inspectorate (ARCI), will become a "next steps" agency on 1 April 1996.

28. The creation of the Environment Agencies will make the distinction between policy and regulation more transparent and will complete a process begun by the Environmental Protection Act 1990, which introduced a separation of functions between the Secretaries of State and the Chief Inspectors of **HMIP**, **HMIPI** and **ARCI** in respect of radioactive waste management. The Environment **Bill** requires the Government to consult on and publish draft general guidance to the Agencies about the performance of their functions in relation to sustainable development. This White Paper will form an important policy framework for guidance to the Agencies on radioactive waste management. It will be supplemented by more specific guidance where necessary.

Nuclear sites

29. Applications to dispose of radioactive waste from "nuclear licensed sites"-i.e. sites, such as nuclear power stations, licensed by the HSE under the Nuclear Installations Act 1965 (NIA 65)-are currently determined jointly by HMIP and MAFF in England, by HMIP and the Welsh Office in Wales, and by HMIPI alone in Scotland. The Bill provides for the streamlining of these arrangements in England and Wales. The Agency would become the sole authoriser, with MAFF and the Welsh Office as statutory consultees, so providing the industry with a "one-stop shop" without impairing the effectiveness of present controls. MAFF will continue the role it has now in assessing critical group doses and in monitoring for radioactivity in the environment. In order to protect MAFF's responsibilities for ensuring the safety of the food chain, the Minister of Agriculture, Fisheries and Food will share with the Secretary of State joint powers to call in applications, to determine appeals and to issue directions to the Agency.

30. The management of radioactive waste on nuclear licensed sites is regulated by HSE's NII. However, there is close liaison between the regulatory bodies under the terms of memoranda of understanding, which set out the lead roles of the organisations and the requirements for timely liaison and consultation. These will be revised with the establishment of the Environment Agencies. To place such consultation on a more formal basis, provisions have been included in the Environment Bill to make HSE a statutory consultee of the Agencies for disposal authorisations for nuclear licensed sites and to make the Agencies statutory consultees of HSE for the waste management implications of licences granted under NIA 65. As now, before granting an authorisation for disposal of waste from a nuclear site, the Agencies will be required to consult relevant local authorities, water undertakings and other public or local bodies as appropriate. When appropriate, they will also invite comments from local interest groups and environmental organisations.

Ministry of Defence sites

31. MOD sites are excluded from statutory regulation under RSA 93, although the regulatory bodies exercise similar controls by administrative means. Statutory regulation is, however, applied to the naval Dockyards at Devonport and Rosyth and the Atomic Weapons Establishment sites at Aldermaston and Burghfield, which are operated by civilian contractors. Devonport and Rosyth also include nuclear licensed sites, and Aldermaston and Burghfield are due to be licensed as such in 1997. MOD's radioactive waste management practices are subject to periodic review by RWMAC.

32. In the interests of greater openness, the Government has included a provision in the Environment Bill which will allow relaxation of the scope of directions made under RSA 93 prohibiting the release of information on the grounds of national security.

Non-nuclear sites

33. For sites other than nuclear licensed sites (e.g. hospitals), RSA 93 requires the keeping and use of radioactive materials and the use of mobile radioactive apparatus to be registered, and the accumulation and disposal of radioactive waste to be authorised. Registration and authorisation certificates issued by HMIP, HMIPI and ARCI set out limitations and conditions relating to the control of radioactive materials and waste.

34. The primary concern of HMIP, HMIPI and ARCI is to control radioactive waste. Occupational exposure to ionising radiation and any direct exposure to other persons arising from a work activity is regulated by HSE under the Health and Safety at Work Act 1974 and the Ionising Radiations Regulations 1985 (IRR 85), although in some cases local authorities are the relevant enforcement body. HSE requires prior notification of all work with ionising radiations (except where that work is exempt from reporting) and receives notice of material changes in the work. HSE will consider with the Environment Agencies whether the memoranda of understanding between them should include a description of their respective roles in relation to non-nuclear sites to ensure that these complement each other and do not overlap.

General

3-S. The work of the existing regulatory bodies received broad support in responses to the review's preliminary conclusions. However, a number of respondents called for greater openness and accessibility, improved consistency in implementing regulatory legislation, and less overlap between the different regulatory bodies. The Government believes that these will be provided by the proposals set out above. Revised guidance will be issued to update the booklet, *Radioactive Substances Act 1960, a guide to the administration of the Act*.

Monitoring

36. Member states are required by Euratom to establish the facilities necessary to carry out continuous monitoring of the level of radioactivity in the air, water and soil and to ensure compliance with the basic standards established under the Treaty. Radioactive discharges and their effect on the environment are monitored by the nuclear industry under the terms of their

disposal authorisations. The regulatory bodies also conduct monitoring programmes of their own. MAFF monitors radioactivity in the marine environment and in terrestrial foodstuffs, which are significant pathways of radiological exposure to the public. HMIP monitors radioactivity in the environment which might lead to exposure of the public from non-food pathways such as might arise from the occupation of beaches, river banks or other areas. The Department of the Environment (DOE) also commissions independent monitoring of radioactivity in drinking water sources and sponsors with DTI a programme of monitoring radioactivity in air and rainwater. The results of all these programmes are published annually.

37. The guiding principle in authorising discharges from a particular site is the need to restrict the radiation doses that might be received by the most exposed members of the public, or "critical group", since adequate protection of this group will ensure that others are also protected. Exposure may result from a number of pathways-e.g. through inhalation of airborne activity or uptake by animals and transfer to foodstuffs. For the purposes of discharge authorisations, the UK has since 1986 applied a limit of 1 millisievert per year (mSv/y) to members of the public from all man-made sources of radioactivity other than medical exposure (see paragraph 64). The Government considers it important that the dose limit should be met without imposing restrictions on people's normal behaviour (e.g. their diet). In applying the critical group methodology to assessing the radiation exposure of members of the public, the regulators should not exclude from consideration any pattern of behaviour which a reasonable person might adopt, whether or not anyone actually engages in such behaviour at a given time. However, behaviour which a reasonable person would regard as extreme and which habit surveys have not revealed need not be considered.

38. The NRPB, MAFF and HMIP have recently published the results of a two-year joint study, *Critical Group Doses around Nuclear Sites in England and Wales*. This concluded that current critical group methods were generally adequate. It stressed that it was important to consider the combination of relevant exposure pathways in assessing critical group doses, and that doses from atmospheric discharges, aquatic discharges or direct radiation pathways should not be considered in isolation. The study noted that this combined approach had been adopted to an increasing extent over the last few years by both the regulators and operators, and recommended that this trend should be continued.

39. With the establishment of the Environment Agencies, the Government will consider the responsibilities of the different regulatory bodies and other organisations for assessing the doses received by members of the public.

Structure of the Nuclear Industry

40. The future of the nuclear industry was considered in the nuclear review conducted by DTI and the Scottish Office. The conclusions of the review were announced by the President of the Board of Trade on 9 May 1995 and were published in a White Paper (Cm 2860). The review confirmed that nuclear power plays an important role in meeting the UK's energy needs and should continue to do so, providing it is competitive and can maintain

rigorous standards of safety and environmental protection. However, the review concluded that, while the market would be the ultimate judge, private finance was unlikely to be available at present for new nuclear construction, and that there was no case for Government support for new stations.

41. The review also examined whether, and over what timescale, it would be possible to privatise the nuclear generators. As a result, the Government has decided to privatise the more modern nuclear stations—the seven advanced gas-cooled reactor (**AGR**) stations and the pressurised water reactor (**PWR**) station at Sizewell—during the course of 1996. A holding company will be created which will have those parts of Nuclear Electric (NE) and Scottish Nuclear (SNL) which are to be privatised as wholly-owned subsidiaries. The liabilities associated with these stations will also be transferred to the private sector. The nine Magnox stations currently owned by NE and SNL will be held in a stand-alone company owned by the Government and in due course integrated with BNFL, which already has two Magnox stations. This will give BNFL a clear incentive to optimise the operation of the Magnox stations together with their fuel-cycle activities.

42. The Government has stressed that safety is of paramount importance and will not be compromised. Over the next year, stations changing ownership will be subject to relicensing and reauthorisation by the regulatory bodies to ensure that they continue to be operated safely and that radioactive waste continues to be managed properly. They will remain subject to the same regulatory regime after privatisation as before.

43. The nuclear review also considered the future structure of Nirex, which was formed by the nuclear industry in 1982 to develop a disposal route for intermediate-level waste. The shares in Nirex are presently owned by BNFL (42½%), NE (42½%), SNL (7½%) and the United Kingdom Atomic Energy Authority (UKAEA) (7½%) with the President of the Board of Trade holding a single "special share". The parties are bound together by a *Shareholders' Agreement* which establishes the basic operating regime for Nirex and sets out the various duties of the shareholders, including an obligation to provide the required funding. The proportions in which the shareholders provide the funding required by Nirex are based on the volumes of waste which each of them expects to dispose of rather than on their shareholding percentage.

44. The options considered by the nuclear review ranged from bringing Nirex within direct Government ownership to restructuring it as a joint venture by the nuclear industry without a Government special share. It has been decided that neither of these would be appropriate. Ownership by the industry is important, not only because, under the polluter pays principle, it is responsible for dealing with the waste which it creates, but also because this is the best means of ensuring that Nirex operates efficiently. On the other hand, given the time horizons involved, matters of this kind cannot be left entirely to the market and the Government must have a means of ensuring that its radioactive waste management policies will be implemented. It has therefore been decided that the Government should retain its special share in Nirex, and that the *Shareholders' Agreement* should contain a specific undertaking that the company will abide by Government policy. With these safeguards, the Government considers it unnecessary to seek additional legal powers to enforce its policies in relation to the timely disposal of waste.

45. The AGR and PWR stations will continue to produce radioactive waste and it will be for the privatised companies to make acceptable arrangements for its disposal. The new privatised companies will be incorporated within the existing broad structure of Nirex, with appropriate shareholdings. The companies will be able to exert a substantial commercial influence to secure the cost-effective operation of Nirex through the requirement in the *Shareholders' Agreement* that major decisions need the affirmative vote of each of the shareholders.

CHAPTER 4

GENERAL PRINCIPLES

46. The IAEA's Safety Standard, *Establishing a National System for Radioactive Waste Management*, identifies the following basic requirements of a radioactive waste management system:

- (a) identification of the parties involved in the different steps of radioactive waste management, including waste generators and their responsibilities;
- (b) a rational set of safety, radiological and environmental protection objectives from which standards and criteria may be derived within the regulatory system;
- (c) identification of existing and anticipated radioactive wastes, including their location, radionuclide content and other physical and chemical characteristics;
- (d) control of radioactive waste generation;
- (e) identification of available methods and facilities to process, store and dispose of radioactive waste on an appropriate timescale;
- (f) taking appropriately into account interdependencies among all steps in radioactive waste generation and management;
- (g) appropriate research and development to support the operational and regulatory needs; and
- (h) the funding structure and the allocation of resources that are essential for radioactive waste management, including decommissioning and, where appropriate, maintenance of repositories and post-closure surveillance.

These principles mirror the development of radioactive waste management policy in the UK and are embodied in the reformulation of national policy set out below.

Policy Aims

47. The consultation document containing the preliminary conclusions of the review considered the policy aims guiding radioactive waste management. Until now, policy has been based on the six responsibilities given to the Secretary of State for the Environment in the 1977 White Paper, *Nuclear Power and the Environment* (Cmnd 6820). The consultation document recognised that these aims remained broadly valid, but suggested that they needed updating and amplifying. A reformulation was proposed, on which views were invited.

48. The majority of responses supported the proposal to update the aims. There was widespread support for the principles of waste minimisation, sustainable development and the polluter pays principle. There was also general support for distinguishing the particular responsibilities of the Government and the waste producers. Some of the responses expressed concern that it would not be possible to separate responsibilities as neatly as the

proposed reformulation suggested. The Government recognises this and accepts that some overlap will and should continue. However, it believes that it is useful to clarify the functions of the organisations involved by means of a general allocation of duties.

49. Detailed comments and suggestions for amendments were received on each part of the reformulation. These included suggestions that the revised aims should be prefaced by a statement that placed policy on radioactive waste within the context of general environmental policy; that reference should be made to the precautionary principle; that greater emphasis should be placed on sustainable development; that a firmer line should be taken on minimising the creation of waste; and that, while waste producers should be responsible for developing their own waste management strategies, the Government should retain some role in monitoring these. All the comments received have been given careful consideration and in the light of these a revised statement of policy is set out below.

50. Radioactive waste management policy should be based on the same basic principles as apply more generally to environment policy, and in particular on that of *sustainable development*. Most societies want to achieve economic development to secure higher standards of living, now and for future generations. They also seek to protect and enhance their environment, now and for their children. Sustainable development tries to reconcile these two objectives. A widely quoted definition of this concept is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This principle is outlined at greater length in *Sustainable Development-the UK Strategy* (Cm 2426), which also sets out the following supporting principles:

- **decisions should be based on the *best possible scientific information* and analysis of risks;**
- **where there is uncertainty and potentially serious risks exist, *precautionary* action may be necessary;**
- **ecological impacts must be considered, particularly where resources are *non-renewable* or effects may be *irreversible*;**
- ***cost implications* should be brought home directly to the people responsible-the *polluter pays principle*.**

51. More specifically, and consistent with the above, radioactive wastes should be managed and disposed of in ways which protect the public, 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.

52. Within the approach outlined in the foregoing two paragraphs:

- (1) the *Government* will maintain and continue to develop a policy and regulatory framework which ensure that:
 - (a) radioactive wastes are not unnecessarily created;

- (b) such wastes as are created are safely and appropriately managed and treated;
- (c) they are then safely disposed of at appropriate times and in appropriate ways;

so as to safeguard the interests of existing and future generations and the wider environment, and in a manner that commands public confidence and takes due account of costs;

- (2) the *regulators*, including in future the Environment Agencies, have the duty to ensure that the framework described above is properly implemented in accordance with their statutory powers;
- (3) within that framework, the *producers and owners* of radioactive waste are responsible for developing their own waste management strategies, consulting the Government, regulatory bodies and disposal organisations as appropriate. They should ensure that:
 - (a) they do not create waste management problems which cannot be resolved using current techniques or techniques which could be derived from current lines of development;
 - (b) where it is practical and cost-effective to do so, they characterise and segregate waste on the basis of physical and chemical properties and store it in accordance with the principles of passive safety (i.e. the waste is immobilised and the need for maintenance, monitoring or other human intervention is minimised) in order to facilitate safe management and disposal;
 - (c) they undertake strategic planning, including the development of programmes for the disposal of waste accumulated at nuclear sites within an appropriate timescale and for the decommissioning of redundant plant and facilities. These programmes should be acceptable to the regulators and discussed with them in advance.

The *producers and owners* of radioactive waste are responsible for bearing the costs of managing and disposing of the waste, including the costs of regulation and those of related research undertaken both by themselves and by the regulatory bodies. They should cost radioactive waste management and disposal liabilities before these are incurred and make appropriate financial provisions for meeting them. They should regularly review the adequacy of these provisions.

Waste Categories

53. In the UK, radioactive waste is classified under the following broad categories, according to its heat-generating capacity and activity content:

- (1) **high-level, or heat-generating, wastes (HLW)**, in which the temperature may rise significantly as a result of their radioactivity, so that this factor has to be taken into account in designing storage or disposal facilities;
- (2) **intermediate-level wastes (ILW)** with radioactivity levels exceeding the upper boundaries for low-level wastes, but which do not require heating to be taken into account in the design of storage or disposal facilities;

- (3) **low-level wastes (LLW)**, containing radioactive materials other than those acceptable for disposal with ordinary refuse, but not exceeding 4 gigabecquerels per tonne (GBq/te) of alpha or 12 GBq/te of beta/gamma activity (e.g. wastes which, under existing authorisations, can be accepted by BNFL's disposal facility at Drigg in Cumbria, or UKAEA's at Dounreay in Caithness);
- (4) **very low-level wastes (VLLW)**, which can be safely disposed of with ordinary refuse (dust-bin disposal), each 0.1 m³ of material containing less than 400 kilobecquerels (k.Bq) of beta/gamma activity or single items containing less than 40 kBq of beta/gamma activity.

54. The consultation document suggested that the current categorisation should be revised to take account of, for example, half-lives and activity. In response, there was general support for redefining the waste classification, which it was felt might make it easier to identify appropriate disposal routes and could be a useful step towards standardising waste categories across the EU. Many respondents, however, said that this should only be done if it could be guaranteed that there would be no erosion of existing safety standards. Further consideration will be given to the possibility of refining the categories of radioactive waste and to the suggestion made in the consultation paper that short-lived ILW might be disposed of at Drigg, provided that the overall safety case for the site was not jeopardised. Decisions will be taken in the light of Government research, any relevant IAEA and European Commission studies, and advice which the Government intends to seek from RWMAC.

Radiological Protection Principles

55. The radiological protection principles underpinning the Government's policy take account of ICRP 60 and the NRPB's formal advice to the Government in its 1993 *Board Statement on the 1990 Recommendations of the ICRP*.

56. For practices involving the use of radioactive substances, the system of protection recommended by ICRP is based on the following principles:

- (a) no practice involving exposures to radiation should be adopted unless it produces sufficient benefit to the exposed individuals or to society to offset the radiation detriment it causes (the **justification** of a practice);
- (b) in relation to any particular source within a practice, the magnitude of individual doses, the number of people exposed, and the likelihood of incurring exposures where these are not certain to be received should all be kept as low as reasonably achievable, economic and social factors being taken into account. This procedure should be constrained by restrictions on the doses to individuals (*dose constraints*), or the risks to individuals in the case of potential exposures (*risk constraints*), so as to limit the inequity likely to result from the inherent economic and social judgements (the **optimisation** of protection);
- (c) the exposure of individuals resulting from the combination of all the relevant practices should be subject to dose limits, or to some control of risk in the case of potential exposures. These are aimed at ensuring that no individual is exposed to radiation risks that are judged to be unacceptable from these practices in any normal circumstances. Not all sources are susceptible to control by action at the source and it is necessary to specify the sources to be included as relevant before selecting a dose limit (individual dose and risk **limits**).

The NRPB endorsed these principles, which with the exception of the new concepts of dose and risk constraint-already formed the basis of radiological protection in the UK. ICRP 60 also recommended changes in the methodology used to calculate doses. Although these cannot be formally implemented until negotiation of the revised Euratom Basic Safety Standards Directive is complete and becomes European law, the new methodology is already being used for the authorisation of discharges under RSA 93.

57. The ICRP principles recognise the need to adopt different approaches to the optimisation and limitation of **discharges** of air-borne or liquid waste and **disposals** of solid waste. For routine releases of radioactive waste to the environment, e.g. in liquid or gaseous form, where radiation exposure of the public is certain even if small, estimates of radiation **dose** are used in the process of setting authorised limits. Where the exposure is not certain to occur, as in the case of storage or disposal of solid waste, it is important to consider a measure of **risk** which refers to radiation dose and to the likelihood of the event which gives rise to it. For licensing and authorising such facilities, therefore, it is appropriate also to have risk criteria. The practical application of the ICRP principles to the protection of members of the general public is considered below.

Early Applications for Authorisation

58. There is nothing in the provisions of RSA 93 to suggest that justification is a necessary condition of authorisations granted under the Act. However, in the case of *R v Secretary of State for the Environment and others ex parte Greenpeace and Lancashire County Council* (the 'THORP case'), Mr Justice Potts interpreted Articles 6A and 13 of the current Euratom Basic Safety Standards Directive as requiring justification to be considered for the purpose of authorisation. He therefore ruled that in granting an authorisation there was a legal obligation to be satisfied that the practice had been justified.

59. Until now, applications made under RSA 93 to dispose of radioactive waste have generally been submitted only once the construction of a plant is nearing completion and authorisations have been granted shortly before it comes into operation. This enables the applicants to provide the regulators with the most accurate assessments of the discharges that are likely to occur. However, the authorisation of radioactive discharges depends not only on maximum discharges and limits of exposure, but also on the justification of the practice and its optimisation-i.e. the requirement that exposures should be kept as low as reasonably achievable (ALARA), economic and social factors being taken into account.

60. In the preliminary conclusions of the review, it was proposed that applicants might be encouraged to apply for an authorisation under RSA 93 at an early stage in a project so that justification could be considered fully, before major capital investment had taken place. If an authorisation was given, the developer could proceed with construction of the plant confident that its subsequent operation would be allowed, providing that extant safety and environmental standards were met. At the same time, justification would have been considered without the need to take account of any substantial sunk costs. Early applications for authorisation would also strengthen application of the ALARA principle by ensuring that waste disposal considerations were addressed at the design stage of the plant in a transparent manner. Until now, this has been achieved through contacts between the regulators under the memoranda of understanding between them (see paragraph 30). Staged procedures are already used by NII for licensing nuclear sites.

61. There was considerable support for this proposal in the responses to the consultation document. A number of local authorities believed that there should be greater public involvement in the authorisation process and that this should start at an early stage. However, environmental groups and other local authorities expressed reservations about the value of early authorisation. They argued that justification could not be fully considered at the planning stage because full details of a facility's operations and waste arisings might not be known then.

62. In the light of these responses, the Government proposes a flexible approach. For major projects, it is expected that developers will make early applications for disposal authorisations. This would be at about the same time that they seek full planning permission for the project, although it would be determined separately. The regulators would then be able to decide on authorisations before major commitments of money and effort had been made. If the regulators are content, the authorisations could be granted containing conditions which if met at specified stages should lead to approval to start operations in due course when the plant is built and commissioned. For some projects-e.g. a power station of the same design as one already built-the design may be well developed at the outset and, if the site has no unusual features, the authorisation may need no further amendment. In other cases, the design may evolve as the project progresses and decisions will be needed about whether to revise or vary the authorisation. If significant changes are made to the conditions in the authorisation, further public consultation will be undertaken and, in any event, application documents, authorisations and all relevant correspondence will be placed on the public record. Legislation is not necessary in order to introduce a system of early authorisations under RSA 93. The procedure will be available under existing legislation for any applicants who choose this route. They will not be required to do so, but the greater certainty it could provide will give applicants an incentive to apply early in the process in appropriate cases. Further guidance will be given in the revised and updated version of *Radioactive Substances Act 1960, a guide to the administration of the Act*.

Discharge of Air-Borne and Liquid Waste

Dose limits

63. Legal dose limits are set by the Euratom Basic Safety Standards Directive and IRR 85. The present statutory requirement, based on *Recommendations of the ICRP* published in 1977 (ICRP 26), is that members of the public should not be exposed to a dose of more than 5 mSv/y from all man-made sources of radioactivity other than from medical exposure. In 1990, ICRP 60 recommended instead a dose limit of 1 mSv/y for members of the public, although in special circumstances a higher dose could be allowed in a single year provided that the average over 5 years did not exceed 1 mSv/y. This is likely to be reflected in the revised Euratom Basic Safety Standards Directive, which is currently under negotiation, and will be implemented in UK law once the revised Directive has been adopted.

64. Lower limits are already applied in considering applications for authorisation under RSA 93. In its 1986 White Paper (Cmnd 9852), one of the objectives set by Government for radioactive waste management in the UK was that the dose to representative members of a critical group should not exceed 1 mSv in any one year, although doses of up to 5 mSv were permissible in some years provided that the total did not exceed 70 mSv over a lifetime. This was based on advice by the NRPB about ICRP's emerging findings.

65. In its *Board Statement on the 1990 Recommendations of ICRP*, published in 1993, the NRPB formally recommended that the dose to members of the public should be limited to 1 mSv in a year. The Government accepts this recommendation and, in the light of experience since 1986, considers that the flexibility to average exposure over more than one year is unnecessary. It further accepts that assessments of dose against this limit should include the effects of past discharges. A limit of 1 mSv/y compares with an average radiation dose to members of the UK population of 2.2 mSv/y from natural background radiation and an average of 0.3 mSv/y from medical exposure.

66. Since members of the public may be exposed to more than one source of radiation, the UK has operated-as part of its system of dose limitation-a target of 0.5 mSv/y in respect of assessed dose arising from radioactive waste discharges from any single nuclear site, irrespective of the size of that site or the number or type of nuclear installations on it. The discharge limits contained in authorisations reflect the totality of operations on the site. In setting limits on specified radionuclides or groups of radionuclides, estimates of dose used for comparison with the 0.5 mSv/y target assume that discharges are maintained at the limits for all radionuclides specified in the authorisations. Since this is unlikely to occur in practice, the doses delivered by the actual discharges from the site will be lower. The need for a dose target has been reviewed in the light of the ICRP's and NRPB's recommendations on dose constraint (see below).

Optimisation

67. In its *Board Statement on the 1990 Recommendations of ICRP*, the NRPB considered that there was a need for prospective constraints to assist in the optimisation of new facilities and recommended that the constraint on dose to members of the public for a single new source should not exceed 0.3 mSv/y. This represents about 10% of the average exposure from all forms of radiation, principally natural radiation which itself varies much more than 0.3 mSv/y across the country even when excluding radon exposures. The NRPB further considered that for most sources of public exposure, lower constraints were expected to be set for the optimisation of protection.

68. In the preliminary conclusions of the review, the Government said that it was minded to accept a constraint of 0.3 mSv/y for a **new** nuclear installation, but that this should complement rather than replace the primary dose limit of 1 mSv/y and the dose target of 0.5 mSv/y for a single site. While supporting a constraint of 0.3 mSv/y, a number of respondents argued that retaining both a constraint and a target would be confusing, and that the use of the term "target" could be misleading, in suggesting something to aim at rather than below. Others proposed that the constraint should be applied to all, and not just new, installations. Taking these points into consideration, the Government accepts that in the interests of clarity a maximum constraint value of 0.3 mSv/y should replace the target of 0.5 mSv/y when determining applications for discharge authorisations from a single new source, defined as "a facility, or group of facilities, which can be optimised as an integral whole in terms of radioactive waste disposals". The Government accepts the NRPB's advice that the value of the constraint should not exceed 0.3 mSv/y. The Environment Agencies should consider whether lower constraints should be defined for radioactive waste disposals from different applications, both nuclear and non-nuclear, for the purpose of authorisations under RSA 93.

69. The NRPB also said that, in general, it should be possible for **existing** facilities to be operated within a dose constraint of 0.3 mSv/y. However it recognised that in some cases a realistic assessment of doses might suggest that the facility could not be operated within this figure. In these cases it believed that the operator must demonstrate that the doses resulting from the continued operation of the facility were as low as reasonably achievable and within dose limits. The Government accepts this advice.

70. Under the restructuring of the nuclear industry following the nuclear review, ownership at a number of sites will be split between the company owning or operating the Magnox station and that owning or operating the AGR or PWR. (For example, Hinkley Point A, a Magnox station, will belong to a different company from Hinkley Point B, an AGR station.) To provide reassurance that standards are not being relaxed as a result of restructuring, it is proposed that an additional "site constraint" should be imposed, equivalent to the previous site target of 0.5 mSv/y. This will apply to the aggregate exposure from a number of sources with contiguous boundaries at a single location, irrespective of whether different sources on the site are owned or operated by the same or by different organisations.

Threshold for optimisation

71. The risks that people are prepared to accept and the degree to which risk is perceived vary considerably from individual to individual. The HSE has conducted a considerable amount of work on tolerable and acceptable levels of risk, culminating in the publication of *The Tolerability of Risk from Nuclear Power Stations* (TOR), originally issued in 1988 and updated in 1992. This recognised that there was an upper limit beyond which a risk would be intolerable, regardless of the benefit which society derived from the activity involved, and a lower level, below which the risk was negligible in comparison with the other risks we run in our daily lives and therefore broadly acceptable. The area in between was the ALARP or "tolerability" region, in which risk is tolerable only if it is as low as reasonably practicable (ALARP)-i.e. to reduce it further would involve disproportionately high cost.

72. The Government proposes to introduce a threshold, or lower bound for optimisation, for radioactive waste discharges similar to the area of broadly acceptable risk recognised in TOR-i.e. an annual risk of death of around one in a million (10^{-6}) or less. As the HSE points out, an annual risk of 10^{-6} is not altogether negligible; it is broadly the same as that of death from electrocution in the home (and is about a hundred times less than the annual average risk of dying in a traffic accident). But it is a level of risk which, provided there is a benefit to be gained and proper precautions are taken, does not generally worry us or cause us to alter our ordinary behaviour in any way.

73. Calculation of the dose: risk relationship is not straightforward, since it depends upon the characteristics of the exposed population. An annual risk of death of 10^{-6} would be broadly equivalent to an individual receiving a dose of 0.03 mSv/y over his or her lifetime. However, in introducing a lower bound of optimisation, the Government has decided to err on the side of caution and set a threshold of 0.02 mSv/y. This is consistent with the HSE's own practice. If exposures are calculated to be below 0.02 mSv/y, the regulators should not seek to secure further reductions in the exposure of members of the public,

provided they are satisfied that the operator is using the best practicable means to limit discharges. However, the regulators will still need to ensure that discharges are properly controlled and monitored and that the radiological assessments submitted to them by the operator are valid.

Disposal of Solid Waste

Safety criteria

74. Environmental safety criteria for radioactive waste repositories were set out by the authorising departments in the 1984 "Green Book", *Disposal Facilities on Land for Low and Intermediate-Level Radioactive Wastes: Principles for the Protection of the Human Environment*. In terms of **policy**, the Green Book is superseded by this White Paper. Its **regulatory** requirements are also out of date; in August last year, the regulators published for consultation a draft of the revised requirements in respect of RSA 93, called *Disposal Facilities on Land for Low and Intermediate Level Radioactive Wastes: Guidance on Requirements for Authorisation*.

75. Forming a judgement about the level of safety afforded by a disposal facility involves assessment of the means by which radionuclides in the wastes might move from the wastes through the immediate physical and chemical environment of the facility (and, in the case of deep disposal, through the surrounding host rocks) back to the human environment. For deep disposal facilities, this involves considering the potential behaviour of radionuclides over extended periods-in excess of thousands of years. The safety case provided by a repository developer or operator will need to address all these issues. The regulators will need to be satisfied that good engineering practice has been used in developing proposals for design, construction and operation of the facility and that good science has been adopted in investigating the suitability of the site, in supporting research and development work, in the interpretation of the resulting data and in the development of safety assessment methodologies.

76. The RWMAC/ACSNI Study Group (see paragraph 21) was asked to advise on the general criteria against which proposed disposal facilities should be assessed in order to provide for an appropriate level of public safety. In its report, published in March 1995, it confirmed that the safety of repositories should be addressed in terms of the risk of developing a fatal cancer, that the HSE's TOR approach (see paragraph 71) was appropriate for radioactive waste repositories, and that the same levels of risk should be used for waste repositories as for other nuclear plant-i.e. a tolerability region of between one in a hundred thousand per year (10^{-5} / y) and one in a million per year (10^{-6} / y). The Group recognised that the confidence limits placed on an estimate of risk arising from a repository would be wider than for other nuclear plant, particularly at long times in the future, but felt that this should be taken into account in the way the potential risks were estimated and assessed rather than by applying different criteria of acceptability. However, in the conclusions of the report the Group said that the public regarded an annual risk of 10^{-6} more as a maximum acceptable figure than as the lower boundary of a tolerability region, and in view of this, more consideration needed to be given to the intolerable or unacceptable risk level for waste repositories. This was regarded as unnecessary by two of the members, who submitted minority views.

77. The NRPB's *Board Statement on Radiological Protection Objectives for the Land-based Disposal of Solid Radioactive Wastes*, published in 1992, recommended that the individual risk to an average member of the critical group, attributable to a single disposal facility for solid radioactive waste, should not exceed a risk constraint of $10^{-5}/y$, and that if the risk did not exceed a design target of $10^{-6}/y$, then the optimisation requirement should be relaxed. The Board considered that the design target represented a level of individual risk which was widely regarded as acceptable, and which was rarely taken into account by individuals in making decisions about their actions. (The advice was intended to apply specifically to engineered, land-based, waste disposal facilities, where human access is from land, but the NRPB believes it may also be applied more generally in judging the acceptability of other disposal options.)

78. In the Government's view, the nature of the disposal system makes it less amenable to such quantified risk assessments than is the case, for example, for new nuclear reactors. Reliance cannot be placed exclusively on estimates of risk to determine whether a disposal facility (or a nuclear plant) is safe. While such calculations can *inform* a judgment about the safety of a facility, other technical factors, including ones of a more qualitative nature, will also need to be considered in arriving at the decision. The Government therefore confirms the preliminary conclusion of the review that it is inappropriate to rely on a specified risk limit or risk constraint as the criterion for determining the acceptability of a disposal facility. A risk target, however, should be used as an objective in the design process and this should be a risk of $10^{-6}/y$ of developing either a fatal cancer or a serious hereditary defect. Where the regulators are satisfied that best practicable means have been adopted by the operator to limit risks and the estimated risks to the public are below this target, then no further reductions in risk should be sought. However, if the estimated risk is above this target, then the regulators will need to be satisfied not only that an appropriate level of safety is assured, but also that any further improvements in safety could be achieved only at disproportionate cost.

79. The Government believes that the approach set out above will provide effective protection of the public and that it is consistent with the IAEA principle that predicted impacts on the health of future generations should not be greater than relevant levels of impact that are acceptable today. The precise approach which the regulators will adopt in relation to the various factors involved in assessing the safety case for a repository will be set out in their publication, *Disposal Facilities on Land for Low and Intermediate Level Radioactive Wastes: Guidance on Requirements for Authorisation*.

80. The Green Book embodied the principle that future generations should be afforded a level of protection equivalent to that provided today but did not specify the timescale over which estimates of risks would need to be made. The presumption was that the repository operator would, as part of the long-term safety case, justify the time-frames over which estimates of risk are made, reflecting site-specific circumstances and the status of safety assessment methodologies at the time. The NRPB recommends that site-specific calculations relating to the biosphere and human behaviour should not continue beyond about 10,000 years into the future and that, further than that, simple reference models of the biosphere and human behaviour should be used to calculate the risks—an approach which has been endorsed by the R WMAC/ ACSNI Study Group. The scientific basis for risk calculations in

the one million year time-frame was considered by the NRPB to be highly questionable and assessments beyond times of, at most, a few million years should concentrate on qualitative discussions.

81. In responses to the preliminary conclusions of the review, there was a widespread view that protection should be at least as great as today and that the timescales for assessment should be as long as realistically possible. The Government has accepted the proposition set out in the IAEA RADWASS Safety Fundamentals Document that radioactive waste should be managed in such a way that predicted impacts on the health of future generations will not be greater than relevant levels of impact that are acceptable today. It believes that the regulators should not prescribe any cut-off for the period over which risk should be assessed. This will depend on the nature of the site-specific safety case. However, they should provide guidance on the factors which applicants need to take into account in determining the nature of the safety case. This will be contained in their *Guidance on Requirements for Authorisation*.

82. In preparing their *Guidance*, the regulators should also consider the more detailed recommendations made by the R WMAC/ ACSNI Study Group about environmental safety criteria.

Site selection

83. The Government also invited the RWMAC/ACSNI Study Group to advise on the general approach that should be adopted in selecting potential repository sites for the disposal of LLW, ILW and HLW. The Government stressed that the approach should be practicable and cost-effective to implement, that it should provide reasonable reassurance that the selected sites would meet the requisite level of public safety and that the process should provide public confidence that a rational approach had been adopted to site selection.

84. In its report, the Study Group proposed a formal, multi-phase procedure, involving the following steps:

- (1) formal adoption of Government policy, following public consultation on issues such as storage versus disposal, the need for a disposal facility, the proposed disposal concept and the role of engineered barriers;
- (2) a desk study by the developer, using quantitative indices to produce a short-list of 10 to 12 areas, the results of which should be published, together with the locations of the short-listed areas, preliminary environmental and radiological assessments and preliminary safety reports estimating the risks and costs of a repository in each area;
- (3) extensive public consultation and evaluation of the social and economic impacts of a repository in each area, overseen by an independent commission with input from local authorities, and with funding provided, after which the commission would recommend to Government about three preferred sites for further site characterisation;
- (4) borehole and site investigations at the three preferred sites, involving--if necessary--small planning inquiries for the investigatory work. The developer would then publish the results of the investigations and indicate his preferred site;

- (5) local public hearings by the commission, which would evaluate the results of the site investigations and recommend a preferred site to Government, who would then decide on one preferred site and on the need for further site investigations, possibly including approval to construct a rock characterisation facility;
- (6) detailed characterisation of one preferred site. This phase should not be rushed; there would be provision for regular publication of results, adequate peer review, reviews by the independent commission and discussions at a local liaison committee. The site could be discarded at any stage;
- (7) consideration of the planning application and interim safety case for construction of the repository at a planning inquiry. At the same time, the regulators would consider the outline application for authorisation and licensing;
- (8) repository construction with continuing review by the independent commission;
- (9) publication of the final safety case to support applications for authorisation and licensing; granting of necessary licences and authorisations; commissioning of the repository;
- (10) operation of the repository;
- (11) repository closure and monitoring.

85. The two members of the Study Group who submitted minority views questioned the practicability of developing the quantitative indices envisaged in the second of these stages, not only because of uncertainty about the geological data, but also because the complexity involved in the interactions between such factors as groundwater return times, the water flow rate, the solubility of the radionuclides in the water and the sorption of the radionuclides onto surfaces in contact with the groundwater. Even if such indices were developed, they felt that using them to rank areas in a provisional order of safety would be inconsistent with the TOR approach, which allows acceptable risks (see paragraph 71). They also considered that 10 or 12 sites would be too many, that 3 or 4 would be more appropriate, and that cost should be considered as a factor, including transport and waste location. Finally, they had reservations about the cost and practicality of an independent commission, especially in the later stages, when its interaction with the established procedures of the public inquiry and the regulators was unclear.

86. The Government welcomes the contribution that the RWMAC/ ACSNI report has made to the debate on site selection of radioactive waste repositories, but has reservations about some of the detailed proposals made. For instance, like the members who submitted minority views, it doubts the justification of excluding issues such as the location and transport of waste from the selection of the initial short-list of sites, and questions the practicability of identifying as many as 10 or 12 sites for an initial round of public consultation. It believes that considerations of cost cannot be ignored in the site selection process. It is concerned, too, about the "corporatist" approach envisaged by the Study Group. Not only does this diminish the responsibility of the waste producers, but it also risks creating confusion between the roles of the local authorities and regulators and that of the proposed commission. It is difficult to see how the Secretary of State could become involved to the extent envisaged without being considered to have already "fettered his judgement" at the time of the final planning and regulatory decisions.

87. Nevertheless, the Government believes that the Study Group has identified issues of genuine concern regarding the need for transparency of decision making and for public reassurance. It proposes to consider how in future it might meet such concerns—for instance, by setting out guidelines for the developers of repositories about the need for transparency in site selection, including the publication of research results, and the specific milestones to be covered in this process. Such a process could include public consultation on a certain number of sites. The opportunity to develop an approach is provided by the need to construct a repository for HLW, where the process of site selection has not yet begun (see paragraph 93). In the case of ILW, the process of site selection is already well under way, and the implications for this of the Study Group's report are considered separately below (see paragraphs 106-110).

CHAPTERS

SPECIFIC POLICIES

Spent Fuel Management

88. Spent oxide fuel, from AGR or PWR reactors, can either be reprocessed relatively soon after unloading from the reactor to extract reusable uranium and plutonium, or held in long-term storage for direct disposal or reprocessing at some time in the future. In the preliminary conclusions of the review, the Government reaffirmed its policy that the question of whether to reprocess, and if so when, should be a matter for the commercial judgement of the owner of the spent fuel, subject to meeting the necessary regulatory requirements. It also accepted that, in accordance with IAEA and Euratom definitions, spent fuel should not be categorised as waste, while the option of reprocessing it remained open and a future use for the fuel could be foreseen.

89. However, at the request of the Secretary of State for Scotland, the review considered a particular issue concerning the siting of dry stores for spent fuel, which had been raised at a public inquiry into an application made by SNL for such a store. SNL applied under Section 36 of the Electricity Act 1989 for consent to build a dry store for spent fuel at its AGR power station at Torness in East Lothian. The Reporter (Inspector) at the subsequent public inquiry concluded that SNL's proposal represented a sound engineering solution to the storage, monitoring and retrieval of spent fuel. However, he recommended that before any consent was issued for a dry store at Torness, the Government should consider the need for a national strategy on the siting of dry stores, with one or more stores on a single site (a single-store strategy) or one or more stores on a number of sites (a multi-store strategy). The Secretary of State accepted that recommendation.

90. In their responses to the review, many local authorities recognised the need for storage. They argued, however, that this should be seen only as a temporary solution and stores should not be given permission to remain open indefinitely. They echoed the Reporter's view that consideration should be given to the need for a national strategy on dry stores. The Secretary of State for the Environment announced on 21 February 1995 that, following consideration of these responses, an appraisal of the implications of a multi-store strategy compared with the potential benefits of a single-store strategy had been carried out with particular regard to the question of safety. That appraisal did not point to conclusive benefits deriving from a central store or stores compared with one or more stores sited beside nuclear generating stations. The Government therefore confirmed its preliminary conclusion that decisions on the siting of dry stores for spent nuclear fuel should be a matter for the commercial judgement of the operators, subject to the necessary planning and regulatory requirements being satisfied.

High-Level Waste

91. HLW is the heat-generating waste which remains from the reprocessing of spent nuclear fuel. Although the amount is relatively small in terms of volume, it contains over 95% of the total activity of wastes identified in the *Inventory of Radioactive Waste Arisings in the UK*. BNFL is in the process of

converting stored, liquid waste into glass cylinders to make it safer and easier to manage. The Government's policy has been that the vitrified waste should be stored for at least 50 years to allow for the short-lived radionuclides to decay and heat generation to reduce, without any decisions being taken about how the waste should be managed after that period. Although the Government reaffirms its policy-widely supported in the responses to the consultation document-that the waste should be stored to allow for cooling, it believes that it should now take more positive steps to consider the ultimate destination of the waste.

92. There has been considerable international research into the disposal of HLW to geological formations on land, and the Government's view is that this is the favoured option for the long term, once the waste has been allowed to cool. Spent fuel is subject to similar heat decay as HLW and should therefore remain stored for similar periods, if it is not reprocessed. The direct disposal of spent fuel to an underground repository presents no fundamentally different technical problems from disposal of vitrified HLW, except that the design will need to take account of the risk of a criticality incident.

93. The programme of geological studies relating to the disposal of HLW deep underground, carried out for DOE by the UKAEA, the Institute of Geological Sciences and others, was discontinued in 1981, although the UK has continued to participate in similar international research. As proposed in the preliminary conclusions of the review, the Government is putting in hand steps to develop and implement the necessary research strategy for the UK. Further research was widely encouraged in the responses to the review, with respondents saying that no options should be closed, and that particular care should be taken to convince the public that safety considerations would be fully addressed. The DOE will shortly be initiating work on a research strategy for the disposal of HLW and spent fuel. The object will be to produce a UK national statement of future intent in this area, setting out the decisions to be taken and the milestones to be achieved in developing an HLW repository, and the supporting research that will be necessary to achieve this. The strategy will be subject to periodic review and updating. Although the statement is a matter for the Government, its implementation will, in accordance with the polluter pays principle, fall to the owners of the waste; they and the regulators will therefore be involved closely in its formulation. The strategy will be able to draw on international research and on the results of research in the UK into the deep geological disposal of ILW. However, it will be carried forward as a separate project. In selecting a site for the disposal of HLW, the Government will take into account the recommendations of the RWMAC/ACSNI Study Group in the way set out in paragraph 87.

Partitioning and Transmutation

94. An alternative means which has been proposed for dealing with some of the waste containing actinides is to separate ("partition") certain long-lived and toxic radionuclides from others and "transmute" them, using particle accelerators or reactors, into radionuclides with shorter half-lives. These would decay faster and present less of a long-term hazard. The UK carried out various studies of transmutation in the late 1970s and early 1980s, although the results were not encouraging. Research into partitioning and transmutation is currently being carried out in the United States, France and Japan, and as part

of the European Commission's research programme. The UK Government will continue to watch with interest the results of work in this area and will initiate desk studies, but-in common with the majority of those responding to the review-it believes that separate research is unnecessary and has no plans to initiate further development of its own.

The Nirex Repository

Timing of the repository

95. The review's preliminary conclusions said that the Government continued to favour a policy of disposal rather than indefinite storage for ILW and considered it appropriate that Nirex should continue with its site investigation programme; that final decisions on the repository itself must, however, depend on the establishment of a sound safety case, the granting of planning consent and compliance with regulatory requirements, as well as costs; that no fixed Government deadline should be set for the completion of this process; and that in the meantime, the evidence as to safety and technology should be kept under review, so that all can be satisfied that the eventual arrangements are the best means by which this generation can fulfil its obligations.

96. There was little support among the responses for a policy of permanent storage as an alternative to disposal. Such a policy would hardly be credible, given the timescales over which the waste would need to be kept safe. Differences did emerge, however, about the length of time for which the waste should remain stored and about the technical difficulty of presenting a convincing safety case for the repository. The crucial question in addressing these issues was how the concept of sustainable development should be applied in this case. It involves an assessment of both quantifiable and non-quantifiable factors.

97. The consultation document included an assessment of the quantifiable factors. This showed a £100 million benefit from delaying the repository by a period of 50 years and discounting the costs over that period. However, more recent information from Nirex, reflecting both changes in the balance of sunk and avoidable costs due to the passage of time since the original study and reductions in the estimated cost of repository development, suggests that the expected saving from 50 years' delay would be less than £100 million and could be close to zero. In the Government's view, there is little difference in financial terms between proceeding with the repository now or delaying by 50 years, and the decision must therefore rest on wider considerations of policy.

98. As the consultation document acknowledged, there is room for debate about the various non-quantifiable factors. One view is that the options available to future generations should not be foreclosed by irreversible action now, but that financial provision should be made so that they can choose their own action (although this approach would not rule out the continuation of exploratory work). This view was supported in responses by some environmental groups, who argued that current scientific knowledge and understanding concerning the processes that would act on radionuclides in the repository were insufficient to allow reliable quantification of the radiological hazard, and that the safety assessment research that had so far been reported by Nirex did not provide a robust guarantee that future generations would not need to intervene to protect their safety. In their view, sustainability and the precautionary principle require that interim storage is developed in parallel

with continued and rigorous long-term research and financial provisioning, so that the next generation can decide whether knowledge has increased sufficiently for a more permanent solution to be adopted or whether storage should be continued.

99. On the other hand, the more widely held view, domestically and internationally, has been that our responsibilities towards future generations are best discharged by early disposal, with the intention that no action should be required of them; that is one of the reasons underpinning the Government's present policy that Nirex should come forward with a well-founded proposal for an appropriate repository. In consultation responses, this view was supported not only by the nuclear industry, but also by the HSC and RWMAC. RWMAC said that it remained of the view that safe, final disposal routes for radioactive wastes could be established in the UK and supported the policy that Nirex should come forward with a well-founded proposal on as early a timescale as possible. However, it also welcomed the proposal that completion of the repository should not be the subject of arbitrary deadlines. The majority of local authorities supported disposal, although many argued that this should still be in a monitorable and retrievable form, with any repository engineered to allow recovery in the future. There was general agreement that there should be no deadline for decisions.

100. Given the length of time needed to develop the repository and the period over which it will remain operational, action how to pursue early deep disposal in fact leaves options open until at least the latter half of the next century, since there would be no significant foreclosure of options until the repository was finally closed. This is likely to be about 50 years after it comes into operation, which itself is unlikely to be achieved for at least 15 years. The option of retrieval would be relatively straightforward during the operational phase of the repository, while it was being filled with waste, and would still be available following closure. The alkalinity of the backfill grout, which is an important element in Nirex's approach, would enhance the life of stainless steel drums and boxes containing most of the waste, so aiding retrieval as well as providing an appropriate chemical environment for long-term safety. Nirex will, however, need to show that the continued safety of future generations does not depend on monitoring, surveillance, preventative or remedial actions after closure of the facility.

101. Having considered all these issues and the consultation responses, the Government continues to favour a policy of deep disposal rather than indefinite storage for ILW and considers it appropriate that Nirex should continue with its programme to identify a suitable site. It has decided that there would be no advantage to be gained from delaying the development of the repository itself, and that once a suitable site has been found, it should be constructed as soon as reasonably practicable. The precise timetable will depend on the granting of planning consent and compliance with regulatory requirements, including the establishment of a sound safety case.

The Royal Society Study

102. In the report of its study for Nirex, *Disposal of Radioactive Wastes in Deep Repositories*, published in November 1994, the Royal Society acknowledged the quality of work undertaken by the company's scientific programme, which commanded high respect from others engaged in parallel work world-wide. It identified a number of areas where scientific understanding was not

yet sufficiently advanced to support the construction of a detailed post-closure safety performance assessment and which were priorities for further work. These included certain issues concerning groundwater flow, gas generation and migration, chemical containment and the modelling of future scenarios. The Royal Society regarded the Rock Characterisation Facility (RCF) as an essential component of Nirex's programme, and recommended that it should be operated for a long enough period to contribute substantially to detailed post-closure safety performance assessments.

103. The Royal Society emphasised that the timetable for the **Nirex** programme must respect the stage of development of the science and suggested that a more robust strategy could be to construct an initial part of the repository for LLW and short-lived ILW within the zone of rock that Nirex is presently investigating at Sellafield. A more extended programme for the disposal of long-lived wastes could then be followed, possibly involving a second phase of a repository sited deeper and to the west of the presently defined potential repository zone.

104. **Nirex** has welcomed the Royal Society's report and noted that the scientific issues identified are being addressed in the company's scientific programme, which is timetabled flexibly to provide time to resolve outstanding matters. Nirex noted that, taking account of costs, its continuing intention is to develop a single repository to accommodate **all** classes of ILW (and any LLW) requiring deep disposal. The company would in any event foresee significant practical difficulties, and important safety issues, arising in the construction and operation of a second phase of the repository at Sellafield at the depths implied by the Royal Society's suggestion.

Rock Characterisation Facility

105. A public inquiry is due to be held later this year into Cumbria County Council's refusal of planning permission for the construction by Nirex of an RCF at Longlands Farm near Sellafield to test further the geology and hydrogeology of the site. The Secretary of State for the Environment has outlined the matters about which he particularly wishes to be informed to help reach his decision on the appeal. These do not include the merits of national policy on the deep disposal of ILW. Policy on deep disposal of ILW has already been the subject of wide consultation in the course of the present review and is now restated in this document. This policy may be a material consideration at a local planning inquiry, but it would not be within the inquiry's scope to seek to use it as a focus to reopen general debate of the national policy itself

Site for the Nirex repository

106. At the Government's request, the R WMAC/ ACSNI Study Group considered how the site selection procedures it has recommended would apply to projects, such as Nirex's, which were already in train. In the case of site selection decisions already having been made using different procedures, it proposed a careful, conscious matching of the process actually adopted for site selection, characterisation and assessment against the phases set out in paragraph 84. Action should be taken to remedy any inadequacies in the approach already adopted. This, it considered, would enhance public confidence. Should the current proposals have reached the stage at which a public inquiry was imminent, a wide-ranging public inquiry might be a preferable way forward, with the independent commission being established in the light of the outcome of the inquiry.

107. As noted above (paragraph 86), the Government has reservations about the site selection procedure recommended by the Study Group. It would not, therefore, be right to assess Nirex's procedure against it in specific detail, although the review has considered whether the company may be considered to have adopted a reasonable approach in its investigations so far.

108. The present site selection programme began in 1987, when the Government accepted Nirex's conclusion that it would be preferable to develop a multi-purpose deep site for LLW and ILW rather than proceed with the investigations for a near-surface facility. In 1987, Nirex published a public consultation document, *The Way Forward*. Some 30% of the British mainland was initially considered to offer geological and hydrogeological potential for repository development. By 1989, Nirex had prepared a short-list of 12 sites. Following advice from **RWMAC**, the Government accepted Nirex's recommendation that a deep repository should be developed under the land rather than the sea and that the next steps should be to carry out detailed geological studies in the vicinity of Sellafield and Dounreay. In arriving at these recommendations, Nirex had concluded that it would be best to explore first those sites where there was some measure of local support for civil nuclear activities. Further evaluation of the geology of those two areas would enable it to decide on their suitability for construction of a repository, or whether it would be necessary to evaluate other sites. The Government made clear that it was for Nirex to obtain the necessary planning permissions for its exploratory work through the normal procedures.

109. In 1991, Nirex announced that results of initial borehole drilling and other investigations at the two sites suggested that either could potentially support the safety case necessary for a deep disposal site, but that it proposed to concentrate its investigations on Sellafield because of the advantages it offered in terms of transport, with the majority of ILW for disposal arising from BNFL's operations at Sellafield. The RCF would form part of those investigations.

110. The matters about which the Secretary of State has said he specifically wishes to be informed by the public inquiry into the RCF concern the local impact of the facility's construction. The Government has already promised to hold a full public inquiry into an application for the repository itself, wherever it may be situated. The Government sees no reason to depart from this procedure. In view of the importance which the R WMAC/ ACSNI report attached to transparency of decision making, Nirex has indicated to the Government that it is formulating proposals to enhance and put onto a regular cycle the publication of information about its scientific work and development of the repository programme. The Government welcomes this initiative and will seek the advice of RWMAC on the company's proposals.

Interim Storage of Intermediate and Low-Level Waste

111. According to Nirex's latest estimates, the earliest that a repository for ILW would be available to receive waste would be 2010. Given this and the Government's view that no fixed deadline should be placed on the completion of Nirex's safety case for the repository, these wastes will have to remain in interim storage for some time to come, as will the **LLW** which is also destined for the repository because its comparatively high alpha-emitting content makes it inappropriate for disposal at Drigg. As a result, the

preliminary conclusions of the review suggested that the presumption in the 1984 *National Strategy* against the conditioning of stored waste needed to be modified. Until now, the policy has been that until a waste disposal facility becomes available, waste should remain in an untreated form for as long as it is safe to do so, although treatment may be justifiable in order to improve the safety of storage. This reflects the danger that a particular form of treatment may prove incompatible with the groundwater chemistry of the repository site that is eventually chosen, leading to the effective foreclosure of disposal options for the wastes that have been conditioned.

112. There was considerable support for the proposal that the presumption against treatment of wastes should be relaxed, although it was generally felt by those outside the nuclear industry that this should be for reasons of safety rather than to gain financial savings. Environmental groups also suggested that if early treatment were to foreclose future options, an assessment of alternatives should be carried out.

113. The Government believes that where the demands of safety are overriding, waste must be treated as necessary to improve storage conditions. In addition, where early treatment of waste will secure worthwhile safety benefits, or worthwhile economic benefits without prejudicing safety, the general presumption against action which might foreclose future waste management options may be relaxed. The relevant costs and commercial risks must be borne by the owner of the waste. Decisions by operators and regulators will need to have regard to all relevant factors, including the following:

- (a) the need for continuing safe storage of the waste, treated and/or contained as necessary;
- (b) the benefits of placing the waste in a chemically and physically stable form, so that safety may be achieved by passive means;
- (c) the risk that treated waste will be incompatible with future disposal requirements and the practicability of re-working treated waste in the future, for disposal or for a period of further storage, should this be necessary;
- (d) the state of storage facilities, including the benefits which would be derived from refurbishment or upgrading;
- (e) the need to minimise waste degeneration, secondary waste arisings and releases to the environment;
- (f) the need to minimise dependence on active safety systems, maintenance, monitoring and human intervention;
- (g) the retrievability of the waste for disposal.

Controlled Burial

114. Authorisations may be issued under RSA 93 for the burial of some LLW at suitable landfill sites, used mainly for other kinds of waste, or—more rarely—at the site where the waste is produced. In either case, the ground must have good containment characteristics. This form of disposal, known as "controlled burial", is used by non-nuclear industries which process raw materials containing natural radioactivity, and by major hospitals and universities for their relatively more active waste streams, as well as by BNFL for waste from its uranium enrichment and fuel fabrication plants and for lightly contaminated excavation spoil at its Sellafield site. Usually, a site receives waste for controlled burial from no more than one or two sources.

115. In order to relieve needless pressure on the disposal capacity of BNFL's LLW disposal facility at Drigg, the consultation document proposed that there would be advantage in encouraging waste producers to make greater use of controlled burial. This would not require new legislation, nor would it involve deregulation of the nuclear industry, since the route is already open to it and disposals would continue to be strictly controlled by the regulators.

116. The proposal was welcomed by the nuclear industry and supported by RWMAC, who suggested that legislation be introduced to require landfill operators to accept waste for controlled burial. The NRPB also considered that the proposal was reasonable, provided that there were satisfactory safety checks. However, local authorities and environmental groups were opposed, many arguing that existing controls and involvement of local authorities were not strong enough, and that either there should be no extension of the route, or that if the Government wished to proceed, there should be clearer proposals, firmer controls and public agreement. Opposition to controlled burial was also expressed in a large number of letters from members of the public.

117. There are sound economic and radiological grounds for encouraging greater use of controlled burial. However, the Government recognises the genuine anxieties that its proposal has aroused among local residents. For that reason, it has decided not to encourage greater use of controlled burial by the nuclear industry. Nevertheless, controlled burial should continue to be available as a disposal route, particularly for "small users"--such as hospitals, universities, research laboratories and non-nuclear industries--subject to the agreement of the site operators and to the necessary regulatory requirements being met.

118. At present, the regulators (HMIP, HMIPI and ARCI) issue a single authorisation to the disposer of the waste, attaching conditions about the site to which it must be taken and the way in which it must be buried. The Government has considered whether additional controls should also be applied to the landfill site operators either by means of authorisations under RSA 93, or through the waste management licensing system. However, it has concluded that it is unnecessary to duplicate the authorisation procedure in this way, especially since in future the Environment Agencies will be responsible for issuing both disposal authorisations and waste management licences. In considering an application for controlled burial, the regulators assess not only the type and activity of the waste but also the containment characteristics of the site to which it is to be sent. If an authorisation is granted, the regulators also arrange for leachate from the sites to be monitored for radioactivity and the results of this are published. Nevertheless, the Government accepts that at present it can be difficult to identify from public registers which landfill sites receive such waste and it will invite the Environment Agencies and ARCI to put forward proposals for making such information more transparent.

119. Section 18 of RSA 93 requires that if waste is authorised by the regulators for controlled burial at "a place provided by a local authority as a place for the deposit of refuse", the local authority has a duty to accept it. The Government has no plans to extend this provision to private site operators or local authority waste disposal companies. Section 18 also requires HMIP, HMIPI and ARCI to consult public or local authorities before granting authorisations which will require them to take special precautions. There is no

similar requirements to consult local authorities when disposal is proposed at private landfills, although in practice they are consulted, as are the landfill operators. The Government will issue formal guidance to the Environment Agencies and ARCI on the need to consult local authorities about authorisations for controlled burial.

Decommissioning

120. The consultation document recognised the importance of decommissioning in relation to future waste management policy, noting that increasing amounts of waste will arise in future from the decommissioning of nuclear power stations and other nuclear facilities. Responses to the consultation document reflected a high level of interest in the subject. Two aspects are of particular importance—decommissioning strategies and financial provision.

Decommissioning strategies

121. The UK's current strategy for decommissioning nuclear power stations is that it should be done in three stages—defuelling immediately on shutdown; dismantling buildings external to the reactor shield 5-10 years later; and demolishing the reactor itself 100 years after shutdown. As an alternative to this, NE and SNL have proposed a "safestore" strategy for their gas-cooled reactors (Magnox and AGRs). The first stage would be unchanged. The next stage would be to remove most inactive buildings, but prepare the active buildings for an extended period of care and maintenance. Around 30 years after shut-down, further work would be undertaken to secure the buildings by replacing exterior cladding with high-integrity materials and infilling unnecessary openings, such as doors and windows, to leave a structure which would require essentially no maintenance over a further period of around 100 years (safestore). Routine surveillance would be undertaken during that period, and at the end of it the buildings and their contents, including the reactor core, would be completely demolished. A variant which might be appropriate would be to proceed with the safestore stage without any delay.

122. Arguments in favour of the safestore proposal are that it would allow more time for radioactive decay and for further advances in technology, and that it would be more cost-effective. Some of those responding to the consultation document also considered that a stronger commitment to safestore would strengthen the UK's position in advising on and assisting with decommissioning internationally.

123. Other respondents, however, argued against safestore and in favour of decommissioning as early as possible on the grounds that this approach would be more in line with the concept of sustainable development. To defer action by implementing a strategy of safestore would leave the physical work of decommissioning to future generations. Making financial provision over a period of 100-135 years would also prevent future generations from taking earlier action if they wished, unless they were prepared to bear additional costs. Deferral ran the risk that plant would deteriorate, leading to leakage and hence more widespread radioactivity. Early decommissioning would be preferable and would enable use to be made of the knowledge and experience of those who had worked on particular sites.

124. The Government believes that, in general, the process of decommissioning nuclear plants should be undertaken as soon as it is reasonably practicable to do so, taking account of all relevant factors. In future, it will ask all nuclear operators to draw up strategies for decommissioning their redundant plant. These will need to include justification of the timetables proposed and demonstration of the adequacy of the financial provision being made to implement the strategies.

125. As with all other operations on nuclear sites, decommissioning will be undertaken in accordance with conditions attached to the nuclear site licence and subject to HSE/NII controls, in order to ensure the safety of the site, workers and the public. Disposal of wastes arising during decommissioning will be subject to regulation under RSA 93. In considering proposals for decommissioning nuclear plant put forward by the operators, HSE/NII will assess them to ensure that the proposals assure the safety of the site at all times, and that the hazards presented by the plant (or site in the case of nuclear power stations) are reduced in a systematic and progressive way. The expected outcome of such consideration will be a plan to remove and/or immobilise the most active and potentially mobile radioactivity on a relatively short timescale, with further actions following at appropriate intervals consistent with the hazards they seek to address. The rate at which the work proceeds will be determined by the potential hazards posed to the public, workers and the environment (recognising the benefits obtainable from radioactive decay), the availability of disposal routes for the wastes and--subject to ensuring public safety--the financial implications of proceeding on different timescales.

126. Given that regulatory approval for decommissioning is required on a case-by-case basis, the Government reaffirms the preliminary conclusions of the review that it would be unwise at present for the operators of nuclear power stations to take steps which would foreclose technically or economically the option of completing Stages II and III on an earlier timescale should that be required, and that they should recognise, when provisioning, the potential uncertainties regarding the timing of Stage II and Stage III decommissioning. Nevertheless, the Government also confirms its preliminary conclusion that there are a number of potentially feasible and acceptable decommissioning strategies for nuclear power stations available to the operator, including the safestore strategy proposed by NE and SNL. To ensure that operators' decommissioning strategies remain soundly based as circumstances change, they will be reviewed quinquennially by HSE, who will consult the Environment Agencies.

127. The Government recognises that, in addition to nuclear power stations, a variety of other nuclear facilities are in the process of being decommissioned, or are to be decommissioned in the future. As with power stations, decisions on decommissioning these facilities should be taken on a case-by-case basis and the same general principles apply in respect of timing. Proposals for dealing with such facilities will need to be included in the operators' decommissioning strategies.

128. For decommissioned nuclear-powered submarines, MOD's current policy is that they should be stored afloat in safe and secure facilities at the naval bases at Devonport and Rosyth. HMS Dreadnought has been stored at Rosyth since 1982; six others have been similarly stored, the first having been taken out of service in 1991. Two more nuclear-powered submarines have been withdrawn from service and will undergo their decommissioning process in due course. MOD has based its long-term plans for the disposal of radioactive

wastes arising from the reactor compartments on the availability of the Nirex repository in about 2010. However, this policy is kept under review.

Financial provision

129. The consultation document recognised the importance of ensuring that appropriate financial arrangements are put in place to cover the costs of decommissioning civil nuclear plant, and noted that the nuclear companies already make full provision for this in their accounts. At the same time, the document noted that considerable uncertainties exist about the likely costs of decommissioning and about whether current provisioning arrangements would be sufficient to meet future requirements. In conclusion, however, the Government said that it should continue to be for the industry to make its own provisioning arrangements.

130. In responses to the document, the nuclear industry welcomed this approach, and reiterated its commitment to structured provisioning. Other respondents, however, argued in favour of the introduction of external, segregated funds, and of ensuring that these were built up during the operation of a power station to allow decommissioning to begin as soon as possible. These funds should be managed by independent trustees and should be invested in safe securities such as Government bonds rather than being reinvested in the nuclear industry. Some argued that a larger share of the estimated costs should be set aside in the early years of provisioning to allow for earlier than expected decommissioning.

131. The Government has given careful consideration to the question of provisioning, in the light both of the responses to the review and of the conclusions of the nuclear review regarding privatisation. The Government believes that it is right that, for those parts of the industry which are privatised, segregated funds for decommissioning should be established. In addition, the Government will examine what improvements can be made in the way in which the unprivatised sections of the industry report on their progress towards decommissioning and on their provisioning policies. The periodic reviews by the regulators (see paragraph 126) should provide the right focus for improved reporting of this kind.

Contaminated Land

132. Last year, the DOE and Welsh Office carried out a review of contaminated land and liabilities, the results of which were published in a policy paper, *Framework for Contaminated Land*, in November 1994. (A similar but separate review was conducted by the Scottish Office.) In order to make the powers to deal with contaminated land clearer and more consistent, the Environment Bill contains a new contaminated land regime, which provides for the definition, inspection and remediation of such land. Regulation will primarily be the responsibility of local authorities, but the Environment Agencies will have responsibility for designated categories of special sites, and will provide advice in respect of other sites.

133. Although the provisions were not developed to deal specifically with land contaminated by radioactivity, such as the sites of old luminising works, they provide a suitable overall framework for this purpose. However, there are a number of issues which need to be addressed, such as the appropriate enforcing authorities and the levels at which radioactivity-which is also a

natural phenomenon-should be regarded as a contaminant. To allow time for these to be examined in greater detail, the Government has not included radioactive contamination in the regime which appears on the face of the Bill. Instead, the Bill provides the Secretary of State with a power to make regulations applying these provisions to radioactive contamination, with such modifications as he considers appropriate. The Government will consult fully on the draft regulations. Subject to Parliament's approval, it is intended that they should come into effect by 1 October 1996.

Waste Substitution

134. Since 1976, all BNFL's contracts for reprocessing spent fuel from foreign companies have included options for the return of operational wastes to the country of origin. (Operational wastes are those which arise during reprocessing, but not from the eventual decommissioning of the reprocessing plant.) Government policy is that the options should be exercised and that the wastes should be returned. It is already planned to return all HLW as soon as practicable after vitrification. However, in respect of some of the less radioactive wastes the Government has said, as long ago as 1986, that there may be other options worthy of study-for example, whether it would be sensible to substitute an equivalent quantity, in radiological terms, of higher level wastes.

135. In 1992, BNFL proposed that it be allowed to offer to its overseas customers the substitution of an additional amount of HLW equivalent in radiological terms to the ILW and LLW, which would remain in the UK. Rather than returning all the operational waste, BNFL would return only HLW. The LLW would be disposed of at BNFL's shallow land disposal facility at Drigg in Cumbria as it arose. The ILW would be held in store, along with the much larger volumes of ILW generated from reprocessing UK Magnox and oxide fuels, pending the development of the Nirex underground disposal facility in the early part of the next century. Substitution would reduce significantly the volume of wastes to be returned and hence the number of waste shipments to overseas countries, notably Japan which is BNFL's largest overseas customer. The consequent savings in transport costs would improve the cost-effectiveness of BNFL's operations. BNFL has made it clear that it would not wish to proceed with substitution if there were environmental detriment to the UK. The Government fully endorses this condition; and accordingly, the views of R WMAC were sought on the technical basis of BNFL's proposals.

136. In its first report, in October 1992, R WMAC concluded that it was too early to reach a decision about the likely radiological and environmental impact on the UK, because: BNFL had not agreed with its overseas customers the technical basis of substitution; the substitution scenario proposed by BNFL depended on the Nirex repository being available by 2005 and was based on a best case groundwater return time; and there were unresolved issues regarding the mobility of certain radionuclides from a deep repository. In October 1993, the Department requested further advice from R WMAC on whether BNFL's proposals were likely to be broadly neutral environmentally and specifically on the "integrated toxic potential" (ITP) system proposed by BNFL for establishing the radiological equivalence between different waste categories. (The toxic potential is the volume of water into which 1m³ of the waste

would have to be dispersed for the water to remain safe to drink. Since the toxicity of the wastes varies over time, the toxic potential has to be integrated over a defined period.) RWMAC's response to this request was appended to the consultation document on the review.

137. RWMAC advised that none of the systems available could be considered ideal, that ITP was no more than a simple contractual yardstick which would enable BNFL to set a level for additional HLW return to its overseas customers, but within its agreed boundaries, ITP provided a reasonable approximation for establishing radiological neutrality. The alternative would be a more rigorous environmental appraisal resulting in every overseas contract being the subject of a lengthy optimisation study. In conclusion, RWMAC supported the use of ITP, despite its limitations, as a means of quantifying substitution, and agreed that broad environmental neutrality in terms of radiological impact can be expected for substitution based on ITP. Furthermore, it considered that if BNFL were given the option of offering substitution to its overseas customers, there was a case for a small, additional quantum of vitrified waste to be returned over and above that calculated on radiological grounds alone. This was to compensate for some minor, negative non-radiological environmental consequences of introducing substitution.

138. RWMAC's conclusions have been welcomed by the nuclear industry and some local authorities in their responses to the review. However, a number of other local authorities and environmental groups were opposed to substitution, arguing that all nations should achieve self-sufficiency in managing their wastes, that the UK should not agree to take extra quantities of wastes, so becoming a "nuclear dustbin", and that countries prepared to accept substitution should have the necessary facilities for dealing with the returned wastes. Nirex said that the flexibility of the repository design should allow the extra volume of ILW for disposal to be accommodated without special problems. However, like RWMAC, it noted that the precise value for any incremental addition of radionuclides to the groundwater would be obtainable only when the siting and design of the repository had been finalised.

139. As is clear from paragraphs 142-147 of the White Paper, the Government believes in the general principle of self-sufficiency in radioactive waste, and would not wish to take any step which would discourage other countries from providing their own waste facilities or which would create a waste disposal problem in the UK. Any approach to substitution needs to recognise these principles as well as meeting the criterion of no overall detriment. The Government notes that while substitution would result in additional volumes of both LLW and ILW being disposed of in the UK, there would be no increase in the amount of radioactivity, since the radioactive content of the additional wastes to be returned would be no less than that in the wastes remaining in the UK. Furthermore, these wastes represent only a small proportion of the volumes of wastes of domestic origin and do not create any novel waste management problems. Substitution is therefore capable of meeting the above criteria provided it is subject to appropriate and properly enforced conditions.

140. On the basis of RWMAC's advice, the Government recognises that BNFL's proposals offer the prospect of broad environmental neutrality to the UK and accepts that ITP is an appropriate contractual basis for comparing the radiological equivalence of different categories of waste. However, it also

notes the Committee's view that a more rigorous environmental appraisal of the detailed characteristics of the disposal facility would be needed to reduce the remaining uncertainties. In the case of LLW this can already be done since facilities exist at Drigg for the disposal of the waste as it arises. However, in the case of ILW, not only would the waste have to be stored pending the establishment of the Nirex repository, but precise equivalence can be established only once a site-specific radiological assessment, based on a finalised design concept for the deep underground disposal facility, has been undertaken. This will be at the stage when a proposed repository has received planning permission. But until the Nirex repository has been established it would be imprudent for the UK to become irrevocably committed to the management of wastes which otherwise might need to be returned.

141. In conclusion, the Government reaffirms its policy that the wastes resulting from the reprocessing of foreign spent fuel should be returned to the country of origin, and the HLW should be returned as soon as practicable after vitrification. It accepts that this policy can be implemented by waste substitution arrangements which ensure broad environmental neutrality for the UK, but considers it prudent not to become irrevocably committed to waste substitution in the absence of appropriate disposal arrangements within the UK. This means that BNFL may engage in waste substitution for LLW now, but any arrangements they now enter into and implement with their overseas customers for the substitution of ILW must be conditional upon confirming, at the time a Nirex repository receives planning permission, that waste equivalence has been properly calculated. Furthermore these arrangements will need to provide for ILW to be returned should the Nirex repository not be established by the time BNFL is contractually obliged to return the wastes (i.e. 25 years after they are generated). In agreeing equivalence between categories of waste, account should be taken of RWMAC's suggestion that some additional HLW should be returned over and above that calculated on radiological grounds alone in order to account for some minor non-radiological environmental consequences of substitution. The Government will invite BNFL to submit proposals for achieving this.

Import and Export of Waste

142. In the preliminary conclusions of the review, the Government proposed that policy towards the import and export of radioactive wastes should be broadly similar to that for other wastes-i.e. there would be a presumption of self-sufficiency, but with some flexibility in view of the highly specialised nature of the waste. Such a policy would be consistent with the IAEA's *Code of Practice on the International Transboundary Movement of Radioactive Waste*, which says that it is the sovereign right of every state to prohibit the movement of radioactive waste into, from or through its territory.

143. Most respondents were in favour of restricting the movement of radioactive waste. Different views were expressed, however, about the circumstances under which import or export should be allowed. The nuclear industry argued that use should be made of the experience it had gained in managing UK waste. Some shipments of waste should therefore be allowed, particularly from countries which did not have the technology to deal with radioactive waste adequately. Although, it was argued, this might have a small negative effect on the UK environment, it would be beneficial to the world environment. In contrast, environmental groups and the majority of local authorities were opposed to further imports and believed that the exceptions

proposed by the Government were too relaxed. Self-sufficiency was an important principle and countries should be encouraged to develop their own solutions to waste management problems.

144. The policy of self-sufficiency proposed in the consultation document recognises that countries which are sophisticated enough to have a nuclear industry should also be able to develop their own waste facilities and that accepting their waste would reduce the incentive for them to develop facilities of their own. On the other hand, countries should not be precluded from taking advantage of the non-nuclear uses of radioactivity, such as medical diagnosis and treatment, because they do not have the resources to develop waste facilities. Equally, there may be sound technical reasons why waste should be imported for treatment, provided there is no environmental detriment to the importing country.

145. The Government's general policy is, therefore, that radioactive waste should not be imported to or exported from the UK, except:

- for the recovery of reusable materials, provided that this is the genuine prime purpose;
- for treatment that will make its subsequent storage and disposal more manageable, in cases:
 - where the processes are at a developmental stage; or
 - which involve quantities which are too small for the processes to be practicable in the country of origin.

Where such processes would add materially to the wastes needing to be disposed of in the UK, the presumption should be that they will be returned to the country of origin.

146. In addition, waste may be imported for treatment and disposal in the UK:

- if it is in the form of spent sources which were manufactured in the UK; or
- if it is waste from small users, such as hospitals, situated in:
 - EC Member States which produce such small quantities of waste that the provision of their own specialised installations would be impractical;
 - developing countries which cannot reasonably be expected to acquire suitable disposal facilities.

147. The Government recognises that the main difficulty in applying such a policy lies in defining the detail, such as the countries to which it should be applied, what quantities are uneconomic and what is a developmental stage. A similar process has, however, just been undertaken for non-radioactive wastes and it should therefore be manageable. As a first step, the Government proposes to invite RWMAC to consider what detailed guidance might be prepared for the regulators; this would then be used as the basis for consultation. In the meantime, the general principles above should be applied to decisions on individual cases.

Small Users

148. The consultation document said that, like the nuclear industry, "small users" of radioactive materials----such as hospitals, universities, research laboratories and non-nuclear industries----should be responsible for the safe

management of their wastes. At the same time, it recognised that small users sometimes experienced difficulties in finding suitable disposal routes. The document proposed that the Government should not direct small users to employ particular disposal routes, but that more guidance should be made available to assist them in selecting appropriate routes, and that they should be encouraged to establish an intermediary body to share experience and disseminate good practice.

149. In parallel with consultation on the review, the Government commissioned research to identify the chief concerns of small users. A questionnaire was sent to 20% of premises in the UK registered to use radioactive materials and to all those authorised to accumulate and dispose of radioactive waste. Regional meetings were also held with selected groups of small users. The Government has considered the findings of this research together with the responses to the consultation document.

150. The majority of responses agreed that the Government should not direct users to particular disposal routes. Concerns were expressed about the availability of certain routes which had been used by many small users in the past, such as incinerators and landfill, but which were now in increasingly short supply. A number of respondents believed that, while not directing users to particular routes, the Government should ensure that each small user had information about at least one disposal route available to it.

151. In view of these responses, the Government believes it right to reaffirm its preliminary conclusion, that small users should not be directed to particular routes, but should remain free to make their own arrangements. The Government recognises the concerns of some respondents, however, that although the volumes of waste produced by small users are not large, they still require careful control, and therefore stresses the responsibilities of small users to manage their wastes carefully. The Government acknowledges that suppliers of materials to small users in many cases already provide advice about disposal. This is welcomed, and the Government encourages suppliers to consider what further action they might take to assist small users in finding disposal routes.

152. On the provision of advice, there was general agreement that more guidance would be welcome. The research study concluded that the majority of small users were satisfied with the Government's overall waste management policy and the means of regulation, but there were a number of specific concerns about the implementation of the regulatory system. Particular requests were made for improved co-ordination between the different regulatory bodies to reduce overlaps, better justification of regulatory charges, better guidance on undertaking radiological assessments, and improved guidance to inspectors to reduce inconsistencies across the UK.

153. The Government recognises these concerns, and considers that the regulatory bodies should continue to liaise closely with each other and with small users to address inconsistencies. As noted in paragraph 34 above, HSE will be considering with the Environment Agencies whether to include in the memoranda of understanding between them a description of their respective roles in relation to non-nuclear sites. The Government will ask the Agencies to maximise the consistency of their regulatory approach towards small users and to provide them with advice on the management of radioactive waste, including appropriate disposal routes. The revised and updated version of *Radioactive Substances Act 1960, a guide to the administration of the Act* will also include relevant guidance.

154. The Government continues to believe that the creation of a special body to offer advice and disseminate good practice should be a matter for the small users themselves. Responses to the proposal were mixed. Many considered that the existing arrangements were satisfactory, although it was felt that HMIP's small user liaison group might be strengthened by means of wider participation. The Government would be willing to offer advice on setting up a new body if small users wished, but believes it might be sensible for them to wait until the guidance referred to above has been issued, before they decide whether such a body would be useful.

Research

155. The Government confirms its view, set out in the preliminary conclusions of the review, that each of the component parts of the industry, regulatory bodies and Government itself should continue to be responsible for commissioning and funding the research and development necessary to support their respective functions in relation to radioactive waste management and that they should do so on the basis of clearly stated aims and objectives. This approach was not questioned in responses to the consultation document.

156. There was also agreement about the need to have a suitable liaison mechanism in place to ensure that there is no unnecessary overlap between or significant omission from the research programmes of the various parts of Government, the regulatory bodies and industry. The existing Radioactivity Research and Environmental Monitoring Committee (RADREM), which already provides a liaison forum for these bodies, was generally seen to be an appropriate mechanism for this. However, a number of suggestions for improving and publicising the work of the committee were made, and these are currently the subject of further discussion and review by the research sponsors represented on the Committee.

157. The Government recognises that, in addition to research to support the day-to-day work of Government and the nuclear industry, there is a need for basic research of a more strategic and long-term nature of the kind funded by the Research Councils. It is felt that work of this nature also needs to be suitably integrated into the overall UK research approach and therefore that the Research Councils should also be involved in the liaison process. The Natural Environment Research Council (NERC) has recently accepted an invitation to join RAD REM. Approaches to other relevant research councils are being considered.

158. The preliminary conclusions of the review acknowledged the possibility of obtaining support for research under the *1994-98 Framework Programme for the European Atomic Energy Community*. Under the research commissioning principles identified by this review, the Government concludes that it is for individual sponsors to decide how best to take up these opportunities subject to their own requirements and the *Framework Programme* operating rules. Where opportunities for collaboration to secure work of common interest exist, it should be for the bodies concerned to reach suitable agreement. The Government will continue to issue information and advice about the EU programmes to those commissioning and undertaking research both through RADREM and other appropriate channels.

CHAPTER 6

SUMMARY OF CONCLUSIONS

159. The following is a summary of the main conclusions reached in the Government's review of radioactive waste management policy.

Regulatory System (paragraphs 27-39)

160. The provisions of the Environment Bill, establishing the Environment Agency and Scottish Environment Protection Agency, will:

- streamline the handling of applications to dispose of radioactive waste from nuclear licensed sites-in England and Wales, the Environment Agency will become the sole authoriser, with MAFF and the Welsh Office as statutory consultees, so providing the industry with a "one-stop shop" without impairing the effectiveness of present controls; the Secretary of State's powers to call in applications, to determine appeals and to issue directions to the Environment Agency will be exercised jointly with the Minister of Agriculture, Fisheries and Food;
- place consultation between the regulatory bodies on a statutory footing-HSE will become a statutory consultee of the Agencies for disposal authorisations for nuclear licensed sites and the Agencies will become statutory consultees of the HSE for the waste management implications of licences granted under NIA 65; the memoranda of understanding which set out the roles of the respective regulatory bodies will be revised;
- allow relaxation of the scope of directions made under RSA 93 prohibiting the release of information on the grounds of national security.

Revised guidance will be issued to update the booklet, *Radioactive Substances Act 1960, a guide to the administration of the Act*.

161. With the establishment of the Environment Agencies, the Government will consider the responsibilities of the different regulatory bodies and other organisations for assessing the doses received by members of the public.

Policy Aims (paragraphs 47-52)

162. The Government has concluded that the policy aims for radioactive waste management should be revised and updated to emphasise the respective roles of Government, regulators and producers and owners of waste, and apply the concept of sustainable development and its supporting principles. Future radioactive waste management policy will be guided by the revised aims set out in paragraph 50-52.

Waste Categories (paragraphs 53 & 54)

163. Further consideration will be given, in the light of Government research and advice from R WMAC, to refining the categories of radioactive wastes in terms of their half-lives and activity, and to the proposal that

short-lived ILW might be disposed of at Drigg, provided the overall safety case for the site is not jeopardised.

Early Applications for Authorisation (paragraphs 58-62)

164. Developers of major projects may, if they wish, submit early applications for disposal authorisations under RSA 93 at about the same time that they seek full planning permission for the project. The regulators will then be able to decide on authorisations before major commitments of money and effort have been made. The authorisations may contain conditions which if met at specified stages should lead to approval to start operations in due course when the plant is built. Where significant changes are made to the conditions in the authorisation, further public consultation will be undertaken.

Discharge of Air-Borne and Liquid Waste (paragraphs 63-73)

165. The Government supports the recommendation of the **NRPB** that the dose to members of the public from all man-made sources of radioactivity, other than from medical exposure, should be limited to 1 mSv/y and accepts that the flexibility to average exposure over more than one year is unnecessary. It further accepts that assessments of dose against this limit should include the effects of past discharges.

166. When determining applications for discharge authorisations, a maximum dose constraint of 0.3 mSv/y will be applied to new nuclear installations. The constraint will apply to a single source, defined as "a facility, or group of facilities, which can be optimised as an integral whole in terms of radioactive waste disposals".

167. The Government accepts the NRPB's advice that it should be possible for existing facilities to be operated within a dose constraint of 0.3 mSv/y, but that in cases where this is not possible the operator must demonstrate that the doses resulting from the continued operation of the facility are as low as reasonably achievable and within dose limits.

168. To limit the aggregate exposure from a number of sources with contiguous boundaries at a single location, a "site constraint" of 0.5 mSv/y will be applied irrespective of whether different sources on the site are owned or operated by the same or different organisations.

169. A threshold, or lower bound for optimisation, will be introduced. If exposures are below 0.02 mSv/y, the regulators should not seek to secure further reductions in the exposure of members of the public, provided that they are satisfied that the operator is using the best practicable means to limit releases.

Disposal of Solid Waste (paragraphs 74-87)

170. The Government believes that reliance cannot be placed exclusively on estimates of risk to determine whether a disposal facility is safe. Other technical factors, including ones of a more qualitative nature, will also need to be considered and the regulators will need to be satisfied that good engineering and good science have been adopted to limit risks. However, the Government believes a risk target is appropriate as an objective in the design process and that this should be a risk of 10^{-6} per year of developing either a fatal cancer or a serious hereditary defect.

171. The approach which the regulators will adopt in assessing the safety case for a repository will be set out in their publication, *Disposal Facilities on Land for Low and Intermediate Level Radioactive Wastes: Guidance on Requirements for Authorisation*.

172. There should be no prescribed cut-off for the period over which risk should be assessed. This will depend on the nature of the site-specific safety case. The regulators should provide guidance on the factors which applicants need to take into account in determining the nature of the safety case over different time-frames.

173. The Government welcomes the RWMAC/ACSNI Study Group's report on site selection criteria for radioactive waste repositories, but has reservations about some of the detailed proposals made. The Government will consider how in future it might meet the need identified in the report for transparency of decision making and public reassurance. The opportunity to develop such an approach is provided by the need for a repository for high-level wastes, where the process of site selection has not yet begun.

Spent Fuel Management (paragraphs 88-90)

174. Like the question of whether and when to reprocess spent fuel, decisions on the siting of dry stores for spent fuel should be for the commercial judgement of the operators, subject to the necessary planning and regulatory requirements being satisfied.

High-Level Waste (paragraphs 91-93)

175. The Government believes that disposal to geological formations on land is the favoured option for the long-term management of vitrified HLW once it has been allowed to cool and is putting in hand development of a research strategy, the aim of which will be to produce a statement of future intent in this area, setting out the decisions to be taken and the milestones to be achieved.

Partitioning and Transmutation (paragraph 94)

176. The Government will continue to watch with interest the results of international research on partitioning and transmutation, but has no plans to initiate further development of its own.

The Nirex Repository (paragraphs 95-110)

177. The Government continues to favour a policy of deep disposal rather than indefinite storage of ILW and considers it appropriate that Nirex should continue with its programme to identify a suitable site. It has decided that there would be no advantage to be gained from delaying the development of the repository itself and that once a suitable site has been found, it should be constructed as soon as reasonably practicable. The precise timetable will depend on the granting of planning consent and compliance with regulatory requirements, including the establishment of a sound safety case.

178. The Government has already promised to hold a full public inquiry into an application for the repository itself and sees no reason to depart from

this procedure. It will seek advice from RWMAC on proposals which Nirex is formulating to enhance and put onto a regular cycle the publication of information about its scientific work and development of the repository programme.

Interim Storage of Intermediate and Low-Level Waste (paragraphs 111-113)

179. When the demands of safety are overriding, waste must be treated as necessary to improve storage conditions. In addition, where early treatment of waste will secure worthwhile safety benefits, or worthwhile economic benefits without prejudicing safety, the general presumption against action which might foreclose future waste management options may be relaxed.

Controlled Burial (paragraphs 114-119)

180. The Government has decided not to encourage greater use of controlled burial by the nuclear industry. Nevertheless, it should continue to be available as a disposal route, particularly for "small users"--such as hospitals, universities, research laboratories and non-nuclear industries--subject to the agreement of the site operators and the necessary regulatory requirements being met. The Government has considered whether additional controls should also be applied to the landfill site operators, but has concluded that it is unnecessary to duplicate the authorisation procedure in this way. The Government will issue guidance to the Environment Agencies on the need to consult local authorities about authorisations for controlled burial.

Decommissioning (paragraphs 120-131)

181. In general, the process of decommissioning nuclear power plants should be undertaken as soon as it is reasonably practical to do so, taking account of all the relevant factors.

182. Since regulatory approval will continue to be required on a case-by-case basis, it would be unwise for the operators of nuclear power stations to take steps which would foreclose technically or economically the option of completing Stages II and III on an earlier timescale should that be required. Nevertheless, the Government believes that there are a number of potentially feasible and acceptable decommissioning strategies for nuclear power stations, including safestore.

183. Nuclear operators will be asked to draw up strategies for decommissioning their redundant plant and these will be reviewed quinquennially by HSE in consultation with the Environment Agencies.

184. Segregated funds for decommissioning should be established for those parts of the industry which are privatised. The Government will examine what improvements can be made in the way in which the unprivatised sections of the industry report on their progress towards decommissioning and on their provisioning policies.

Contaminated Land (paragraphs 132 & 133)

185. The Government intends to introduce regulations, by October 1996, applying to radioactive contamination the contaminated land provisions of the Environment Bill with such modifications as are necessary.

Waste Substitution (paragraphs 134-141)

186. The Government reaffirms its policy that the wastes resulting from the reprocessing of foreign spent fuel should be returned to the country of origin, and the HLW should be returned as soon as practicable after vitrification. It accepts that this policy can be implemented by waste substitution arrangements which ensure broad environmental neutrality for the UK, but considers it prudent not to become irrevocably committed to waste substitution in the absence of appropriate disposal arrangements within the UK. In agreeing equivalence between categories of waste, account should be taken of R WMAC's suggestion that some additional HLW should be returned over and above that calculated on radiological grounds alone in order to account for some minor non-radiological environmental consequences of substitution. The Government will invite BNFL to submit proposals for achieving this.

Import and Export of Waste (paragraphs 142-147)

187. Radioactive waste should not be imported to or exported from the UK other than in the specific cases set out in paragraphs 145 and 146.

Small Users (paragraphs 148-154)

188. The Government will not direct small users to particular routes for disposal of their radioactive waste, but will leave them free to make their own arrangements. Suppliers of materials should consider what further help they can provide in advising on disposal routes. The Government will ask the Environment Agencies to maximise the consistency of their regulatory approach towards small users and to provide them with advice on the management of radioactive waste, including appropriate disposal routes. The creation of a special body to offer advice and disseminate good practice should be a matter for the small users themselves.

Research (paragraphs 155-158)

189. Each of the component parts of the industry, regulatory bodies and the Government itself should continue to be responsible for research and development necessary to support their respective functions. Improvements are being considered to the co-ordination of research through the RADREM Committee. NERC has recently accepted an invitation to join RADREM and approaches to other relevant research councils are being considered. The Government will continue to issue information and advice about the EU programmes to those commissioning and undertaking research.

GLOSSARY OF TERMS

Actinide

An element following Actinium in the Periodic Table. Many of the actinides are long-lived alpha-emitters; examples are uranium and plutonium.

AGR

Advanced gas-cooled reactor. The second generation of nuclear reactors built in the UK. Uses slightly enriched uranium dioxide clad in stainless steel as fuel, and operates at a much higher temperature than do the Magnox plants from which the design was developed.

ALARA

As low as reasonably achievable. Radiological doses or risks from a source of exposure are as low as reasonably achievable when they are consistent with the relevant dose or target standard and have been reduced to a level that represents a balance between radiological and other factors, including social and economic factors. The level of protection may then be said to be optimised.

ALARP

As low as reasonably practicable. To satisfy the ALARP principle, measures necessary to reduce risk must be taken until or unless the cost of those measures, whether in money, time or trouble, is disproportionate to the reduction in risk.

Authorisation

Permission given by regulatory authority to dispose of radioactive waste (or in the case of non-nuclear licensed sites to accumulate or dispose of radioactive waste); normally subject to conditions which must be met.

BPEO

Best practicable environmental option. A concept developed by the Royal Commission on Environmental Pollution, it implies that decisions on waste management have been based on an assessment of alternative options evaluated on the basis of factors such as the occupational and environmental risks, the environmental impacts, the costs and the social implications.

BPM

Best practicable means. Within a particular waste management option, the BPM is that level of management and engineering control that minimises, as far as practicable, the release of radioactivity to the environment whilst taking account of a wider range of factors, including cost-effectiveness, technological status, operational safety, and social and environmental factors. In determining whether a particular aspect of the proposal represents the BPM, the Inspectorates will not require the applicant to incur expenditure, whether in money, time or trouble, which is disproportionate to the benefits likely to be derived.

Bq

Becquerel. The standard international unit of radioactivity equal to one radioactive transformation per second. See also GBq, kBq.

Controlled burial

Authorisations are issued for the burial of some LLW at suitable landfill sites which have good containment characteristics-for example, if they have several metres of clay lining.

Critical group

For a given source, the critical group of members of the public whose exposure is reasonably homogeneous and is typical of people receiving the highest dose from the given source.

Criticality incident

The accidental occurrence of a self-sustaining fission chain reaction in fissile material which is not in the core of a nuclear reactor.

Decommissioning

The process whereby a nuclear facility, at the end of its economic life, is taken permanently out of service and its site made available for other purposes. In the case of nuclear power stations, the IAEA defines three different stages: immediately after the final closure, radioactive material such as nuclear fuel and operational waste is removed; the buildings surrounding the reactor shield are dismantled; and finally the reactor itself is dismantled.

Disposal

In the context of solid waste, disposal is the emplacement of waste in a disposal facility without intent to retrieve it at a later time; retrieval may be possible but, if intended, the appropriate term is **storage**. Disposal can also refer to the release of airborne or liquid wastes to the environment (i.e. emissions and discharges).

Dose

A measure of the radiation received. Various forms of dose are commonly referred to, including equivalent dose, effective dose and absorbed dose. (Measured in Sieverts and Grays.)

Dose constraint

A restriction on annual dose to an individual from a single source such that when aggregated with doses from all sources, excluding natural background and medical procedures, the dose limit is not likely to be exceeded; the dose constraint places an upper bound on the outcome of any optimisation study and will therefore limit any inequity which might result from the economic and social judgements inherent in the optimisation process.

Dose limit

For the purposes of discharge authorisation, the UK has (since 1986) applied a limit of 1 mSv/y to members of the public from all man-made sources of radiation (other than from medical exposure).

Effective dose

Effective dose relates to exposure of the body as a whole. This quantity takes account of the relative effectiveness of different types of radiation in causing tissue damage, and the relative sensitivity of different organs to increased cancer risk from radiation. (Measured in Sieverts.)

Euratom

Within the European Union, nuclear matters are the subject of a separate Treaty dating from 1957. This established the European Atomic Energy Community (EAEC) or Euratom, which was set up to encourage progress in the field of nuclear energy.

GBq

Gigabecquerel. A unit of radioactivity equal to one thousand million becquerels. When divided by weight (e.g. GBq/te) this provides a measure of the concentration of the radioactivity.

Green Book

In 1984 the authorising departments published a booklet in green covers, entitled *Disposal Facilities on Land for Low and Intermediate-Level Radioactive Wastes: Principles for the protection of the human environment*. A revised draft version was published in 1994, as a consultation document, with the title *Disposal Facilities on Land for Low and Intermediate-level Wastes: Guidance on Requirements for Authorisation*.

HSC

Health and Safety Commission. The Health and Safety Commission and Health and Safety Executive are bodies created by the Health and Safety at Work etc Act 1974. The Commission is responsible to the Secretary of State for Employment (and to other Secretaries of State) for the administration of the Act. The Commission makes substantial use of independent advisory committees who advise it directly. The Commission's independent adviser on the subject of nuclear safety is the Advisory Committee on the Safety of Nuclear Installations (ACSNI).

HSE

Health and Safety Executive. A distinct statutory body with day-to-day responsibility for making arrangements for the enforcement of safety legislation. The Executive is the statutory licensing authority for civil nuclear installations, a function which it delegates to senior officials within the Nuclear Installations Inspectorate (**NI**) which is part of HSE's Nuclear Safety Division.

HMIP

Her Majesty's Inspectorate of Pollution. The regulatory body currently within the Department of the Environment, but soon to form part of the proposed Environment Agency, responsible for authorising disposal of radioactive wastes (including emissions and discharges to the environment). In the case of nuclear licensed sites, this responsibility is currently exercised jointly with the Ministry of Agriculture, Fisheries and Food (MAFF).

HMIPI

Her Majesty's Industrial Pollution Inspectorate. The equivalent organisation to HMIP in Scotland, reporting to the Scottish Office.

HMNII

Her Majesty's Nuclear Installations Inspectorate. A part of the Nuclear Safety Division of HSE, senior officers of which have delegated regulation and enforcement powers relating to nuclear licensing under the Nuclear Installations Act 1965.

Human intrusion

The inadvertent penetration of the disposal facility or surrounding media, for example by excavation or the sinking of boreholes, with the potential to lead to exposure of those involved in the event or others, or to degrade the performance of the disposal system.

Inventory of Radioactive Waste Arisings in the UK

A report produced periodically which gives details of stocks and projected arisings of radioactive wastes in the UK. Wastes produced from power reactors, commercial reprocessing and fuel manufacture, medical and industrial sources, research and development and Ministry of Defence activities are considered.

kBq

Kilobecquerel. A unit of radioactivity equal to one thousand becquerels.

Magnox

The first generation of gas-cooled nuclear reactor, used for electricity generation at power stations constructed in the 1960s. Takes its name from the magnesium-based alloy in which the natural uranium metal fuel is contained.

millisievert

A unit of dose equal to one thousandth of the international unit the sievert.

Post-closure performance safety assessment

Analysis to predict the performance of the radioactive waste disposal site to establish its long-term safety.

Practice

Human activity which results in an overall increase, or likelihood of increase, in the exposure or the number of people exposed to a dose.

PWR

Pressurised water reactor. The most recent type of reactor to be constructed in the UK, water cooled and moderated. Uses slightly enriched uranium dioxide clad in Zircaloy as fuel.

Radiological risk

The probability of harmful consequences of radiation in a given period of time. This term is usually used to refer to the product of the probability of a potential occurrence and the probability of developing either cancer or hereditary effects.

Radionuclide

General term for an unstable nuclide that emits ionising radiation e.g. Caesium -137.

RCF

Rock Characterisation Facility. Nirex has proposed the construction of such a facility up to 600m deep below Langlands Farm near Sellafield in order to test further the geology and hydrogeology of the site to determine its suitability for a repository for low and intermediate-level waste.

RWMAC/ACSNI Study

A study, published in March 1995, of a group drawn from members of RWMAC and ACSNI, entitled *Site selection for radioactive waste disposal facilities and the protection of human health*.

Sievert

The standard international unit of dose.

Source

A facility, or group of facilities, which can be optimised as an integral whole in terms of radioactive waste disposals.

THORP

Thermal Oxide Reprocessing Plant at Sellafield, Cumbria, owned and operated by British Nuclear Fuels plc.

Tolerability of Risk

The Tolerability of Risk from Nuclear Power Stations (TOR), a 1992 HMSO publication prepared by the HSE which explains the way in which risks from nuclear installations in the UK are regulated.

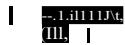
Tritiated waste

Low and intermediate waste containing the radionuclide tritium. Tritium has a 12 year half-life and is of low radiotoxicity.

LIST OF ABBREVIATIONS

ACSNI	Advisory Committee on the Safety of Nuclear Installations
AGR	Advanced gas-cooled reactor
ALARA	As low as reasonably achievable
ALARP	As low as reasonably practicable
ARCI	Alkali and Radiochemical Inspectorate
BNFL	British Nuclear Fuels pk
BPM	Best practicable means
Bq	Becquerel
CBI	Confederation of British Industry
COMARE	Committee on Medical Aspects of Radiation in the Environment
DOE	Department of the Environment
DTI	Department of Trade and Industry
EU	European Union
Euratom	European Atomic Energy Community
GBq	Gigabecquerel
HLW	High-level waste
HSC	Health and Safety Commission
HSE	Health and Safety Executive
HMIP	Her Majesty's Inspectorate of Pollution
HMIPI	Her Majesty's Industrial Pollution Inspectorate
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ICRP26	ICRP publication 26, 1977
ICRP60	ICRP publication 60, 1990
ILW	Intermediate-level waste
IRAC	Ionising Radiations Advisory Committee
IRR85	Ionising Radiations Regulations 1985
ITP	Integrated toxic potential
kBq	kilobecquerel
LLW	Low-level waste
MAFF	Ministry of Agriculture, Fisheries and Food
MOD	Ministry of Defence
mSv	millisievert
NE	Nuclear Electric
NEA	Nuclear Energy Agency
NERC	Natural Environment Research Council
NIA65	Nuclear Installations Act 1965
NII	Her Majesty's Nuclear Installations Inspectorate

Nirex	Originally Nuclear Industry Radioactive Waste Executive, now UK Nirex Ltd
NRPB	National Radiological Protection Board
OECD	Organisation for Economic Co-operation and Development
PWR	Pressurised water reactor
RADREM	Radioactivity Research and Environmental Monitoring Committee
RADWASS	Radioactive Waste Safety Standards
RCF	Rock Characterisation Facility
RSA93	Radioactive Substances Act 1993
RWMAC	Radioactive Waste Management Advisory Committee
SEPA	Scottish Environment Protection Agency
SNL	Scottish Nuclear Limited
THORP	Thermal Oxide Reprocessing Plant
TOR	The Tolerability of Risk from Nuclear Power Stations (HSE)
TUC	Trades Union Congress
UK	United Kingdom
UKAEA	United Kingdom Atomic Energy Authority
UN	United Nations Very
VLLW	low-level waste
10-s	one in a hundred thousand
10-6	one in a million



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