Regulatory Guidance Series, No RSR 1

Radioactive Substances Regulation – Environmental Principles

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Record of changes

Version	Date	Change
1.0	September 2009	
2.0	April 2010	Issued for launch of phase 2 of the Environmental Permitting Regime. Minor changes to terminology only.

Published by:

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Foreword

I'm pleased to introduce the first full edition of our Radioactive Substances Regulation Environmental Principles (REPs). These replace an interim version of the REPs that we published in 2006. We have updated the 2006 version to reflect the Government's 2008 Nuclear White Paper and Government's and the Welsh Minister's new Statutory Guidance to us on radioactive discharges. We have also developed all the REPs topic areas that were incomplete.

The REPs will help us to regulate better. Also they should help those that we regulate to work to high standards to protect the environment. The REPs help clarify our expectations and provide the basis for our decisions both when we regulate radioactive substances directly and when we are consulted by others about the matters that they regulate, particularly our colleagues in the Health and Safety Executive's Nuclear Directorate. In developing our REPs we have drawn significantly from the Safety Assessment Principles that are used by the Nuclear Directorate. This will help ensure consistency as we work together to regulate nuclear sites.

Our work in Radioactive Substances Regulation is increasing, especially with the important changes that are taking place in the nuclear industry. Government and the Nuclear Decommissioning Authority (NDA) are taking forward the decommissioning and clean up of the UK's nuclear legacy and mapping out an approach to dispose of higher activity waste in a future geological repository. NDA is also introducing changes at its legacy sites with new management consortia to run the sites and drive innovation, effectiveness and efficiency. Consistent with Government's policy on the future role of nuclear power, new operators are also coming forward with plans to develop new nuclear power stations. And, with the Health and Safety Executive's Nuclear Directorate, we are already working together assessing new nuclear power station designs in Generic Design Assessment. Our REPs will help our regulatory work in all these areas.

We are grateful to all who have contributed to the development of the REPs, especially those who responded to our consultation on the draft that we issued last year. This version of the REPs has been informed and improved by your views and comments.

Lastly, I would like to emphasise that in using the REPs we will take a pragmatic, proportionate and sensible approach. We will keep the REPs under review and make any improvements to them where required.

Joe McHugh,

Head of Radioactive Substances Regulation, Environment Agency, September 2009

Radioactive Substances Regulation - Environmental Principles : a quick guide

This is high level guidance on how we regulate radioactive substances activities under the Environmental Permitting (England and Wales) Regulations 2010. We have produced this document in order to provide a standardised framework for technical assessments and judgements that the Environment Agency's Radioactive Substances Regulators have to make. It provides technical guidance that underpins the decisions that we make regarding radioactive substances regulation, including those about permitting and compliance where we regulate directly, and those where we are consultees or have influence.

The document provides an overall hierarchy and topic framework for the principles, an objective for radioactive substances regulation, fundamental principles, and generic developed principles.

This document was first published in full in 2009 in relation to the Radioactive Substances Act 1993. This is a revised version that reflects changes in terminology resulting from the move to regulation under the Environmental Permitting Regulations 2010. There are no other changes to the content of this document.

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1. Introduction

1.1 The purpose of the RSR Environmental Principles (REPs)

1. The Radioactive Substances Regulation Environmental Principles (REPs) are intended to form a consistent and standardised framework for the technical assessments and judgements that we must make when regulating radioactive substances. The REPs provide technical guidance that helps underpin the decisions that we make relating to radioactive substances regulation, including those about permitting and compliance where we regulate directly and those where we are consultees or advisors or otherwise have influence. The REPS address all aspects of the regulatory process, that is permitting, compliance and enforcement and address our regulatory processes as well as our expectations of operators. The development of the REPs is consistent with our commitment to modernising regulation and improving our effectiveness and efficiency.

2. The principles have been written generically to apply to both the nuclear and non-nuclear sectors, without explicit distinction between them. In applying them on nuclear licensed sites we must be mindful of the provisions of the Environmental Permitting Regulations 2010, the Nuclear Installations Act 1965 (NIA65) and the Health and Safety at Work etc Act (HSWA), and the consequent interactions between ourselves and the Health and Safety Executive (HSE). The principles do not change the scope of what we regulate in relation to radioactive substances activities nor alter the relationship with other legislation or regulators.

3. The target audience for the REPs is primarily our radioactive substances regulators. The REPs will also be of value to current and potential operators and owners of facilities and sites where radioactive substances are used and radioactive wastes are generated and managed.

4. Our main audience, regulators and operators, is a specialist one. We need to make our requirements as clear and unambiguous as possible for them. This guidance therefore contains a large number of specialist terms that have a precise meaning. We recognise that this may make the document less accessible to a wider audience, but we have tried to avoid this as much as possible. In particular, we have provided an introductory section to each chapter, so that everyone can understand what the chapter is about. We have also included an extensive glossary of significant specialist terms.

5. The Environmental Permitting Regulations 2010 (see box below) provide the legal framework for the regulation of activities involving the use of radioactive substances and giving rise to releases of radioactive waste. The Regulations implement the relevant sections of the BSS Directive. The high level objectives of this regulatory framework are in relation to radioactive waste that:

   - an optimal level of protection of the environment and the population is achieved and maintained;
   - all exposures to ionising radiation of any member of the public and of the population as a whole resulting from the disposal of radioactive waste are kept as low as reasonably achievable, economic and social factors being taken into account (ALARA); and
   - the sum of all doses resulting from the exposure of any member of the public shall not exceed specified dose limits.

6. Premises regulated under the Regulations may also be subject to other environmental legislation, and will also be subject to other legislation, in particular the Health and Safety at Work and the Nuclear Installations Act. Appendix 1 describes these related regimes and their interaction with radioactive substances activities. The relationship with the HSE is considered further below.

Environmental Permitting Regulations 2010: Radioactive Substance Activities – Brief Summary

- The Regulations apply to operators who use "premises for the purposes of an undertaking" (e.g. a trade or business) except the Ministry of Defence.
- Operators, other than on nuclear licensed sites, must be permitted for the keeping and use of "radioactive material" (as defined in the Regulations).
- Operators must be permitted for the keeping and use of "mobile radioactive apparatus" (as defined in the Regulations).
- Operators must be permitted to receive and dispose of "radioactive wastes" (as defined in the Regulations).
- Operators, other than on nuclear licensed sites, must be permitted to accumulate radioactive wastes.
- Certain exemptions exist to these requirements for permits – as set out in "Exemption Orders". Compliance with the condition of Exemption Orders is still required and is regulated by the Environment Agency.

1.1.1 BAT, ALARA and Other Principles

7. The Government through statutory guidance has stated that we should base our regulatory decisions in relation to discharges of radioactive waste by applying the environmental principles set out in the 2008 UK Discharges Strategy. These principles are:

- sustainable development;
- the use of Best Available Techniques (BAT);
- the precautionary principle;
- the polluter pays principle;
- optimisation of protection on the basis that radiological doses and risks to workers and members of the public from a source of exposure should be kept as low as reasonably achievable (the ALARA principle);
- the preferred use of 'concentrate and contain' in the management of radioactive waste over 'dilute and disperse' in cases where there would be a definite benefit in reducing environmental pollution, provided that BAT are being applied and worker dose is taken into account.

8. These principles are in addition to the principles of justification, optimisation and the application of limits and conditions. Chapter 3 of the Discharges Strategy sets out how these principles should be addressed to achieve a balanced approach.

9. The Statutory Guidance notes that that the concept of BAT is defined in the OSPAR Convention and in Directive 1996/61/EC on Integrated Pollution Prevention and Control (IPPC). Ministers consider these definitions of BAT to be essentially the same and to deliver the same level of environment protection as achieved until now by the use of BPM and BPEO.

10. Operators should use BAT to achieve a high degree of protection of the environment, taken as a whole and to meet the principle of optimisation. That is, where an operator uses BAT, he will be taken to have reduced discharges and exposures to as low as reasonably achievable. This together with consideration of the local environmental conditions, the technical characteristics of the facility, and its location, provides the basis for permit conditions and limit values. The BAT approach involves consideration of costs and benefits to ensure that the cost of applying techniques is not grossly disproportionate in relation to the environmental protection they provide. The guidance on Principles of optimisation and related guidance provides more information on this.

1.1.2 Interface with HSE

11. We aim to regulate in concert with the HSE in order to achieve common safety and environmental objectives, to ensure that we place common requirements on operators to achieve these objectives and to avoid duplicate or conflicting requirements. We seek to achieve this by a combination of:

- consistent principles and guidance, including commonality with the HSE safety assessment principles (SAPs), such that we have common expectations of an operator; and
- close and integrated working between ourselves and the HSE.

12. We have agreed Memoranda of Understanding with the HSE to facilitate how we work towards achieving common regulatory outcomes.

1.1.3 Application of the REPs

13. The REPs contain principles and “considerations”. The principles form the underlying basis for regulatory judgements made by our regulators. The considerations provide either further explanation of the principles, or guidance on their interpretation in actual applications and the measures against which judgements can be made. In time we aim to develop further technical guidance to support the consistent application of the principles by our regulators including joint guidance with the HSE for Nuclear Licensed sites.

14. Not all the principles in this document will apply to every site or facility. The principles are a reference set from which we need to choose the relevant ones for any given situation and in relation to our regulatory locus. This means that the extent to which individual principles apply to any specific matter will depend on:

- the nature of the facility;
- the nature of the issues; and
- our regulatory locus.

15. We will therefore advise applicants and operators of the information to be provided in applications and other submissions through our application forms and other guidance. The REPs, and supporting guidance, will advise operators of our expectations of the standards to be achieved and so will assist operators in the preparation of their submissions. We will then assess the information provided against the relevant principles.

16. The REPs are not intended to increase the regulatory burden. To this end, we will not request new forms of documentation from operators unless it is essential to do so in order to carry out our RSR assessments. Our aim will be to make as much use as possible of existing forms of documentation, whether prepared for our purposes or not. Where we need additional information we will encourage operators to add to existing documentation rather than preparing new documents. We will encourage operators of new nuclear facilities to make joint submissions to HSE and ourselves. We will also suggest that operators of existing nuclear facilities make joint submissions where appropriate. In such cases there should be no need for operators to prepare, for example, separate radioactive waste management strategies, integrated waste strategies, decommissioning strategies, or radioactive waste management cases, for our purposes.

17. We need to ensure that our assessment work and the requirements we place on operators are proportionate to the actual or potential impact on the public and the environment presented by a facility or site. This is particularly important in the non-nuclear sector, where actual and potential impacts are often lower than in the nuclear sector. In both sectors our aim should be to achieve an optimum level of protection of people and the environment for a whole facility and, where relevant, for an entire site.

18. It is necessary to bear this in mind when assessing the degree to which each principle is met and when determining what is BAT for each aspect of a facility to which BAT applies. In some cases we may have to balance and weight principles depending on their relative importance to the assessment in hand, take into account other relevant matters, and resolve any potentially conflicting requirements in order to achieve the overall, optimum, environmental outcome.

19. This document sets out the:

- overall structure (hierarchy) for REPs;
- the general objective for RSR;
- fundamental principles for RSR;
- the generic developed principles for use in regulatory assessments; and
- the generic developed principles for regulatory processes.

20. The intention is to revise this document at intervals, as experience is gained in applying the REPs and in the light of policy and other developments. Feedback about problems, observations, comments, suggestions and successes relating to the application of the principles and the use of this document is thus actively encouraged. We expect to consult our stakeholders about major revisions of the REPs.

2. Overall Structure for REPs

21. The overall structure (hierarchy) for the REPs is based on a structure that has been identified by the International Atomic Energy Agency (IAEA) for their safety standards, modified to be more relevant to the Environment Agency's regulatory role with its environmental rather than safety focus. The Health and Safety Executive (HSE) has taken a similar approach, basing their 2006 Safety Assessment Principles for Nuclear Facilities (SAPs) structure around the IAEA safety standards. Our overall structure is shown graphically in Figure 1 and is listed in Table 1, together with the corresponding IAEA themes.

22. The main elements are:

- objective for RSR
- fundamental environmental principles for RSR;
- developed principles – generic (see topics in Table 1); and
- developed principles – sector / site specific (see topics in Table 1).

23. We will only generate sector or site specific developed principles where an existing generic developed principle does not address the issue at hand and is not required to be created.

Table 1 Overall Structure for RSR Environmental Principles and IAEA Safety Principles

Environment Agency	***IAEA***
RSR Objective	**Safety Objective**
Fundamental Environmental Principles for RSR	**Safety Fundamentals**
Developed Principles – Generic	**Thematic**
Management and Leadership for the Environment	Management Systems
Radioactive Substance Management (including Waste Disposal)	Radioactive Waste Management
Radiological Protection	Radiation Protection
Site Evaluation	Site Evaluation
Engineering	*(none)*
Emergency Preparedness and Response	Emergency Preparedness and Response
Decommissioning	Decommissioning
Contaminated Land and Groundwater	Rehabilitation of Contaminated Areas
Regulatory Framework	Legal and Governmental Infrastructure
Compliance Assessment	Assessment and Verification
Evaluation and Information	(*none)*
Enforcement	(*none)*
Developed Principles – Sector/Site Specific	**Facility Specific**
Nuclear Power Stations	Nuclear Power Plant Design
	Nuclear Power Plant Operation
Fuel Cycle Facilities (U Processing and Enrichment, Fuel Fabrication and Related Wastes etc)	Fuel Cycle Facilities
Fuel Cycle Facilities (Reprocessing, Pu Processing, MOX Fuel and Related Wastes etc)	
Research Facilities	Research Reactors
Defence Facilities	(*none)*
Radioisotope Manufacture	*(none)*
Disposal Sites	Waste Treatment and Disposal Facilities
Site Specific (e.g. Sellafield; Dungeness A)	(*none)*
Non-nuclear *(to be developed)*	*(none)*

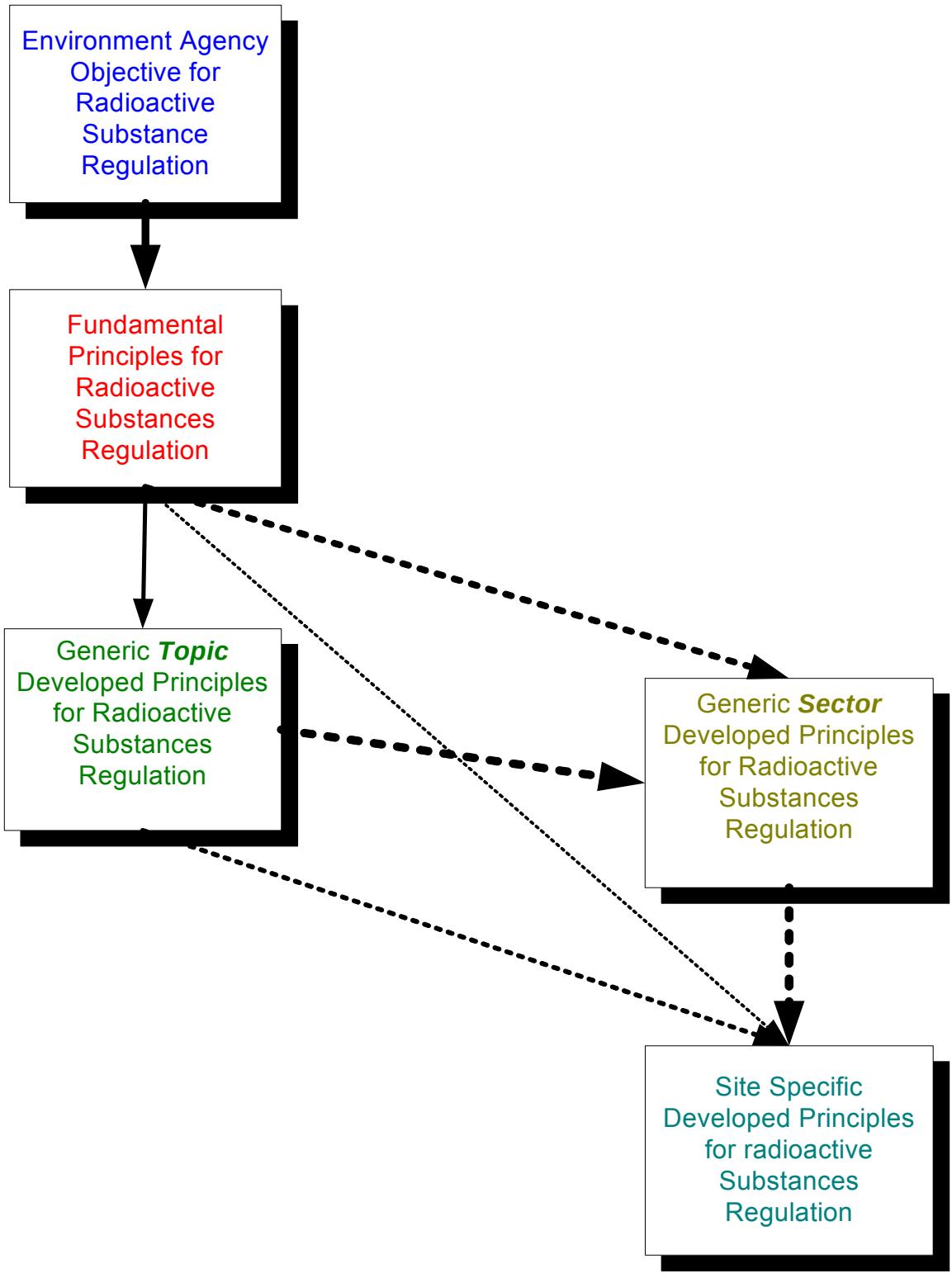

Figure 1 Radioactive Substances Regulation Environmental Principles Overall Structure / Hierarchy

3. RSR Objective

24. The Environment Agency's objective in radioactive substances regulation is that, consistent with Government policy and legislation, radioactive substances are managed to meet the needs of current and future generations by preventing, and where that is not possible minimising, adverse effects on people and the environment, and that environmental damage is remedied.

4. RSR Fundamental Principles

Fundamental Principle A – Sustainability

25. **Radioactive substances should be managed to avoid placing a burden on future generations and their environment such that it compromises their ability to meet their needs**.

Fundamental Principle B – Stakeholders

26. **To give confidence that the right decisions will be made for the right reasons, citizens, communities and organisations should have access to information relating to radioactive substances, key decisions should be informed by their views, and the right to justice should be respected.**

Fundamental Principle C – Integrated Planning

27. **All radioactive substances should be managed within integrated strategies that plan their complete lifecycle taking account of all interactions, dependencies and principles.**

Fundamental Principle D – Selecting and Implementing Management Options

28. **The best available techniques for the management of radioactive substances should be used. These should be identified from systematic consideration of potential alternatives. Consideration should include human health, safety, the environment, waste prevention, minimisation and disposal and other likely costs and benefits.**

Fundamental Principle E – Protecting Human Health and the Environment

29. **Radioactive substances should be managed to ensure an optimal level of protection to human health, wildlife, organisms and the wider environment, and compliance with relevant dose limits and constraints is achieved. Monitoring and assessment should be undertaken to inform decisions about radioactive substances and to establish the state of the environment.**

Fundamental Principle F – Regulation

30. **Regulatory systems for radioactive substances should be independent, seek best practice through high standards of management, take account of risk, and be transparent, accountable, consistent and targeted.**

Fundamental Principle G – Best Scientific Knowledge

31. **Decisions on radioactive substances should be informed by the best scientific knowledge. Appropriate research should be undertaken to facilitate technology**

development, to promote innovative solutions and where significant gaps in knowledge are recognised.

Fundamental Principle H – Uncertainties and the Precautionary Principle

32. **Decisions about radioactive substances should take into account uncertainties and where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing cost effective measures to prevent potential harm to people and the environment.**

Fundamental Principle I – Polluter Pays

33. **Producers, owners and users of radioactive substances should be accountable for the costs of managing and disposing of their radioactive substances, for associated regulation and research and for rectifying environmental damage.**

Fundamental Principle J – Justification of Practices and Interventions

34. **Benefits and detriments arising from practices or interventions involving radioactive substances should be considered to establish whether the practice or intervention is justified.**

5. Generic Developed Principles: Regulatory Assessment

35. We have developed our guidance in the form of "principles" as this is the approach taken internationally by the International Atomic Energy Authority and within the UK by the HSE in relation to the safety of nuclear facilities.

36. Many of the principles in this section are similar to those on the corresponding topics in the HSE SAPs for nuclear facilities [HSE, 2006]. This is because environment protection and nuclear safety often have common goals. Such principles are included in the REPs to make it clear that, when we are consulted by HSE, the basis for our assessment will be aligned with their assessment as the nuclear safety regulator. There are also some instances where there is tension between the requirements for nuclear safety and those for environment protection and there may be differences between the REPs and the SAPs. For all facilities it is particularly important that we adopt a proportionate approach in applying our assessment principles, so that our requirements and expectations are commensurate with the actual and potential impact of such facilities on the public and the environment.

5.1 Management and Leadership for the Environment

37. We consider that management systems and the leadership shown by senior management have key roles in ensuring business and other users use radioactive substances in a way which fully protects people and the environment. In this section we describe how we expect an operator to manage its business and provide that leadership to ensure that the business minimises its impact on people and the environment from the use of radioactive substances. This section covers matters such as the structure of an organisation, how it trains and manages staff, how the senior management provide leadership and direction and how they assess the environmental performance of the business.

38. These principles are based largely on national and international guidance on management and leadership for the safety of nuclear facilities [HSE, 2006; IAEA, 2006a and 2006b]. Although the principles apply to all the organisations that we regulate as radioactive substances activities, the extent to which the detailed considerations apply depends very much on the scale of their use of radioactive substances and/or management of radioactive wastes, and the associated risks. All the considerations are likely relevant at large organisations where the management of radioactive substances and radioactive wastes is a major part of their activities. At organisations where only a few people are involved in the management of radioactive substances and radioactive wastes a much simpler approach will often suffice, providing it achieves compliance with the principles.

MLDP1 – Establishing and Sustaining Leadership and Management

39. **All organisations whose activities might adversely affect people or the environment should establish and sustain effective leadership and management for the environment to ensure that people and the environment are properly protected from adverse effects.**

40. Considerations:

- Prime responsibility for environment protection always falls to the organisation or person responsible for the activities that could give rise to adverse effects. Others (organisations or people) who contribute to or might affect an organisation's environment protection performance should be made aware of their responsibilities.
- Effective management for the environment includes:
  - leadership;
  - capability;
  - decision making; and
  - learning.

MLDP 2 – High Standards of Environment Protection

41. **Directors, managers and leaders at all levels should focus the organisation on achieving and sustaining high standards of protection of people and the environment.**

42. Considerations:

- Focusing the organisation includes:
  - establishing strategies, policies, plans, systems, goals and standards for protection of people and the environment;
  - ensuring that these are delivered throughout the organisation;
  - providing direction and oversight that encourages a strong environment protection culture to underpin operation;
  - visibly demonstrating commitment to environment protection through their activities;
  - recognising and resolving conflict between environment protection and other goals;
  - ensuring that any reward systems promote environment protection;
  - endorsing behaviour that protects people and the environment;
  - challenging behaviour that threatens people or the environment;
  - reinforcing the value of environment protection in interactions with staff, contractors, suppliers, stakeholders and the public;
  - engaging staff at all levels through proper consultation and involvement to secure collective responsibility, personal accountability, shared values and improvement of environment protection;
  - providing training in environment protection goals and methods;
  - supporting oversight of environment protection, led by the management board;
  - securing an effective, preferably integrated, management system throughout the organisation. In general, formal accreditation of management systems should be achieved. An appropriately certified environmental management system will be most effective if it is a component of an integrated management system.

MLDP3 – Capability

43. **Organisations should have the capability to secure and maintain proper protection of people and the environment.**

44. Considerations:

- Capability includes:
  - having sufficient human resources with regard to numbers, skills, competencies and knowledge at all times;
  - having effective processes for assessing, monitoring and maintaining the sufficiency of human resources;
  - having effective processes for assessing all organisational changes, planned and unplanned, that might affect environment protection;
  - having effective processes to secure and maintain the technical, behavioural, managerial, and leadership competencies of all individuals whose performance might affect environment protection;
  - ensuring that all of the individuals who have responsibilities for environment protection have sufficient personal authority, including access to resources, to deliver those responsibilities effectively;
  - having an organisational structure and management system (preferably integrated) that secures effective co-ordination and collaboration by all those directly and indirectly involved in the organisation's activities that might affect environment protection;
  - taking account of factors that affect the reliable performance of organisations when designing organisational structures, jobs, processes and procedures that might affect environment protection;
  - having clear roles, responsibilities, accountabilities, objectives, expectations and performance standards for environmental protection;
  - having effective supervision and oversight of all activities and individuals that might affect the environment;
  - securing and maintaining within the organisation sufficient knowledge and competence about matters relating to environment protection such that:
    a) it understands what proper protection of people and the environment requires and it remains in control of achieving this; and
    b) its ability to do so is not compromised when it uses contractors or others to carry out work or other related activities on its behalf because it maintains itself as an "intelligent customer";
    c) having effective processes for capturing, assessing, interpreting, understanding and communicating plant, system, equipment and process performance and environmental information so that faults, problems and issues that might have adverse affects on the environment are identified early. These processes include having expertise and knowledge of expected and unexpected performance and consequences and arrangements for ensuring that this capability is maintained throughout all stages of facility lifecycle;
    d) having effective processes for knowledge management such that sufficient relevant information is available to those who make decisions that might

affect environment protection. These processes include matters relating to how information is structured and communicated as well as its content;

e) having effective processes for managing (including identifying, updating, validating, approving, preserving and making available) records and documents that are relevant to environment protection.

MLDP4 – Decision Making

45. **Decisions at all levels that might affect environment protection should be rational, objective, timely, transparent and prudent.**

46. Considerations:

- Effective decision making processes should be used for all decisions that might affect the environment. This includes:
  - ensuring a high priority is given to environment protection and is evident in all decisions that might affect the environment;
  - ensuring that an integrated approach is taken, i.e. all relevant matters are taken into account and priorities properly assigned, in decisions where there is conflict or potential conflict between environment protection and any other goals of the organisation (e.g. relating to health, safety, security, quality, economic and commercial matters);
  - ensuring that relevant information, including data and opinion, is sought, considered and used to inform decisions that might affect the environment;
  - evaluating the quality of data and opinions;
  - questioning assumptions;
  - exploring all relevant scenarios of expected and unexpected behaviours and consequences that might affect the environment;
  - considering short and long term implications of decisions;
  - allowing for error, uncertainty and the unexpected and demonstrating a prudent approach;
  - inviting effective active challenge and review of decisions, made at all levels of the organisation, that might affect environment protection.

MLDP5 – Learning from Experience

47. **Organisations should learn from their own and others' experience so as to continually improve their ability to protect the environment**

48. Considerations:

- The organisation's ability to protect the environment includes leadership, capability and decision making.
- Effective processes for learning should be established and sustained by organisations whose activities might adversely affect people and the environment. Effective processes include:
  - active arrangements for gaining, assessing and acting upon information from all relevant sources;
  - sources of information include:
    a) staff at all levels (via e.g. observations, near misses, suggestions, deviation and non-conformance reports) and trade unions;

b) monitoring, review and audit activities relating to strategies, plans, goals, standards, processes, procedures, plant and systems, testing and validation procedures, environmental monitoring, inspections and investigations, non-conformances, incidents and events, and self and external assessments;

c) reviews by external organisations of such matters, including publication of new standards;

d) performance benchmarking with other relevant organisations;

i) is available to those who make decisions that might affect environment protection. These processes include matters relating to how information is structured and communicated as well as its content;
ii) tracking corrective actions arising from learning to ensure that these are implemented and assessing their effectiveness.

5.2 Radioactive Substance Management (including Waste Disposal)

49. In this section we describe in general terms how an operator should manage the radioactive substances it uses including any wastes that it creates, manages and disposes of. We expect operators to have sufficient relevant information about its radioactive substances and a written strategy for their management. We expect an operator to do its best - what we describe more formally as using "best available techniques"- when using radioactive substances to minimise the amount of waste created and disposed of, taking into account costs and benefits. We also describe more specific requirements on issues such as avoiding the production of waste, the storage and disposal of waste, and record keeping.

50. These principles apply to all the organisations that we regulate as radioactive substances activities but the level of detail to which an organisation should be expected to comply with them depends on the scale of the organisation's radioactive substances operations. For example, on a nuclear licensed site a strategy for the management of radioactive substances (principle RSMDP1) may be large and complex and will need to be described in one or more substantial documents (eg an integrated waste strategy (IWS) document). At a small laboratory where small quantities of radioactive substances are used a radioactive substance management strategy can be very simple and described in one or two pages.

Principle RSMDP1 – Radioactive Substances Strategy

51. **A strategy should be produced for the management of all radioactive substances.**

52. Considerations:

- The strategy should ensure that for human health and the environment:
  - An optimal level of protection is achieved and maintained; and
  - That impact and risks have been optimised taking into account all relevant factors including:

    a) Worker and public safety (including radiological risks);

    b) Security;

    c) Technical capability;

d) Burdens on future generations;

e) Precautionary principle;

f) Use of resources;

g) Stakeholder views

h) cost.

- The strategy should be integrated so as to take into account all matters that might have a bearing on the management of radioactive substances. Such matters include:
  - How the creation of radioactive waste will be prevented, and where that is not practicable minimised, including taking opportunities for recycling and reuse, through application of the waste management hierarchy;
  - How the unnecessary introduction of radioactive waste into the environment will be avoided;
  - The requirement that radioactive wastes are safely disposed of, at appropriate times and in appropriate ways;
  - Relevant radiological risk assessments;
  - The requirement that predicted impacts on future generations, including health, will not be greater than relevant levels of impact that are accepted today;
  - The use of the best available techniques to prevent, and, where that is not practicable, generally to reduce emissions and the impact on people and the environment as a whole;
  - All radioactive wastes arisings, including those from operations, decommissioning and site restoration;
  - Actions having irreversible consequences including inadvertent actions;
  - The desire to dispose of waste in near-by facilities, where available, so as to minimise the environmental impact of transport;
  - How the characterisation, segregation and categorisation of wastes will be undertaken;
  - How progressive reductions in discharges will be achieved consistent with the UK Discharge Strategy including identifying any cases needing short term increases in discharges.
  - Constraints imposed by existing facilities and proposed developments;
  - The predicted future pattern of radioactive waste arisings, disposals and discharges;
  - How, during development, a range of appropriate options will be considered, documented and the chosen options substantiated;
  - How and when BAT assessments will be undertaken;
  - The outcomes of BAT assessments;
  - How on site and off site interdependencies, e.g. between processing facilities, have been taken into account;

- That each step in the management of radioactive substances should be compatible with all other steps including pre-treatment, treatment, storage, disposal, handling, and on-site and off-site transport;
- How existing inventories and future arisings of radioactive wastes will be managed to avoid or minimise further processing and secondary wastes;
- How creation of waste, incompatible with current disposal techniques or developing techniques likely to be successful, will be prevented;
- Where wastes have already been produced which are likely to be incompatible with current disposal techniques, how these will be managed and solutions identified or developed;
- How relevant stakeholders will be engaged;
- How uncertainties and risks relating to the achievement of the strategy will be identified and managed;
- The management system for radioactive substances;
- The radioactive properties of the substances including decay and in-growth;
- The non-radioactive properties of the radioactive substances including their physical, chemical and biological properties;
- Anticipated timescales for the management of radioactive substances; and
- Monitoring of radioactive substances and the environment.

- The strategy should seek to be consistent with Government Policy, UK international commitments, and regulatory and other relevant requirements. Any inconsistencies should be identified, explained and justified.
- When developing the strategy a proportionate approach should be adopted taking into account the scale and scope of use of radioactive substances.
- The strategy for the management of radioactive substances should be consistent with all other relevant strategies.
- The strategy should avoid disproportionate adverse environmental effects, for example in terms of use of raw materials or energy, or in the generation of non-radioactive wastes.
- The strategy should be developed as part of the planning stage for new facilities and, for existing facilities, as part of the review of existing plans.
- The strategy should be reviewed periodically and following significant internal and external changes.
- The strategy should be consistent with the operator's policy, principles and objectives with regard to radioactive substances.
- The strategy should set out all relevant information, including:
  - Uncertainties;
  - Risks;
  - Assumptions;
  - Exclusions and
  - Key decision points.

- The strategy should include requirements for its own review for example being reviewed every few years and more often if necessary to take into account:
  - changes in legislation or policy;
  - new facilities and substantial changes to existing facilities;
  - new scientific and technical knowledge;
  - technical developments.

Principle RSMDP2 – Justification

53. **Radioactive wastes shall not be created unless the practice giving rise to the waste has been justified (in advance for new practices).**

54. Considerations:

- The principle of justification can be stated as: "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".
- "Justified" in relation a class or type of practice means justified by its economic, social or other benefits in relation to the health detriment it may cause.
- Under the relevant regulations, Government Departments are responsible for consideration of justification[1] .
- A list of existing justified practices is maintained by Government.
- Justification can be reviewed for existing practices if significant new information about the benefits or detriments of the practice becomes available.

Principle RSMDP3 – Use of BAT to minimise waste

55. **The best available techniques should be used to ensure that production of radioactive waste is prevented and where that is not practicable minimised with regard to activity and quantity.**

56. Considerations:

- Processes creating radioactive materials should be chosen and optimised so as to prevent and where that is not practicable minimise the production of radioactive waste at source over the complete lifecycle of the facility.
- Processes handling, treating or storing radioactive substances should be chosen and optimised so as to prevent or where that is not practicable minimise the production of secondary radioactive wastes over the complete lifecycle of the facility.
- The process of optimisation to minimise the radioactive waste produced should:
  - be done as part of a waste strategy;
  - use option studies, particularly for proposed new facilities or proposed modifications to existing facilities; and
  - use best available techniques.
- Considerations during optimising should include choice of process; design including choice of materials, structures, systems and components; manner of operation

[1] The Justification of Practices Involving Ionising Radiation Regulations 2004. SI 2004 No. 1769.

including supervision, maintenance and training; and manner of commissioning and decommissioning;

- Considerations should also include reuse and recycling of materials and wastes, in accordance with the waste hierarchy.
- Radioactive materials and wastes should be properly contained using the best available techniques so as to avoid spread of radioactivity and contamination of other materials;
- Processes producing radioactive waste should be reviewed at intervals to identify opportunities to further minimise waste production.

Principle RSMDP4 – Methodology for Identifying BAT

57. **The best available techniques should be identified by a methodology that is timely, transparent, inclusive, based on good quality data, and properly documented.**

58. Considerations:

- The process to identify the best available techniques should be carried out by competent, properly informed personnel who have relevant expertise and involve strategic decision makers.
- The resources used in the process to identify the best available techniques should be proportionate to the environmental benefits or potential environmental benefits to be derived.
- The process to identify the best available techniques should be initiated:
  - For new sites or facilities at an early stage when options are being conceived, evaluated and decided on;
  - For existing sites or facilities, when modifications to scope or function are proposed or expected and when options are being conceived, evaluated and decided on;
  - When there are significant reasons to believe that substantially better options might be available;
  - On a periodic basis.
- The process to identify the best available techniques should be transparent such that:
  - The process is properly documented and be capable of review;
  - The decision to be made is clear;
  - The scope of the study is clear and that all boundaries and constraints relevant to the decision to be made are set out;
  - All assumptions are set out plainly, together with the data and basis on which they have been made;
  - Sufficient information is provided to confirm the validity of all data used; and
  - The conclusion arrived at has integrity, i.e. it is rational, equitable and defensible.
- The process to identify the best available techniques should be inclusive such that the extent to which stakeholders are involved reflects:

- The technical and societal significance and human health and environmental implications of the decision;
- The information that stakeholders can bring to the process;
- What the impact on the process and its conclusion might be of a wider range of stakeholder perspectives, established for example through sensitivity studies;
- Whether stakeholder "ownership" of the process is an objective; and
- The need for wider confidence in the process.

- The process to identify the best available techniques should use good data and in particular:
  - All data should be at a level of detail that ensures that it is fit for purpose;
  - Relevant information and data should be identified and considered;
  - Where there is significant uncertainty about the data used this shall be taken account of within the process. Where there is significant uncertainty in key data associated with particular options then it may be appropriate that such options are screened out of further consideration at an early stage or further work to reduce the uncertainty is undertaken or that a range of conclusions are reached dependent on the outcome of such uncertainties.
- The process to identify the best available techniques shall be properly documented such that there is sufficient detail to support the conclusions reached.

Principle RSMDP5 – Actions having Irreversible Consequences

59. **Actions with radioactive substances having irreversible consequences should only be undertaken after thorough, detailed, consideration of the potential consequences of those actions and of the other available options. The best available techniques should be used to prevent irreversible consequences from occurring inadvertently.**

60. Considerations:

- Preference should be given to preventing and minimising releases by concentrating and containing activity rather than by relying on dilution and dispersion of the release, particularly for radionuclides that have long half-lives and accumulate in the environment.
- The best available techniques should be used to prevent releases of radioactive substances being made inadvertently including via leakage.
- Where leakage has occurred, the best available techniques should be used to prevent the migration of activity.

Principle RSMDP6 – Application of BAT

61. **In all matters relating to radioactive substances, the "best available techniques" means the most effective and advanced stage in the development of activities and their methods of operation.**

62. Considerations:

- "Available techniques" means those techniques that have been developed on a scale that allows their implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the UK, as long as they are reasonably accessible to the operator.

- "Best" means the most effective in achieving a high general level of protection of the environment as a whole.
- "Techniques" includes everything that has a bearing on the benefits to be derived, for example:
  - The selection of a process to be used;
  - The design of facilities and systems;
  - The detailed implementation of facilities and systems; and
  - How it is managed, operated and maintained.
- Consideration of what are the best available techniques should be carried out on a case by case basis at each decision point where options exist.
- What is "*the best available techniques*" is specific to the circumstances that exist at each specific decision point. Decisions should be informed by relevant guidance and good practice, wider experience and developments, e.g. at facilities elsewhere.
- A technique will not be BAT if its costs are grossly disproportionate to its environmental benefits. Costs include time, trouble, money and all other resources. All benefits and potential benefits should be taken into account.
- Where a statutory obligation requires stricter conditions and limits than those achievable by the use of BAT, then additional measures should be applied.
- If any benefit or reduction in detriment, however small, can be achieved using few or no additional resources then it should be secured.
- There is no threshold to dose, or any other detriment including environmental risk or contamination, below which no further consideration of what are the best available techniques is required.
- In determining BAT, an operator needs to achieve a balance across safety and environmental, societal and economic issues,

Principle RSMDP7 – BAT to Minimise Environmental Risk and Impact

63. **When making decisions about the management of radioactive substances, the best available techniques should be used to ensure that the resulting environmental risk and impact are minimised.**

64. Considerations:

- Examples of decisions that concern environmental risk and impact include:
  - When specifying the resources and expertise necessary to properly design, construct, commission, operate, maintain and decommission a system, facility or site;
  - Decisions at the detailed design stage, when implementing the option has been determined to be BAT;
  - At the procurement stage, when materials are being specified and purchased;
  - When specifying maintenance schedules,
  - At the operational level, for example when deciding whether a specific batch of aqueous effluent should receive further treatment to reduce activity;
  - During facility perturbations, for example when deciding on actions to return the facility to its usual state or performance.

Principle RSMDP8 – Segregation of Wastes

65. **The best available techniques should be used to prevent the mixing of radioactive substances with other materials, including other radioactive substances, where such mixing might compromise subsequent effective management or increase environmental impacts or risks.**

66. Considerations:

- The requirements of subsequent radioactive substance management steps through to disposal should be considered before mixing radioactive substance streams, including with other materials. Such steps include the ability to store, characterise, retrieve, treat, condition, and dispose.
- Segregation of radioactive substances should be addressed when designing new facilities.
- Mixing of radioactive substances should be prevented where the mixing is with other substances or materials with incompatible physical or chemical properties.
- Mixing of radioactive substances, including with other materials, may be undertaken where this facilitates subsequent management.
- Mixing of radioactive wastes to increase their total volume should only be carried out when it is a stage in the use of the best available techniques to manage the wastes.
- The degree to which wastes that are already mixed should be segregated should be determined as part of the assessment of what are the best available techniques to manage the wastes.

Principle RSMDP9 – Characterisation

67. **Radioactive substances should be characterised using the best available techniques so as to facilitate their subsequent management, including waste disposal.**

68. Considerations:

- Characterisation should provide sufficient information, including physical, chemical, radiological and biological properties and inventory, to properly inform decisions and reports.
- Characterisation is required to properly inform decisions about, for example, design, operation, maintenance and decommissioning of facilities; handling, storage, processing and transport of radioactive substances, and the disposability of wastes.
- Characterisation should be carried out:
  - Where there is a lack of sufficient information or knowledge;
  - Where information might be out of date or properties changed;
  - For quality assurance or checking; and
  - At stages in a process when information can be optimally assessed, for example with regard to minimising measurement uncertainties, or where otherwise information might be lost.

Principle RSMDP10 – Storage

69. **Radioactive substances should be stored using the best available techniques so that their environmental risk and environmental impact are minimised and that subsequent management, including disposal is facilitated.**

70. Considerations:

- This principle applies to radioactive wastes and materials that may become or give rise to radioactive wastes in the future.
- Radioactive substances should be stored in a passively safe state that minimises the need for further treatment. In this state the substances will be:
  - Immobilised in a form that is physically and chemically stable; and
  - Stored in a manner that minimises the need for, control and active safety systems, maintenance and monitoring, and prompt human intervention.
- The arrangements for storage of radioactive substances should take into account the following considerations
  - The planned future use or treatment of the material being stored;
  - The avoidance of leaks to ground or groundwater from the store through, for example, multiple barrier techniques. Where releases of contaminated water are unavoidable, these should be minimised and appropriately managed;
  - The need to avoid or minimise and manage gaseous releases from the store;
  - The need to avoid loss or escape of radioactive substances;
  - The prevention of access to stored substances by any unauthorised persons
  - The need to minimise degradation of the store and the substances stored;
  - The need for facilities to be constructed, maintained and used to minimise contamination and cross-contamination;
  - Stores should avoid being located close to any corrosive, explosive or flammable materials, except where necessary because of a facility's function;
  - The provision of appropriate monitoring , including the ability to inspect both the substances being stored and the storage facility;
  - Appropriate records of stored substances, storage conditions, storage durations, and any changes in these during the storage period; and
  - The ability to retrieve substances.
- Where radioactive wastes are being packaged, the packaging should take account of all relevant requirements including compatibility with handling, retrieval, transport and disposal requirements.
- Where radioactive wastes are being packaged, operators first need to demonstrate that the wastes being packaged will meet anticipated disposal requirements;
- Waste packages should be clearly marked to indicate that they are radioactive, to provide other information necessary for their identification, and to ensure records related to the packages are traceable. Unique marking may be appropriate.

Principle RSMDP11 – Storage in a Passively Safe State

71. **Where radioactive substances are currently not stored in a passively safe state and there are worthwhile environmental or safety benefits in doing so then the substances should be processed into a passively safe state.**

72. Considerations:

- Decisions about whether it is worthwhile to process substances into a passively safe state, and if so when, should take into account:
  - The environmental risk and impact arising from:
    a) The state of existing storage facilities and their anticipated lifetime;
    b) The availability of contingency storage in the event of failure;
    c) The physical stability of the waste and its potential deterioration;
    d) The radiological hazard of the waste;
    e) Reliance on active safety systems, maintenance, monitoring and human intervention; and
  - Security issues;
  - Worker safety;
  - The need for progressive radiological hazard reduction;
  - Uncertainty about the current state of substances and storage;
  - The availability of detailed knowledge about substances and storage arrangements from records and via other means (eg corporate memory);
  - The availability of storage facilities for ongoing arisings;
  - The availability of techniques to retrieve and process the waste, including secondary wastes;
  - The anticipated final disposability of the passively safe waste;
  - Costs, where these are grossly disproportionate to the risks of continuing to store the substances; and
  - The potential that disposal options might be unacceptably foreclosed i.e. the future acceptability of waste made passively safe for the disposal options that might be available.
- Where a number of radioactive substances need to be processed into a passively safe state, the priority should be assessed and the substances processed accordingly. Factors taken into account should include those identified above.

Principle RSMDP12 – Limits and Levels on Discharges

73. **Limits and levels should be established on the quantities of radioactivity that can be discharged into the environment where these are necessary to secure proper protection of human health and the environment.**

74. Considerations:

- Limits and levels should be established on those radionuclides and/or groups of radionuclides which:
  - Are of significance in terms of radiological impact for humans and non-human species, including those which may be taken up in food;

- Are of significance in terms of the quantity of radioactivity discharged;
- Have long half-lives and which may persist and/or accumulate in the environment, and may contribute significantly to collective dose;
- Are significant indicators of facility performance and process control; or
- Provide for effective regulatory control and enforcement.

- The time periods on which limits and levels should be based should be consistent with the intent of the limit or level. Such periods include annual, quarterly, monthly, weekly and daily. The periods may be calendar or rolling.
- Limits and levels may also be set on the total discharge arising from a specific work activity e.g. decommissioning ponds at a power station. The time period for such limits should take into account the project programme.
- Limits and levels should be set on discharges from a site and where appropriate discharges from individual facilities and or groups of facilities on a site. Decisions should be informed by criteria set out in specific guidance in this area.
- Limits should be based on the level of releases achievable through the use of BAT by operators.
- Limits should be set such that there is minimum headroom between actual levels of discharge expected during normal operation and the discharge limit. "Operation" relates to the current activities at a site including commissioning, operations and decommissioning. "Normal" operation includes maintenance and relevant operational fluctuations, trends and events that are expected to occur over the likely lifetime of the facility.
- Where the operations carried out on a site are discontinuous or of varying throughput or output, variable limits and levels may be set to track the operations while continuing to minimise headroom.
- Consistent with the UK Discharge Strategy, progressive reductions in limits and discharges should be sought to achieve its targets and aims by means including:
  - Implementation of new technology or techniques;
  - Process optimisation;
  - Facility closure or replacement; and
  - Decommissioning of legacy facilities.
- In seeking further reduction in discharges it should be recognised that a point is reached where additional costs of those reductions far outweigh the benefits arising from the improvements in the protection of the public or the environment.
- Where the prospective dose to the most exposed group of members of the public is below 10 μSv/yr from the overall discharges of an authorised site, limits should not be further reduced, provided that the operator applies and continues to apply BAT.
- Limits may be increased:
  - To mitigate risks associated with stored historical waste;
  - To deal with wastes arising from facility decommissioning;
  - To enable new justified operations to be established;
  - In the light of experience of operation of new facilities or processes;

- Where a facility's predicted technical characteristics result in an increasing source term e.g. activation and accumulation of carbon-14 in reactor cores;
- For existing facilities or processes, where the best available techniques are being used and there are worthwhile environmental, safety or operational benefits.

- In all cases where an increased discharge limit is being considered operators should be required to make a fully substantiated application. The increased discharge limits should be no greater than is necessary and may be time limited.
- Advisory levels should be set that:
  - Prompt review of whether the best available techniques are being used; and
  - Ensure early assessment of the potential impact of increased discharges.
- Advisory levels should require early reporting of:
  - Operational performance issues leading to increases in discharges; and
  - Events that have given rise to higher than normal short term discharges.
- The process by which limit and levels are determined should be based on a data set of appropriate quality and breadth.

Principle RSMDP13 – Monitoring and Assessment

75. **The best available techniques, consistent with relevant guidance and standards, should be used to monitor and assess radioactive substances, disposals of radioactive wastes and the environment into which they are disposed.**

76. Considerations:

- The operator should use the best available techniques to carry out monitoring and assessment of radioactive substances and disposals of radioactive waste. The objectives are that:
  - Responsibility for carrying out monitoring and assessments is taken by those holding the radioactive substances or making disposals of radioactive waste;
  - The monitoring and assessment is carried out by those who should have the best knowledge of their processes;
  - Ownership of the consequent environmental impact is taken by those making disposals; and
  - Monitoring and assessment is carried out in compliance with relevant requirements and standards including those legally imposed.
- We will ensure that the quality of operator self-monitoring of radioactive substances and radioactive waste disposals is acceptable, requiring the use of Standards, Auditing and Check Monitoring. Our objectives are to:
  - Achieve consistency, robustness, enforceability and safe practices;
  - Ensure adequate standards are being applied through auditing;
  - Provide an independent check of major releases of liquid radioactive effluent to inland and coastal waters and sewers, and gaseous emissions to air and to verify compliance with disposal permits.

- Provide an independent check on the adequacy of operator declarations for radioactivity inventories in disposals of solid waste and on underlying declaration assumptions (eg waste stream “fingerprints”); and
- Verify compliance with regulations and conditions of disposal of solid waste; and
- Provide an independent check on the adequacy of operator monitoring of the environment to verify their arrangements.

- The objectives of the operator’s and our environmental monitoring programmes are to:
  - Enable doses to critical groups to be independently estimated for comparison against legal limits and for operators to assess dose as a performance measure (*monitoring for critical group*);
  - Enable doses to vulnerable reference non-human species to be independently estimated and for operators to assess impact on wildlife as a performance measure (*wildlife monitoring*);
  - Provide reassurance that the radiological impact of authorised discharges of radioactive waste and other transfers of radioactivity into the environment is acceptable (*reassurance monitoring*);
  - Establish background levels of natural radioactivity in the environment (*background monitoring*);
  - Establish baseline conditions of artificial radioactivity in the environment before new discharges (*baseline monitoring)*
  - Identify and characterise land and groundwater contamination (*land contamination monitoring*);
  - Understand / monitor behaviour of radionuclides in the environment – distribution (spatial), dispersion/concentration, changes in environmental behaviour and model validation (*environmental behaviour monitoring*)
  - Provide a long term measure of the state of the environment (*environmental indicator monitoring*); and
  - Investigate incidents or developing scenarios, detect abnormal releases, detect fugitive and unauthorised releases (e.g. non-point source, unexpected, non-predicted) (*investigative monitoring*).
- Monitoring and assessment of the receiving environment should be carried out by the operator to determine the distribution of radioactivity in the environment and its radiological and environmental impact.
- We will retrospectively assess the impact of releases of radioactive substances to the environment to:
  - Provide an independent check on the adequacy of operator monitoring of the environment and their assessment of impact; and
  - Ensure all obligations under Article 35 of the Euratom Treaty are fulfilled.
- We will retrospectively assess the impact of releases of radioactive substances to the environment by:
  - Proportionate check monitoring of environment in the vicinity of sites releasing radioactive substances; and

- Monitoring of the wider environment.

Principle RSMDP14 – Record Keeping

77. **Sufficient records relating to radioactive substances and associated facilities should be made and managed so as: to facilitate the subsequent management of those substances and facilities; to demonstrate whether compliance with requirements and standards has been achieved; and to provide information and continuing assurance about the environmental impact and risks of the operations undertaken, including waste disposal.**

78. Considerations:

- Records relating to radioactive substances and associated facilities include:
  - Those made throughout a site or facility's life-cycle such as:
    a) Management arrangements;
    b) Underlying and ongoing research and development;
    c) Studies, evaluations, strategies and plans; and
    d) Environmental monitoring and assessments;
  - Those made at the stages of a facility's life-cycle such as:
    a) Site evaluation and selection;
    b) Facility design, construction, commissioning and modifications;
    c) Operations and maintenance;
    d) Evaluation of trends and events;
    e) Facility decontamination and decommissioning; and
    f) Site remediation, clearance and release from regulatory control;
  - Those made at relevant stages of the lifecycle, such as waste discharges, disposals and transfers.
- The requirements of all radioactive substance management steps through to disposal should be considered when defining the records to be made and retained. Records are required to properly inform decisions about, for example, sites, design, operation, maintenance and decommissioning of facilities; handling, storage, processing and transport of radioactive substances, remediation of contaminated land and the disposability of wastes.
- The quantity, quality and level of detail of the records made and retained should be such that they are fit for purpose.
- Where there is significant uncertainty about data this should be taken in account in deciding which records to make and retain.
- Records should include details of data uncertainties, in quantitative or qualitative form.
- The manner of retention of the records should ensure that they remain available for all reasonable purposes for which they might be needed.

Principle RSMDP15 – Requirements and Conditions for Disposal of Wastes

79. **Requirements and conditions that properly protect people and the environment should be set out and imposed for disposal of radioactive waste. Disposal of radioactive waste should comply with imposed requirements and conditions.**

80. Considerations:

- The requirements and conditions may be specified in, for example:
  - Permits;
  - Exemption Orders; and
  - Waste receiver conditions for acceptance.
- The intent of the requirements and conditions are to:
  - Protect people and the environment, now and in the future;
  - Comply with legislation;
  - Implement Government policy;
  - Meet international obligations e.g. OSPAR;
  - Implement Environment Agency's policies;
  - Implement relevant principles;
  - Meet the requirements of waste receivers.

- Requirements and conditions may include:
  - Limits on the activity of the waste that can be disposed of;
  - Limits on the volume or mass of waste that can be disposed of;
  - Action levels on the activity of wastes disposed of;
  - Restrictions on the types of waste that can be disposed of;
  - Restrictions on the route by which the waste may be disposed of;
  - Restrictions on the other materials that can be in the radioactive waste;
  - Restrictions on the source of the waste;
  - Restrictions on when waste can be disposed of;
  - Requirements on preventing and/or minimising the quantity and activity of waste created and discharged;
  - Requirements on management systems;
  - Requirements for maintenance of related facilities;
  - Requirements for information reporting;
  - Requirements for keeping and managing records;
  - Requirements for improvements;
  - Requirements for measurements and assessments;
  - Requirements for discharge and environmental monitoring;
  - Requirements on the condition of facilities;
  - Requirements set by waste receivers; and
  - Requirements to retrieve non-compliant wastes transferred to waste receivers.
- Specific requirements for gaseous disposals may include:

- The use of the best available techniques to minimise the activity of waste discharged for example by HEPA filtration, electrostatic filters, charcoal filters, scrubbers, etc;
- The use of the best available techniques to provide good dispersion e.g. location of discharge point, stack design and height, plume buoyancy, exit velocity; and
- The use of the best available techniques to monitor and assess discharges.

- Specific requirements for aqueous liquid disposals may include:
  - The use of the best available techniques to minimise the activity of waste discharged for example by filtration, settling, ion exchange treatment, evaporation and condensation;
  - The use of the best available techniques to provide good dispersion e.g. location of discharge point, of approved routes, timing of tidal discharges; and
  - Controls on pH and temperature, and the use of the best available techniques to minimise oils, solvents, miscible solvents, solids and entrained gases.
- Specific requirements for combustible waste disposals by incineration may include:
  - The use of the best available techniques to remove particulates and water from organic liquids;
  - The use of the best available techniques to minimise the activity of discharges from an incinerator by use of filtration, electrostatic filters, scrubbers, etc;
  - The use of the best available techniques to provide good dispersion e.g. location of discharge point, stack design and height, plume buoyancy, exit velocity; and
  - The use of the best available techniques to monitor and assess waste input and/or discharges.
- Specific requirements for waste disposals by transfer may include:
  - Constraints arising from requirements for transport;
  - Constraints arising from subsequent waste management processes including disposal;
  - Obligations to transport and receive back waste found not to meet specification; and
  - Obligations to transfer information relating to wastes, in appropriate formats.
- Specific requirements for solid waste disposal may include[2]:
  - Package identification requirements;
  - Quality assurance;

[2] For higher activity wastes on nuclear-licensed sites see:
i) HSE, Environment Agency, SEPA (2010). Fundamentals of the management of radioactive waste. An introduction to the management of higher-level radioactive waste on nuclear licensed sites.
ii) HSE, Environment Agency, SEPA (2010). The management of higher-level radioactive waste on nuclear licensed sites. Parts 1, 2 and 3.
These documents are available at http://www.hse.gov.uk/nuclear/wastemanage.htm

- Records and information management;
- Conditioning to agreed specifications including demonstration of compliance of the waste and its packaging with, for example:
    a) Criticality limits on fissile material;
    b) Characterisation of the package including radioactivity content;
    c) Fire resistance;
    d) Voidage limits;
    e) Restrictions on free liquids
    f) Exclusion of compressed gases, explosives and pyrophoric materials;
    g) Mechanical integrity and resistance criteria;

- Evaluation of the long term performance of the waste form for example:
    - Leachability;
    - Potential for gas generation;
    - Potential for cracking;
    - Chemical degradation;
    - Compatibility of the waste with its container and any immobilisation matrix;
    - Use of coupons and non-radioactive analogues to monitor performance;
    - Impact of toxic materials.

5.3 Radiological Protection – People and the Environment

81. In this section we describe the basic principles which underpin how we regulate businesses to protect people and the environment against radioactivity. There are 3 principles, justification, optimisation and compliance with limits. The first ensures that where an activity (or "practice") involves exposure to radiation there is an overall net benefit from that activity. The Government decides which practices are allowed (or "justified"), so setting out the activities or practices that radioactive substances can be used for. Optimisation means users of radioactive substances must do their best to minimise radiation exposure, for example by minimising the amount of radioactive waste discharged - we describe our principles for how an operator can achieve this elsewhere in this document. Lastly, the radiation dose to people arising from their exposure to radioactive substances or wastes must be less than the values set out in law.

82. The following points should be noted in connection with the radiological protection principles.

- The radiological protection principle of justification is covered in the topic areas to which it is most relevant in radioactive substances regulation (see RSMDP2 and CLDP3).
- No references to the International Commission on Radiological Protection (ICRP) are included because this could imply direct acceptance of ICRP recommendations, without scrutiny by the Health Protection Agency, which is the statutory adviser to the UK government on radiological protection standards.
- Specific principles for facilities for the disposal of solid radioactive wastes are given in the GRA document [Environment Agency et al, 2009] and take account of relevant REPs.

Principle RPDP1 – Optimisation of Protection

83. **All exposures to ionising radiation of any member of the public and of the population as a whole shall be kept as low as reasonably achievable (ALARA), economic and social factors being taken into account.**

84. Considerations:

- The ALARA principle should be applied to all aspects of the management of radioactive substances and wastes, including their disposal. This includes the management of radioactively contaminated land (see Section 5.8).
- In the case of disposals of radioactive wastes, compliance with the ALARA principle should be achieved by applying 'best available techniques' (BAT). The scope of BAT assessments should be such that aspects relevant to ALARA are included.
- The requirement to apply the ALARA principle in all our RSR activities stems from the Radioactive Substances (Basic Safety Standards) (England and Wales) Direction 2000 (known as the BSS Direction).

Principle RPDP2 – Dose Limits and Constraints

85. **Radiation doses to individual people shall be below the relevant dose limits and in general should be below the relevant constraints.**

86. Considerations:

- No option for the management of radioactive substances or radioactive wastes shall be pursued if, in normal operation, it would lead to doses above the legal limits. These dose limits are specified in the Ionising Radiations Regulations 1999, to which all the organisations that we regulate as radioactive substances activities are subject, and are referred to in the Regulations. They are given here for completeness.
  - The dose limits for members of the public are: 1 mSv per year effective dose, 15 mSv per year dose to the lens of the eye and 50 mSv per year dose to the skin. The limits do not apply to doses in the event of nuclear accidents or radiological emergencies, to natural background radiation or to medical irradiation.
  - The dose limits for workers over 18 years old are: 20 mSv per year effective dose, 150 mSv per year dose to the lens of the eye and 500 mSv per year dose to the skin. (There are lower limits for trainees and for pregnant women, see the Ionising Radiations Regulations 1999 and their Approved Code of Practice for details.)
- Two dose constraints for members of the public should be used at the planning stage in radioactive discharge regulation. These constraints are given in the BSS Direction and are:
  - 0.3 mSv per year for proposed discharges and direct radiation from any new source;
  - 0.5 mSv per year for discharges from any single site.
- Unless there are exceptional circumstances that make compliance with these constraints impracticable, no option for the management of radioactive substances or radioactive wastes should be pursued if, in normal operation, its associated discharges would lead to doses above them.

Principle RPDP3 – Protection of Non-Human Species

87. **Non-human species should be adequately protected from exposure to ionising radiation.**

88. Considerations:

- The objective generally should be to protect populations of species of flora and fauna, rather than to protect every individual organism except where specified by legislation.
- The approach used to assess the adequacy of protection of non-human species should be that described in R&D Publication 128 and R&D Technical Report P3-101/SP1a [Copplestone et al, 2001 and 2003]. Key species that need protection in appropriate habitats and habitat features should be identified. Dose rates to these species should be estimated using information in the reports and compared to a guideline value of dose rate below which there appears to be no harm to the species at the population level. Our current guideline value is 40 microGray per hour.[3]
- Note that the requirement for "optimisation" (keeping risks as low as reasonably achievable) applies only to radiological risks to people. Other living organisms must be protected from radiological hazards but there is no optimisation requirement.

Principle RPDP4 – Prospective Dose Assessments for Radioactive Discharges into the Environment

89. **Assessments of potential doses to people and to non-human species should be made prior to granting any new or revised permit for the discharge of radioactive wastes into the environment.**

90. Considerations:

- Applicants for new or revised permits should carry out prospective dose assessments and submit these with their applications. The assessments should be for discharges at expected levels and at requested limits.
- In general, the assessments should include doses to people and dose rates to non-human species. The requirement to estimate dose rates to non-human species may be relaxed if it is clear that there is no possibility of significant impact on such species.
- Where necessary, we will carry out our own prospective dose assessment for discharges at our proposed limits.
- Assessments of doses to the public should be consistent with guidance given in 'Principles for the Assessment of Prospective Public Doses'[4] and with guidance produced by the National Dose Assessment Working Group (see www.ndawg.org).
- Doses to individuals (members of critical groups) should be estimated and compared to the appropriate limits and constraints.

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[3] Environment Agency, 2005. *Considerations for Radioactive Substances Regulation under the Radioactive Substances Act 1993 at Nuclear Sites in England and Wales.* (Available at www.environment-agency.gov.uk.)

[4] Environment Agency et al, 2002. *Authorisation of Discharges of Radioactive Waste to the Environment, Principles for the Assessment of Public Doses. Interim Guidance.* (Available at www.environment-agency.gov.uk.)

- Where appropriate, collective doses should be estimated for use in BAT assessments and ALARA studies. Collective doses should be broken down into their components in time, space and, where appropriate, individual dose levels.
- Dose rates to non-human species should be estimated using the approach in [Copplestone et al, 2001 and 2003].
- The level of detail in assessments should be commensurate with the magnitude of anticipated radiological impacts.
- Alternative assessment approaches to those above may be proposed where appropriate and should be considered.
- All assessments should be based on appropriate science and data. Realistic assumptions should be used in assessments unless screening tools are employed.
- In due course, the results of prospective dose assessments should be checked against the results of retrospective dose assessments based on monitoring data where these are available (see RSMDP13).

5.4 Site Evaluation

91. In this section we describe the environmental issues that an operator should consider when choosing a site for a new business or when thinking about expansion of an existing business. This is to ensure that the operator is aware of the nature of the local environment, where people live and work and other relevant issues such as the local production of food, and will take these issues into consideration when proposing such new or changed uses.

92. These principles are relevant to the evaluation of generic and specific sites proposed for new nuclear facilities and other facilities where radioactive substances are used. They are also relevant to the evaluation of the continued suitability of sites throughout the construction and operation of nuclear and other facilities. In the case of major new facilities, site evaluation will often be part of a wider site-specific or strategic environmental impact assessment and planning process. Further guidance on the evaluation of sites proposed for new disposal facilities for solid radioactive wastes is given in the guidance on requirements for authorisation (GRA) documents [Environment Agency et al, 2009].

Principle SEDP1 – General Principle for Siting of New Facilities

93. **When evaluating sites for a new facility, account should be taken of the factors that might affect the protection of people and the environment from radiological hazards and the generation of radioactive waste.**

94. Considerations:

- The factors to be taken into account include:
  - the locations and habits of people, especially those likely to be most exposed as a result of releases of radionuclides into the environment from the facility (potential critical groups);
  - the locations where terrestrial, freshwater and marine foodstuffs are produced and obtained;
  - the locations of surface and underground water supplies used by people and animals and the vulnerability of those water supplies;
  - the potential effects of coastal erosion and sea level rise;

- the presence of radioactively contaminated land or groundwater;
- the locations of land and water bodies used for recreational and amenity purposes;
- the locations of non-human species and protected habitats and habitats features, including designated and candidate European and Ramsar sites;
- the locations of sites of special scientific interest (SSSIs), areas of outstanding natural beauty and areas of significance to cultural heritage.

Principle SEDP2 – Migration of Radioactive Material in the Environment

95. **Data should be provided to allow the assessment of rates and patterns of migration of radioactive materials in the air and the aquatic and terrestrial environments around sites.**

96. Considerations:

- The applicant should provide the necessary data for sites for new facilities.
- The data provided should be sufficient to allow prospective dose assessments to be carried out (see RPDP4).
- For radionuclide dispersion in air, the information provided should include meteorological data for the area in which the site is located (eg wind speeds and directions, air temperatures, precipitation rates, atmospheric stability parameters), and variations in these data arising from local topography (eg hills, buildings).
- For the marine environment, the information provided should include hydrological, physical and physico-chemical data for modelling the movement of radionuclides in seawater, suspended sediments and seabed sediments.
- For surface freshwater bodies, the information should include hydrological, physical and physico-chemical data needed for modelling the movement of radionuclides in water, suspended sediments and bed sediments.
- For soils and rocks, the information should include geological, hydrogeological and geochemical data needed to model radionuclide movement in near-surface and deeper groundwater.
- For all environments, concentration factors or other transfer parameters should be given to enable the assessment of radionuclide movement through food chains and radionuclide concentrations in relevant non-human species.
- Information on the presence of non-radioactive pollutants should be provided if these pollutants are likely to affect radionuclide movement through food chains and other ecosystems.

Principle SEDP3 – Ambient Radioactivity

97. **Levels of ambient radioactivity around the sites of new facilities should be assessed.**

98. Considerations:

- Information about ambient levels of natural and artificial radioactivity should be used to estimate pre-existing doses to people and dose rates to non-human species. These estimates should be part of the input to the assessment of the radiological impact of the new facility on people and the environment. The estimates of pre-existing doses from authorised discharges should be used in the determination of regulatory limits and levels for the new facility (see RSMDP12).

- The information should be used as a baseline for further investigations and monitoring of the effects of the new facility during its operational life.
- Radioactivity levels in all the relevant parts of the environment should be determined (air, surface waters and their sediments, soils, groundwaters, fauna and flora).
- Radionuclides of natural and artificial origin should be included and distinguished where practicable.

Principle SEDP4 –Multi-Facility Sites

99. **In the case of nuclear and other sites on which there are already one or more facilities, the radiological impact of the whole site on people and the environment should be assessed when considering the suitability of the site for any new facility.**

100. Considerations:

- Assessments of future radiological impacts of sites should include on-going and new operations at existing facilities and, if relevant, their decommissioning.
- The potential for existing facilities and shared services to affect the radiological impact of the new facility should be assessed.
- If there are or will be different operators on the same site or on adjacent sites, formal mechanisms for co-operation between operators should be established and demonstrated to regulators.

Principle SEDP5 – On-Going Evaluation

101. **The characteristics of the site and its surrounding area should be kept under review and assessments made of the effects of natural and man-made changes.**

102. Considerations:

- The relevant changes are any that could affect the radiological impact of the site on people and the environment, eg changes in land use (such as introduction of different agricultural practices), changes in the habits of actual or potential critical groups, introduction of new non-human species, changes in weather patterns.
- The operator should make arrangements with relevant stakeholders to be informed about changes and, if appropriate, consulted about proposed changes. In particular, the operator should arrange with local planning authorities to be consulted about proposed changes in land use.
- The operator should maintain and update databases of dispersion and other radiological impact assessment parameters for the sites of existing facilities, and notify us when changes are made to these databases.

5.5 Engineering Principles

103. In this section we describe the standards we expect an operator to use when designing and operating its plant – “engineering principles”. These cover matters such as the design and commissioning of a plant, its mechanical and electrical parts and its control systems and monitoring instrumentation. In these matters we expect the operator to use what are the established, recognised, good standards across the industry – “relevant good practice” or “best available techniques” – and to achieve a high degree of performance and reliability.

104. The engineering principles are based on those in the HSE SAPs but are focused on environment protection. The opportunity has also been taken to simplify and consolidate many of the engineering principles in the SAPs [HSE, 2006]. The principles are intended to be applicable to all the nuclear and non-nuclear facilities that we regulate as radioactive substances activities, but the level of detail in which facilities should be expected to comply depends on the scale of radioactive substances operations. For example, at nuclear facilities many or all the considerations will apply but at small laboratories fewer will be relevant. We expect that our assessments of compliance with the engineering principles will be able to be carried out largely through examination of safety cases prepared by operators for other purposes (eg for submission to HSE), rather than by requiring operators to prepare other documents.

Principle ENDP1 – Inherent Environmental Protection

105. **The underpinning environmental aim for any facility should be that the design inherently protects people and the environment, consistent with the operational purpose of the facility.**

106. Considerations:

- An inherently safe environmental design is one that avoids radiological hazards to people and the environment rather than controlling them.
- The principle applies to both routine operations and emergency situations.

Principle ENDP2 – Avoidance and Minimisation of Impacts

107. **Radiological impacts to people and the environment should be avoided and where that is not practicable minimised commensurate with the operations being carried out.**

108. Considerations:

- Best available techniques should be employed to avoid, and where this is not practicable minimise, radiological impacts to people and the environment, either as a consequence of routine discharges or for those discharges resulting from an emergency (accident) situation.
- The inventory of radiologically harmful substances should be reduced to the minimum necessary while still maintaining the required function of the facility.
- The physical state of radiologically harmful substances should be controlled and managed to minimise their potential impacts to people and the environment.

Principle ENDP3 – Defence in Depth

109. **A facility should be designed as to allow for defence in depth against the occurrence of radiological impacts to people and the environment.**

110. Considerations:

- During any normally permissible state of a facility no single random failure should prevent the delivery of an environment protection function.
- Environment protection measures should be independent of each other, and the number of levels of protection should depend on the consequences of failure and the magnitude of the radiological impacts to people and the environment.
- Redundancy, diversity and segregation should be incorporated as appropriate within the design of environment protection measures.

- Common cause failure (CCF) should be explicitly addressed where an environment protection measure employs redundant or diverse components, measurements or actions to provide high reliability.
- Where required reliabilities cannot be achieved due to CCF considerations, the required environment protection function should be delivered taking account of the concepts of diversity and segregation, and by providing at least two independent environment protection measures.

Principle ENDP4 – Environment Protection Functions and Measures

111. **Environment protection functions under normal and fault conditions should be identified, and it should be demonstrated that adequate environment protection measures are in place to deliver these functions.**

112. Considerations:

- An environment protection function is a function that is necessary to a facility for the avoidance and/or minimisation of radiological impacts to people and the environment. Examples of environment protection functions are: 'minimisation of gaseous discharges of radioactive wastes from vessel x during normal operations'; and 'prevention of liquid releases of radioactive waste during fault condition y'.
- The identification of environment protection functions should be based on an analysis of all potential events (faults) which could lead to radiological impacts to people and the environment, and consider all planned routine releases of radioactive waste to the environment and the release points.
- Support services and facilities necessary for the delivery of an environment protection function should be designed and routed such that, in the event of an incident there is sufficient capability to maintain their performance.
- Environment protection measures that are employed to deliver each environment protection function should be identified. Examples of environment protection measures are particulate filters in gaseous discharge lines and liquid effluent treatment plants.
- Environment protection measures should be included for both accidental and routine releases.
- The availability and reliability of the environment protection measures should be commensurate with the significance of the radiological impact to people and the environment to be managed.
- Unauthorised access to or interference with environment protection measures and with related structures and components, should be prevented.
- The introduction of administrative environment protection measures should also be considered where appropriate.
- There should be measures in place to mitigate the consequences of any fault where radioactivity is released to the environment from its intended containment, but these measures should not be regarded as a substitute for fault prevention.
- The method for assessing environment protection measures should take into account:
    - the consequence of failing to deliver the appropriate environment function;
    - the extent to which the function is required, either directly or indirectly, to prevent, protect against or mitigate the consequences of initiating faults;

- the potential for a functional failure to initiate a fault or exacerbate the consequences of an existing fault;
- the likelihood that the measure will be called upon; and
- the time following any initiating fault at which, or the period throughout which, it will be called upon to operate.

- Passive environment protection measures that do not rely on control systems, active systems or human intervention are preferable to active measures.
- Automatically initiated active engineered environment protection measures are preferable to manually initiated measures.
- Environment protection measures that need to be manually brought into service should be considered only if passive and/or automatic measures are impractical.
- There should be substantiation that environment protection measures deliver environment protection functions. Where appropriate this should be carried out by setting limits or levels and demonstrating compliance with them.

Principle ENDP5 – Human Factors

113. **Human actions should be taken into account in the design of a facility and in operating procedures.**

114. Considerations:

- A systematic approach should be taken to identifying human actions that can impact on the delivery of an environment protection function.
- When designing measures to deliver an environment protection function, the allocation of actions between humans and technology should be substantiated and dependence on human action to maintain a benign state should be minimised.
- The actions of personnel responsible for monitoring and controlling the facility both in normal operations and responding to faults, and of personnel carrying out maintenance, testing and calibration activities, should be defined. This includes consideration of the impacts of engineers, analysts, managers and other staff who may not interact directly with plant and equipment.
- Administrative controls used to deliver an environment protection function should be systematically identified. The design of these controls should be such that the requirements for action by personnel are clearly identified and unambiguous to those responsible for their implementation.
- An analysis should be carried out of tasks important to delivering an environment protection function to determine demands on personnel in terms of perception, decision making and action.
- The workload of personnel required to fulfil environment protection functions should be analysed and demonstrated to be reasonably achievable.
- User interfaces, comprising controls, indications, recording instrumentation and alarms should be provided at appropriate locations and should be suitable and sufficient to support effective monitoring and control of the facility during all facility states.
- The user interface should:

- enable the operator to determine facility states and the availability and status of equipment, and provide conspicuous early warning of any changes in facility state;
- provide the means of confirming environmental challenges and identifying, initiating and confirming necessary actions;
- support effective diagnosis of deviations; and
- enable the operator to determine and execute appropriate system actions, including actions to overcome failures of automated systems or to reset a system after its operation.

- Procedures should be produced to support reliable human performance during activities that could impact on the delivery of an environment protection function.

Principle ENDP6 – Engineering Codes and Standards

115. **Environment protection measures should be designed, manufactured, constructed, installed, commissioned, quality assured, maintained, tested and inspected to the appropriate standards.**

116. Considerations:

- The standards should reflect the reliability requirements of structures, systems and components and be commensurate with their environment protection function.
- Appropriate national or international codes and standards should be adopted for structures, systems and components, with a preference for international standards where available.
- The codes and standards should be evaluated to determine their applicability, adequacy and sufficiency and should be supplemented or modified as necessary to a level commensurate with the importance of the environment protection function(s) being performed.
- Where there are no appropriate established codes or standards, an approach derived from existing codes or standards for similar equipment, in applications with similar significance, may be applied. Alternatively, the statistical results of experience, tests, analysis, or a combination thereof, should be applied to demonstrate that the item will perform its environment function(s) to an appropriate level.

Principle ENDP7 – Reliability

117. **A facility should be so designed and operated that the environment protection measures are reliable.**

118. Considerations:

- The reliability claimed for any environment protection measure in preventing or minimising radiological impacts to people and the environment should take into account its novelty, the experience relevant to its proposed environment, and the uncertainties in operating and fault conditions, physical data and design methods.
- Adequate reliability and availability for environment protection measures should be demonstrated by suitable analysis and data.
- Where reliability data is unavailable, the demonstration should be based on a case-by-case analysis and include:
  - a comprehensive examination of all the relevant scientific and technical issues;

- a review of precedents set under comparable circumstances;
- a periodic review of further developments in technical information, precedent and best practice.

- Where data are shown to be inadequate, appropriate steps should be taken to ensure that the onset of failure of any environment protection measure can be detected, and that the consequences of failure are minimised. This may include replacing the component after a fixed lifetime, or dependent on inspection results.

Principle ENDP8 – Ageing and Degradation

119. **The working life of an environment protection measure that is intended to deliver an environment protection function should be assessed to ensure that the measure will be effective during its intended lifetime.**

120. Considerations:

- Particular attention should be given to the evaluation of those components that are judged to be difficult or impracticable to replace.
- There should be an adequate margin between the intended operational life and the predicted working life of such structures, systems and components.
- Programmes for monitoring, inspection, sampling, surveillance and testing, to detect and monitor ageing and degradation processes, should be used to verify assumptions and assess whether the margins will be adequate for the remaining life of the structure, system or component.

Principle ENDP9 – Fault Sensitivity

121. **The sensitivity of the facility to potential faults that could have radiological impacts to people and the environment should be minimised.**

122. Considerations:

- Ideally, environment protection measures should have no unsafe failure modes.
- Any failure, process perturbation or mal-operation in a facility should ideally produce a change in facility state towards a benign condition, or produce no significant response.
- If the change is to a less benign condition, then systems should have long time constants such that key parameters deviate only slowly from their desired values.

Principle ENDP10 – Quantification of Discharges

123. **Facilities should be designed and equipped so that best available techniques are used to quantify the gaseous and liquid radioactive discharges produced by each major source on a site.**

124. Considerations:

- Discharge routes should be provided with suitable means to measure any release of radioactive substances from the facility to the environment, whether the release is routine or accidental.
- Wherever practicable, discharge monitoring should occur prior to release into the environment.
- Where several discharge routes come together before the point of release to the environment there should be means of monitoring or assessing each route so that

the contributions from various sources to discharges to the environment can be quantified.

- Within each facility there should be means to provide early warning of states that could lead to discharges above normal levels for that facility.

Principle ENDP11 – Maintenance, Inspection and Testing

125. **Structures, systems and components that are, or comprise part of, environment protection measures should receive regular and systematic examination, inspection, maintenance and testing.**

126. Considerations:

- Requirements for in-service testing, inspection and maintenance procedures for environment protection measures, and the frequencies of such tests etc., should be identified prior to initial operation, and at regular intervals thereafter.
- Appropriate facilities and locations should be provided within the facility to conduct any required maintenance, tests etc.
- Radioactive waste management procedures should be put in place to deal with the expected arisings of waste during maintenance operations.
- For components of particular concern and where it is not possible to confirm the ability to operate under the most onerous design conditions, reference data from commissioning or rig testing should be established for comparison against in-service test results.
- Commissioning and in-service inspection and test procedures should be adopted that ensure initial and continuing quality and reliability.
- Inspection should be of sufficient extent and frequency to give adequate confidence that degradation will be detected before loss of the environment protection function.
- Where test equipment, or other engineered means, are claimed as part of in-service or periodic testing, maintenance, monitoring and inspection provisions, the extent to which they reveal failures affecting environment protection functions should be justified. The test equipment, or other engineered means, should be tested at intervals sufficient to uphold the reliability claims of the equipment within which it is claimed to reveal faults.
- Where practicable maintenance, inspection and testing should be carried out as part of normal operations and it must be possible to carry out these tests without the loss of any environment protection function.
- Structures, systems and components that are, or comprise part of, environment protection measures, should be inspected and/or re-validated after any internal or external event that might have challenged their design basis.

Principle ENDP12 – Commissioning

127. **Before operating any facility or process, commissioning tests should be defined and carried out to demonstrate that, as built, the facility or process will be capable of delivering the environment protection functions.**

128. Considerations:

- Radioactive substances should not be generated on the facility, or brought onto the facility, unless and until sufficient and suitable arrangements are available for their containment and management.

- Commissioning tests should endeavour to identify any errors made during the design, manufacture, or construction/installation stages.
- Commissioning tests and inspections should:
  - confirm the facility's design assumptions and predicted performance in relation to the environment protection functions;
  - characterise the facility as a basis for evaluating its behaviour during its operational life. The analysis should be reviewed in the light of the results of the commissioning programme and of any modifications made to the design or intended operating procedures since the commencement of construction.
- The tests should be divided into stages such as to complete as much inactive testing before the introduction of any radioactive substances. Inactive testing should demonstrate that the facility has been constructed, manufactured, and installed correctly.
- Inactive testing should also be used to confirm the operational features of the facility and to develop the operating instructions, which should then be confirmed as adequate during active commissioning.

Principle ENDP13 – External and Internal Hazards

129. **External and internal hazards that could affect the delivery of an environment protection function should be identified and the best available techniques used to avoid or reduce any impact.**

130. Considerations:

- For each type of external hazard, either facility specific (or if this is not appropriate, best available relevant), data should be used to determine the relationship between event magnitudes and their frequencies.
- For each internal or external hazard that cannot be excluded on the basis of either low frequency or insignificant consequence, a design basis event should be derived.
- Analyses should take into account that:
  - certain internal or external hazards may occur simultaneously or in a combination that can reasonably be expected;
  - an internal or external hazard may occur simultaneously with a facility fault, or when the facility is not available due to maintenance;
  - where there is a significant potential for internal or external hazards to act as initiators of common cause failure, including loss of off-site power and other services;
  - internal and external hazards which have the potential to threaten more than one level of defence in depth at once;
  - internal hazards (eg fire) which could arise as a consequence of faults internal or external to the site and which should therefore be included in the relevant fault sequences; and
  - the severity of the effects of the internal or external hazard experienced by the facility may be affected by facility layout, interaction, and building size and shape.

- The on-site use, storage or generation of radioactive substances should be controlled and located so that any accident to, or release of, the substances will not jeopardise delivery of an environment protection function.
- Sources that could give rise to hazards such as fire, explosion, missiles etc. should be identified, specified quantitatively, and their potential as a source of radiological impact to people and the environment assessed. This identification should take into account:
  - projects and planned future developments on and off the site;
  - the adequacy of protection of the environment from the effects of any incident in an installation, means of transport, pipeline, power supplies, water supplies etc either inside or outside the facility; and
  - that sources could be either on or off the site.

Principle ENDP14 – Control and Instrumentation - Environment Protection Systems

131. **Best available techniques should be used for the control and measurement of plant parameters and releases to the environment, and for assessing the effects of such releases in the environment.**

132. Considerations:

- Environment protection systems should be established to ensure, during normal and fault conditions, that environment protection measures are operating correctly. An environment protection system is any integrated system of environment protection measures, associated instrumentation and controls, communications, and relevant instructions and computer software.
- Adequate provisions should be made to enable the monitoring of the facility state in relation to protection of people and the environment, and to enable the taking of any necessary actions.
- Adequate provisions should be made to enable environmental monitoring (to measure the impact of facility discharges).
- Variables used to initiate an environment protection system action should be identified and shown to be sufficient for the purpose of avoiding or minimising radiological impacts to people and the environment. The limiting conditions for those variables for which the environment protection system has been established should be specified. The system should be designed to respond such that these limiting conditions are not transgressed.
- The system should employ diversity in the detection of fault sequences, preferably by the use of different variables, and in the initiation of the environment protection system.
- An environment protection system should be automatically initiated and, normally, no human intervention should be necessary following the start of a requirement for protective action. Where human intervention is necessary, then the time before such intervention is required should be demonstrated to be sufficient.
- The capability of an environment protection system, and of each of its constituent sub-systems and components, should be defined. The capability should exceed by a clear margin the maximum service requirement(s).The selected margin should make due allowance not only for uncertainties in facility characteristics, but also for the effects of foreseeable degradation mechanisms.

- Adequate provision should be made to prevent the infringement of any service requirement of an environment protection system, its sub-systems and components.
- Environment protection system actions and associated alarms should not be self-resetting, irrespective of the subsequent state of the initiating fault.
- An appropriate alarm philosophy should be applied such that where large numbers of alarms are generated by an event, alarm masking and flooding is avoided.
- No means should be provided, or be readily available, by which the configuration of an environment protection system, its operational logic or the associated data may be altered, other than by specifically engineered and adequately secured maintenance/testing provisions used under strict administrative control.
- The interfaces required between an environment protection system and the facility to detect a fault sequence and bring about a benign facility state should be engineered by means that have a direct, known, timely and unambiguous relationship with facility behaviour.
- Where practicable, the design of an environment protection system should avoid complexity, apply a fail-safe approach and incorporate a means of revealing internal faults from the time of their occurrence.
- An environment protection system should avoid spurious operation at a frequency that might directly or indirectly degrade its performance.
- In determining environment protection system provisions, allowance should be made for the unavailability of equipment. The minimum amount of operational environment protection system equipment for which any specified facility operation will be permitted should be defined and shown to meet the (no) single failure principle.
- The vetoing or the taking out of service of any environment protection system should be avoided. Where such action is proposed, each need should be justified and the adequacy of its implementation demonstrated. In an environment protection system comprising several redundant or diverse sub-systems no single action should affect more than one sub-system.
- Where the system reliability is significantly dependent upon the performance of computer software, the establishment of and compliance with appropriate standards and practices throughout the software development life-cycle should be made, commensurate with the level of reliability required, by a demonstration of ‘production excellence’ and ‘confidence-building’ measures.
- Suitable and sufficient environment protection system control and instrumentation should be available to the facility operator at appropriate locations within the facility.
- The reliability, accuracy, stability, response time, range and, where appropriate, the readability of instrumentation should be adequate for its required service.
- Adequate and reliable controls should be provided to maintain variables within specified ranges.
- The minimum control and instrumentation for which facility operation may be permitted should be specified and its adequacy substantiated.
- Environment protection system control and instrumentation should be operated from power supplies for which reliabilities and availabilities are consistent with the functions being performed.

- Adequate communications systems should be provided to enable information and instructions to be transmitted between locations and to provide external communications with auxiliary services and such other organisations as may be required.
- Control systems should respond in a timely and stable manner to normal facility disturbances without causing demands on environment protection systems.

Principle ENDP15 – Mechanical Containment Systems for Liquids And Gases

133. **Best available techniques should be used to prevent and/or minimise releases of radioactive substances to the environment, either under routine or accident conditions.**

134. Considerations:

- The primary means of confining radioactive substances should be by the provision of passive sealed containment systems in preference to the use of active dynamic systems and components.
- Where appropriate, containment design should:
  - define the containment boundaries with means of isolating the boundary;
  - establish a set of limits for the containment systems and for individual structures and components within each system;
  - define the requirements for the performance of the containment in the event of a severe accident as a result of internal or external hazards, including its structural integrity and stability;
  - include provision for maintaining the facility in a benign state following any incident involving the accidental release of radioactive substances within or from a containment, including equipment to allow decontamination and post-incident re-entry to be safely carried out;
  - minimise the size and number of service penetrations in the containment boundary, which should be adequately sealed to reduce the possibility of radioactive substances escaping from containment via routes installed for other purposes;
  - avoid the use of ducts that need to be sealed by isolating valves under accident conditions. Where isolating valves and devices are provided for the isolation of containment penetrations, their performance should be consistent with the required containment duties and should not prejudice adequate containment performance;
  - provide discharge routes, including pressure relief systems, with treatment system(s) to minimise releases of radioactive substances. There should be appropriate treatment or containment of the fluid contained within it, before or after its released from the system;
  - define the performance requirements of containment systems to support maintenance activities;
  - demonstrate that the loss of electrical supplies, air supplies and other services does not lead to a loss of containment nor the delivery of its environment function; and

- demonstrate the control methods and timescales for re-establishing the containment conditions where access to the containment is temporarily open (eg during maintenance work).

- Containment systems should be designed such as to make provision for the segregation of different waste streams. This applies to vessel inputs as well as the vessels themselves.
- Should a pressure relief system operate, the performance of the containment should not be degraded.
- Where the environmental challenge dictates, waste storage vessels, process vessels, piping, ducting and drains (including those that may serve as routes for escape or leakage from containment) and other items that act as containment for radioactive substances, should be provided with further containment barrier(s) that have sufficient capacity to deal safely with the leakage resulting from any fault.
- Suitable monitoring devices with alarms, and provisions for sampling, should be provided to detect and assess changes (eg level, volume, concentration) in the stored radioactive substances.
- Appropriate sampling and monitoring systems and other provisions should be provided outside the containment to detect, locate, quantify and monitor leakages of radioactive substances from the containment boundaries under normal and accident conditions.
- Where provisions are required for the import or export of radioactive substances into or from the facility containments, the number of such provisions should be minimised.

Principle ENDP16 – Ventilation Systems

135. **Best available techniques should be used in the design of ventilation systems.**

136. Considerations:

- Where a ventilation system is deemed necessary, it should include appropriate treatment systems to remove and collect airborne radioactive substances prior to discharge of the cleaned gas stream to the environment. Such systems may include particulate filtration, scrubbers and cyclones where appropriate.
- Where appropriate, ventilation systems should include the following:
  - means for control of the dispersal, and reduction of the concentration, of airborne activity within the process plant and in aerial discharges;
  - segregation and isolation to protect against internal and external hazards and to prevent the mixing of ventilation streams of different hazard potentials, eg explosive, toxic and radioactive. Such hazards should be managed to avoid compounding the harm potential;
  - facilitating, where appropriate, permanent or temporary access to facility zones without impairing the performance of the ventilation system;
  - accounting for effects of wind velocity and potential air pressure fluctuations caused by nearby structures, discharges from other facilities and extreme weather conditions;
  - facilities enabling removal and reinstatement of ventilation equipment for maintenance and replacement purposes.

- qualification of ventilation systems in terms of their environment function and appropriate selection of materials and equipment for the required design life.
- minimising the total airflow through the system from inlet to discharge to reduce the requirement for disposal of filters, while retaining a safe atmosphere, airflow velocities, pressure differences and other features of the design.

- The location of ventilation filters should minimise the dose rates to the general public.
- The design should provide for monitoring and testing of ventilation systems and associated filters and gas treatment systems to ensure that they continue to meet the design requirements. This should include provision of appropriate alarm/control systems on key facility parameters.

Principle ENDP17 – Civil Engineering

137. **It should be demonstrated that structures which are, or comprise part of, environment protection measures are sufficiently free of defects such that the relevant environment function(s) is not compromised, that identified defects are tolerable, and that the existence of defects that could compromise the environment protection function can be established throughout their life-cycle.**

138. Considerations:

- Consideration should be given to groundwater conditions, contamination conditions and soil dynamic properties at the design stage of a facility.
- The design of embankments, natural and excavated slopes, river levees and sea defences close to a facility should be such so as to prevent or minimise the release of radioactive substances to the environment.
- The design should be such that the facility remains stable against possible changes in the groundwater conditions.
- The design should take account of the possible presence of underground structures such as tunnels, trenches and basements.

Principle ENDP18 – Essential Services

139. **Best available techniques should be used to ensure that loss of essential services does not lead to radiological impacts to people or the environment.**

140. Considerations:

- Services need to be provided for a sufficient period of time to allow the facility to be brought to a benign state and maintained in that state until such time as the normal supply is restored.
- Where a service is obtained from a source external to the facility, that service should also be obtainable from a back-up source within the facility. Each back-up source should have the capacity, duration, availability and reliability to meet the maximum requirements of its dependent systems.
- Where essential services are shared with other facilities on a multi-facility site, the effect of the sharing should be taken into account in assessing the adequacy of the supply.
- Protection devices provided for essential service components or systems should be limited to those that are necessary and that are consistent with facility requirements.

- Where a source external to the facility is employed as the only source of the essential services needed to provide adequate protection then, where practicable, the specification, availability and reliability should be the same as for an internal source.
- Essential services should be designed such that the simultaneous loss of both normal and back-up services will not lead to radiological impacts in the environment.

5.6 Emergency Preparedness and Response

141. The permits we issue under the Regulations for non-nuclear facilities contain conditions that require the permit-holder to have and maintain an accident management plan. We are a consultee under Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) for emergency plans prepared by operators of nuclear sites and some non-nuclear sites, carriers of radioactive materials, and local authorities. HSE is the enforcing authority for REPPIR, has a role of coordination and, if required, is the arbiter of what should go into an emergency plan for nuclear sites. We may also be asked about contingency plans prepared under the Ionising Radiations Regulations 1999 and under other relevant provisions. These principles are intended to assist us in these regulatory, consultative and advisory roles. They are to be applied in a way that is commensurate with the scale of anticipated accidents at the facility being considered. Guidance on emergency preparedness and response includes IAEA Documentation such as GS-R-2, and the UK's Nuclear Emergency Planning Liaison Group guidance on Emergency Preparedness, Response and Recovery.

Principle EPRDP1 – Facility Design

142. **The design of a facility, in terms of layout, construction, communications and infrastructure, should be such that response arrangements can be enacted in the event of an emergency.**

143. Considerations:

- Although facility design and operation should be carried out so as to prevent accidents, the potential impact of reasonably foreseeable accidents should be assessed and provision should be made, at the design stage, for adequate response to relevant accidents and emergencies. Such provision should include consideration of:
  - access roads (both internal and external) for emergency vehicles;
  - communications;
  - storage and deployment of emergency equipment;
  - services for use in an emergency (eg secure electricity supplies, firewater, emergency lighting, vehicle fuel);
  - storage of wastes arising from an accident;
  - drainage for fire-water runoff;
  - instrumentation to detect, and subsequently monitor the progress of, an emergency situation;
  - the need for environmental monitoring.
- This design principle should be borne in mind when considering the other principles throughout this document, and in particular the Engineering Principles (see Section 5.5).

Principle EPRDP2 – Emergency Plans

144. **Emergency plans should be prepared and should take due account of the need to protect the environment.**

145. Considerations:

- Emergency plans should be developed at the design stage for a new facility, taking into account the considerations in EPRDP1.
- At nuclear-licensed sites and at other sites where REPPIR apply, emergency plans should meet the requirements of the REPPIR.
- Emergency plans should be regularly reviewed and updated. Reviews and updates should also be carried out following any accident or 'near miss'.
- Emergency plans should be informed by fault analysis.
- Emergency plans should take into account the need for interventions to protect the environment.
- Emergency plans should be regularly tested to ensure that they are suitable for preventing and / or mitigating the radiological impacts to people and the environment.
- Personnel who have emergency response responsibilities should be properly trained, and the training refreshed at suitable intervals;
- Where we are expected to provide assistance or cooperation in an emergency we should be consulted about the plans in advance.

Principle EPRDP3 – Remediation

146. **Arrangements should be put in place to ensure that environmental remediation, post-accident, can be carried out quickly and safely.**

147. Considerations:

- Planning for emergencies should include a consideration of the likely environmental impacts of an accident and so the likely scope of remediation requirements; eg contamination of off-site buildings, land and water.
- Resources (trained personnel and equipment) for the characterisation and remediation of these impacts should be identified as part of the emergency planning process.

5.7 Decommissioning

148. In this section we describe the principles that we will use to assess operators' proposals for decommissioning their plants - so as to minimise the amount of radioactive waste to be disposed of. We would expect an operator to have decommissioning strategy and plan to show how he will achieve this aim.

149. The principles for decommissioning relate to all sites and facilities where radioactive substances have been used and where radioactive wastes will arise during demolition or redevelopment. They do not apply to disposal facilities for solid radioactive wastes that are being 'closed' (ie where the wastes are to remain in place), rather than 'decommissioned' (ie where the wastes are to be removed). The principles are derived from national policy and international guidance for decommissioning of nuclear facilities [DTI, 2004; IAEA, 2006c]. They should be applied in a way that is proportionate to the risks and hazards posed by the sites and facilities. For example, the decommissioning strategy for a nuclear site (principle DEDP1) is likely to be complex and should be

developed with appropriate stakeholder involvement. The strategy for a small non-nuclear facility can be simple and be prepared by the operator alone. The principles related to our role in regulating radioactive wastes produced during decommissioning are in Section 5.2.

Principle DEDP1 – Decommissioning Strategy

150. **Each site should have a decommissioning strategy that is updated and refined at appropriate intervals.**

151. Considerations:

- The decommissioning strategy should be integrated with other relevant site strategies (eg those for waste management and for the management of contaminated land).
- Stakeholder views should be taken into account in developing, updating and refining the decommissioning strategy.
- Strategy development should be informed by an environmental assessment and optimisation process in which alternatives are systematically evaluated and compared in terms of their impacts on worker safety, people and the environment, their financial costs and other factors.
- Alternative strategies should differ in, amongst other aspects, the time at which decommissioning will take place. The preference is for prompt decommissioning but decisions should be made on a case-by-case basis, taking into account all the relevant factors.
- The strategy should include timescales for the future operation, shutdown and decommissioning of all the facilities on a site, including proposed new facilities, and timescales for the remediation of contaminated land
- The strategy should describe the proposed end-state for the site and show how stakeholders' views will be taken into account in reviewing it.
- The strategy should incorporate the use of the best available techniques to minimise the generation of radioactive and non-radioactive wastes, particularly by re-using equipment, facilities and buildings, and by re-using or recycling materials.
- The strategy should include a demonstration that appropriate financial arrangements have been made for decommissioning and restoration of the site.
- It is acceptable to establish one, over-arching strategy for a group of similar sites, provided that it is clear how that strategy will be implemented at each separate site.
- The decommissioning strategy should be updated and refined during the operating life of the site and in the initial stage of decommissioning. Updates should take into account policy, regulatory and technological changes. Refinements should add more detail as the time for decommissioning approaches.

Principle DEDP2 – Decommissioning Plan

152. **There should be a decommissioning plan for each facility and this should be updated and refined throughout its operating life and during decommissioning**.

153. Considerations:

- Initial decommissioning plans should be prepared during the design and construction of new facilities.

- Decommissioning plans for facilities should be consistent with the decommissioning strategy for the site.
- Plans should include decommissioning programmes for each facility, with timings for key actions.
- Decommissioning plans should describe the end-state for each facility, and any interim states.
- Estimates of the types and quantities of wastes that will be generated during decommissioning should be included in plans, with indications of when the wastes will arise.
- Plans should specify the means of managing facility decommissioning wastes. These means should be consistent with the waste management strategy for the site.
- Plans should specify the means of managing contaminated land associated with each facility. These means should be consistent with the contaminated land strategy and the integrated waste strategy for the site.
- Decommissioning plans should include a programme for further characterisation of irradiated and contaminated structures, plant and equipment in each facility, and further characterisation of any contaminated land and groundwater.
- Plans should include activities to make facilities passively safe before any period of care and maintenance (eg by removing any radioactive wastes that are not in a form suitable for passively safe storage, by removing or immobilising radioactive contamination).
- If there is no decommissioning plan for an existing facility, one should be prepared as soon as is practicable.
- Updates of facility decommissioning plans should take into account changes to the site decommissioning strategy and policy, regulatory and technological changes. Plans should be made more detailed as the time for decommissioning approaches.

Principle DEDP3 – Considering Decommissioning during Design and Operation

154. **Facilities should be designed, built and operated using the best available techniques to minimise the impacts on people and the environment of decommissioning operations and the management of decommissioning wastes.**

155. Considerations:

- Designs should include features to prevent radioactive contamination and limit its spread.
- Designs, including choices of materials, should minimise activation of structures, plant and equipment.
- Designs should facilitate the segregation of radioactive and non-radioactive wastes during decommissioning.
- The implications for decommissioning should be considered throughout the operating life of a facility, especially when modifications to plant, equipment or methods of operating these are proposed.
- All other appropriate steps should be taken during design and operation to maximise the potential re-usability of plant, equipment and materials when the

facility reaches the end of its operating life, and to minimise the quantities of radioactive wastes produced when it is decommissioned.

Principle DEDP4 –Discharges during Decommissioning

156. **Aerial or liquid radioactive discharges to the environment during decommissioning should be kept to the minimum consistent with the decommissioning strategy for the site.**

157. Considerations:

- For every major decommissioning operation that would lead to radioactive discharges the best available techniques should be used to prevent and where that is not practicable minimise these discharges.
- Increases in discharge levels should only be permitted when they are essential to implementation of the site decommissioning strategy. Both the size and duration of increases in discharges should be minimised. In general, increases should take place within a framework of progressive reductions in discharges as decommissioning of the site proceeds.

Principle DEDP5 – Legacy Wastes

158. **Decommissioning strategies and plans should provide for the timely characterisation, retrieval, conditioning and packaging of legacy radioactive wastes.**

159. Considerations:

- Prior to retrieval of legacy wastes, they should be characterised in enough detail to allow the best available techniques for retrieving, conditioning and packaging them to be defined. More detailed characterisation should be performed after retrieval, if necessary.
- Legacy wastes should be conditioned and packaged using the best available techniques to meet requirements for interim storage and for eventual disposal.

5.8 Contaminated Land and Groundwater

160. The release of radioactive material can lead to contaminated land and groundwater, which can also act as a pathway to the spread of radioactivity into the wider environment. In this section we describe how operators should act to minimise the contamination of land and groundwater and how they should clean this up, where present.

161. There are two sets of principles for radioactively contaminated land and groundwater. One set (see Section 5.8.1) are general principles that apply to most sites. The other set (see Section 5.8.2) apply only to sites that we are regulating under Part 2A of the Environmental Protection Act 1990, as modified by the Environment Act 1995, and the 2006 and 2007 regulations for radioactive contaminated land in England and Wales (see, for example, Statutory Instrument 2006 No. 1379). These regulations for radioactive contaminated land do not apply on nuclear licensed sites. The principles related to our role in regulating radioactive wastes produced during the characterisation and remediation of radioactively contaminated land on all sites are in Section 5.2.

5.8.1 General Principles

Principle CLDP1 – Prevention of Contamination

162. **The best available techniques should be used to prevent and where that is not practicable minimise radioactive contamination of land and groundwater, whilst allowing permitted disposals of radioactive wastes.**

163. Considerations:

- Facilities should be designed, operated and decommissioned so that there is no radioactive contamination of land or groundwater under normal conditions.
- Facilities should also be designed, operated and decommissioned using the best available techniques to minimise the probability of contamination occurring, and the extent of contamination, under fault conditions.
- Operators should locate and stop, or if that is not practicable minimise, leaks of radioactive substances to land or groundwater as soon as possible, and take measures to prevent recurrences. On-going leaks that cannot be stopped should be monitored or otherwise assessed.
- Operators should take measures to prevent the spread of contamination and monitor their effectiveness.
- We should establish whether the source of radioactive contamination, or the dispersion of radioactive contamination, constitutes an unauthorised discharge under the Regulations and act accordingly.
- Permitted disposals are those that are permitted under the Regulations or do not require permitting (eg because they are covered by an Exemption Order).

Principle CLDP2 – Strategy for Radioactively Contaminated Land and Groundwater

164. **Each site should have a strategy for the detection and management of radioactively contaminated land and groundwater.**

165. Considerations:

- This principle applies to all nuclear-licensed sites and all other sites where it is known or suspected that there is radioactively contaminated land and/or groundwater.
- The strategy should include the detection, characterisation, short-term control and monitoring of radioactively contaminated land and groundwater, as well as their long-term management. It should cover the site and land and groundwater adjacent to it.
- The contaminated land strategy should be integrated with other relevant site strategies (eg those for decommissioning and for waste management on nuclear-licensed sites).
- Stakeholder views should be taken into account in developing, updating and refining the contaminated land strategy.
- The strategy should include non-radioactive contamination of land and groundwater, if there is any such contamination present on the site.
- Strategy development should be informed by an environmental assessment and optimisation process in which alternatives are systematically evaluated and compared in terms of their impacts on people and the environment, their financial costs and other factors.

- The end-state for the site (or the end-states for each area within the site) should be described in the strategy, with any interim states that are envisaged. The end-states should have been derived taking into account stakeholder views.
- The strategy should specify that radioactively contaminated land will be remediated to appropriate standards before any new facilities are constructed on or close to it.
- It should be shown how plans for the long-term management of each contaminated area will be developed and implemented.
- The strategy should set out the record-keeping arrangements to be used throughout the process of managing contaminated land.

Principle CLDP3 – Approach to Management of Radioactively Contaminated Land and Groundwater

166. **The approach to the management of radioactively contaminated land and groundwater should have regard to the guidance developed for the SAFEGROUNDS learning network.**

167. Considerations:

- Operators should have regard to the SAFEGROUNDS guidance (see www.safegrounds.com) when carrying out[5]:
  - site characterisation;
  - prioritisation of contaminated areas;
  - identification and evaluation of management options for areas;
  - implementation and validation of management options;
  - record-keeping.
- There should be appropriate stakeholder involvement throughout the process of managing the radioactively contaminated land and groundwater.
- There should be appropriate monitoring throughout the implementation of management options and at the end to validate that the end-state has been achieved. Thereafter there should be no need for monitoring unless the end-state is an interim one and further remediation is envisaged to be needed at a later date.

5.8.2 Principles for Regulating under Part 2A

168. The principles in this section stem from the Statutory Guidance on Part 2A, to which reference should be made for further details [Defra, 2006]. It should be noted that groundwater is included in the Part 2A regime as a pathway for radionuclides to move through the environment but not as an environmental receptor in its own right (ie we cannot regulate radioactively contaminated groundwater per se under Part 2A).

Principle CLDP4 – Justification and Optimisation of Interventions under Part 2A

169. **All interventions that are part of the remediation of radioactive contaminated land should be justified and optimised.**

170. Considerations:

- Remediation in this context should be taken to include all the activities involved in assessing the condition of the contaminated land, as well as operations and actions

[5] The main SAFEGROUNDS guidance on the management of contaminated land is currently being revised, as are the documents that support this guidance.

to prevent, minimise, remedy or mitigate the harm caused by contamination. It also includes subsequent inspections to keep the condition of the land under review.

- Justification in this context means that the reduction in radiation detriment and any other benefits of the intervention should outweigh its financial costs, societal costs and any other adverse impacts, ie the intervention should do more good than harm.
- Optimisation in this context means ensuring that the form, scale and duration of the intervention maximises the net benefit, ie that the intervention option chosen is the one that will do most good. Only justified intervention options should be assessed and compared in optimisation exercises.
- The factors that should be considered in justification determinations and in comparing intervention options include: the human radiation exposures and health detriments averted, financial costs, social benefits (eg reduction in anxiety), social costs (eg the disruption caused by limiting access to property), adverse effects on the environment (eg heavy traffic, radioactive and non-radioactive risks to air, water, soil, plants and animals), radiation exposures of remediation workers, and the generation, transport and disposal of wastes.
- A range of stakeholders should be consulted during justification and optimisation, particularly to understand and take into account their views on the relative importance of the benefits, costs and other attributes of intervention options.
- Assessments of radiation doses and health risks to people should be carried out to provide input to justification and optimisation.
    - The assessments should be for the land in its current use, including any temporary use, and any foreseeable future use that would not require new or amended planning permission.
    - All reasonable remediation options should be considered, including, where appropriate, the option of doing nothing beyond further site characterisation.
    - Doses and risks to individuals and populations should be assessed. The individuals to be considered are those who would incur the highest doses and those who would be at most risk. The time period used in collective dose calculations should be at most 500 years.
    - The level of detail in assessments should be commensurate with the level of risks to people and the conditions at the site, in particular the number and nature of exposure pathways.
    - Assessments should be based on sound scientific data.
    - Assessments should include an analysis of how uncertainties in key parameters and assumptions affect their results. This need not be fully quantitative nor entail complex calculations.
- At any site where both radioactive and non-radioactive contamination are present one integrated remediation strategy to deal with all contaminated land should be developed and implemented.
    - Only justified interventions for radioactive contaminated land should be considered when developing site-wide remediation strategies.
    - The effects of the interventions for radioactive contaminated land on the significant pollution linkages for non-radioactively contaminated land should be assessed and taken into account in strategy development.

- The factors to be included when comparing alternative strategies are as given above for justification and optimisation, with the addition of health detriments to the public and workers from non-radioactive contaminants.
- A range of stakeholders should be consulted during comparisons of alternative strategies, particularly to understand and take into account their views on the relative importance of the benefits, costs and other attributes of remediation options.

- Radioactive contaminated land should be characterised in enough detail to provide the information required to select and implement remediation options and strategies.
  - Site characterisation should provide the information needed to determine whether intervention is justified, identify the optimum intervention option and plan and implement the selected option.
  - The information required includes concentrations of key radionuclides in soil and groundwater and the physical and chemical forms of these radionuclides.
  - Characterisation should focus on the significant pollution linkages.

Principle CLDP5 – Remediation Objectives under Part 2A

171. **Remediation objectives should be set for each specific site and should be based on the remediation option or strategy selected for that site.**

172. Considerations:

- The minimum requirement is that remediation should make land suitable for its current use, ie it should no longer be 'radioactive contaminated land' in the Part 2A sense, subject to justification considerations.
- In cases where it is decided that the best course of action is to redevelop the site, the minimum requirement is that the land in its new use should not give rise to doses above the constraint for practices (0.3 mSv/yr).
- There should be consistency between remediation objectives for similar types of site in similar situations.
- There should be monitoring on and around sites during remediation but not subsequently (unless there is a possibility that further remediation will be required).
  - Monitoring should be carried out during remediation to ensure compliance with procedures and regulations and to detect any unexpected radioactivity levels.
  - Monitoring should not usually be carried out after remediation. The exception is when potential changes in pollutants, pathways or receptors that are part of significant pollution linkages have been identified that would, if they occurred, make the land 'radioactive contaminated land' again and hence necessitate further remediation.
- Remediation plans should be reviewed in the light of new information and modified if necessary.
  - Remediation plans should be reviewed in the light of monitoring results to determine whether they continue to be appropriate or whether they need to be modified. Several reviews of plans may be required during the course of remediation.
  - Plans should also be reviewed if significant new scientific or technical information becomes available during their implementation.

- Modifications to remediation plans should be approved prior to implementation.

- Surveys should be carried out to verify that remedial measures have been implemented as planned.
  - The main aim of verification surveys should be to determine whether the objectives of remediation have been met, including whether all remedial measures have been implemented appropriately.
  - The surveys should also assess compliance with other regulations and procedures.
  - Plans for verification surveys should be made prior to the start of remediation and modified if necessary as remediation proceeds.
  - Where appropriate, verification surveys should be done by an organisation that is independent of those which planned and carried out remediation.
- Records should be kept of all the information gathered and decisions made during the selection, implementation and verification of remediation options and strategies.
  - Owners of sites should arrange for detailed records to be kept and passed on to new owners when sites are sold.
  - Records should be in a form that will enable information to be accessed easily in the future and that will last as long as necessary.

6. Generic Developed Principles: Regulatory Process

173. The principles in this section are not unique to RSR. Some appear in various forms in other Environment Agency documents and are included here for completeness and to signpost these other documents.

6.1 The Regulatory Framework

174. In this section we set out principles which underpin how we regulate the use of radioactive substances and the disposal of radioactive wastes. These principles are not unique to the regulation of radioactive substances but are largely common to other regulatory regimes. Indeed some of the principles appear in the Regulator's Compliance Code which applies to a wide range of organisations.

175. This topic area includes the radioactive substances regulatory framework itself (in so far as we have control over it or can influence those that do) and general aspects of the ways in which we implement the framework. The principles are based on national and international guidance [BERR, 2007; BRTF, 2005; Hampton, 2005; IAEA, 2006d; IAEA, 2000].

Principle RFDP1 – Independence

176. **The radioactive substances regulatory framework and the means of implementing it should be independent of those being regulated.**

177. Considerations:

- We will consult those we regulate and other stakeholders, as appropriate, when developing those parts of the radioactive substances regulatory framework that are our responsibility. We will also consult appropriately when developing the means of implementing the framework. In all cases the final decisions will be ours.
- Statutory Guidance and Ministerial Directions must be followed when contributing to the development of the radioactive substances regulatory framework but our regulatory decisions are taken independently from Government.

Principle RFDP2 – Clarity

178. **The radioactive substances regulatory framework should be clear and unambiguous.**

179. Considerations:

- We should seek to ensure that regulations related to radioactive substances are clear and simple.
- Our guidance on radioactive substance regulation should be in language that is appropriate to its readership. Where possible it should be issued before regulations take effect.
- Such guidance should explain clearly what is required from those regulated and what the consequences of non-compliance are. Guidance should distinguish clearly between statutory requirements and expectations that go beyond these.

- The duties and responsibilities of radioactive substances regulators should be clearly set out and available to those regulated and other relevant stakeholders.

Principle RFDP3 – Cost-Effectiveness

180. **The radioactive substances regulatory framework should be cost-effective for the regulators and for those who are regulated.**

181. Considerations:

- When developing systems to deliver new radioactive substances legislation, and when re-assessing how to deliver outcomes from the existing regime, we should use the most cost-effective regulatory approaches.
- The choice of regulatory approach should be informed by impact assessments that have been carried out according to guidance from the Better Regulation Executive. (These impact assessments will usually have been carried out by legislators rather than by us.)
- We should encourage the consideration of various options when the radioactive substances regulatory framework is further developed. These options should usually include not regulating a particular activity or part of an activity, improving compliance with existing regulations and guidance, and providing more advice on good practice.
- We should encourage legislators to simplify the existing radioactive substances regulatory framework where appropriate. Simplification could consist of replacing, removing, consolidating or rationalising the whole of or parts of regulations.
- When the proposed radioactive substances regulatory approach or guidance would cover several business sectors, particular attention should be paid to its potential impact on small organisations ('think small first').
- We should routinely seek ways of making it easier to comply with regulations, particularly by facilitating on-line and other forms of electronic submissions and applications for permits under the Regulations.
- The regulatory charges imposed on producers, owners and users of radioactive substances should be commensurate with the risks to people and the environment from the management of the substances and associated wastes, and consistent with our need to recover our costs.

Principle RFDP4 – Consistency

182. **The Environment Agency should act in a consistent manner when developing and implementing the radioactive substances regulatory framework.**

183. Considerations:

- We should aim to make the radioactive substances regulatory framework self-consistent (within sectors and from one sector to another).
- A further aim should be for consistency, to the extent necessary, between the radioactive substances regulatory framework and other regulatory frameworks, including those implemented by other regulators, (eg for non-radioactive wastes and pollutants, for health and safety, for security at nuclear sites). Where the radioactive substances regulatory framework takes precedence this could entail seeking to change other frameworks.

- We should act in a consistent way when carrying out our radioactive substances regulatory duties (within a site, from one site to another, from one sector to another, and over time).
- We should seek to work with other regulators in a consistent and co-ordinated way, while ensuring proper implementation of our duties under the radioactive substances regulatory framework.

Principle RFDP5 – Prioritisation on the Basis of Risk

184. **The radioactive substances regulatory framework and the means of implementing it should give priority to those organisations and activities that, separately or together, pose the greatest risks to people and the environment.**

185. Considerations:

- Regulatory effort on radioactive substances should be proportionate to the risks to people and the environment that the regulated activity poses. This will involve targeting organisations, particular sites or particular activities on a site or sites that pose the highest risks.
- Targeting particular groups of 'small users' is desirable when the whole group together pose relatively significant risks, even though each individual user poses small risks.
- In setting priorities, consideration should be given to routine and accident risks, short-term and long-term risks, individual and societal risks, local, regional and global risks, current and possible future operations.
- It is desirable to take account of differing views on the interpretation of scientific and technical data when carrying out risk assessments for the purpose of setting priorities.

Principle RFDP6 – Stakeholder Engagement

186. **The radioactive substances regulatory framework should include adequate opportunities for informing and consulting stakeholders when key decisions are made, including decisions about the framework itself.**

187. Considerations:

- The effort devoted to stakeholder engagement should be proportionate to risks to people and the environment and to uncertainties about the magnitude of these risks.
- Effective consultation should take place before regulatory proposals are developed, to ensure that stakeholders' views and expertise are taken into account.
- Stakeholders should be given sufficient time and information to respond to consultation documents.
- Consultation procedures should be reviewed in the light of experience and revised if necessary.

Principle RFDP7 – Reviewing

188. **There should be reviews of the effectiveness and impact of the radioactive substances regulatory framework and of the level of compliance with it.**

189. Considerations:

- Information for the reviews should be gathered by formal and informal means, preferably during the course of normal regulatory duties.

- Experience should be shared over sites and sectors.
- Account should be taken of scientific and technological developments.
- The outcomes of reviews should be made known to legislators and used to improve our procedures and guidance.

6.2 Compliance Assessment

190. These principles are based largely on the 2007 Regulators' Compliance Code, to which reference should be made for further details [BERR, 2007]. The principles are for our compliance assessment work. Principles and considerations for operator' compliance assessments are in the relevant sections (eg Section 5.2 for radioactive substances management).

Principle CADP1 – Compliance Assessment Programmes and Plans

191. **Our compliance assessment activities should take place in accordance with a compliance assessment programme and plan.**

192. Considerations:

- Compliance assessment programmes and plans should be based on risk assessments. These assessments may involve qualitative judgements.
- Compliance assessment resources should be targeted on those sites and parts of sites that pose the greatest risk to people and the environment and where there is the greatest potential for reductions in those risks.
- Compliance assessment includes all compliance activities, not just site visits.
- We should have regard to the Regulators' Compliance Code when establishing compliance assessment programmes and plans.

Principle CADP2 – Inspections and Visits

193. **No inspection or visit should take place without a reason.**

194. Considerations:

- Inspections and other visits (eg compliance or advice visits) should only occur in accordance with a compliance assessment plan, except in circumstances where visits are requested by the operator, or where the regulator acts on relevant intelligence (including incidents and complaints).
- Compliance assessment programmes should include a small element of random inspection to test the effectiveness of the assessment methodology.
- We should have arrangements with other regulators to minimise the burdens on those regulated, eg through joint or coordinated inspections.

Principle CADP3 – Documentation and Feedback

195. **Our compliance assessment activities should be documented and appropriate documentation made available to the operator.**

196. Considerations:

- Documentation should be produced in a timely manner and in an accessible format.
- In addition to documentation, we should give operators positive feedback to reinforce and encourage good practice.

Principle CADP4 - Advice

197. **There should be means for operators to seek and access our advice on compliance.**

198. Considerations:

- We should provide means to ensure that operators can reasonably seek and access advice without directly triggering an enforcement action.
- When responding to an approach from an operator we should aim primarily to provide advice and guidance to ensure compliance.
- When offering compliance advice we should distinguish between statutory requirements and advice or guidance aimed at improvements above minimum standards.
- Advice should be confirmed in writing if requested.

6.3 Evaluation and Information

199. This area is taken to include our evaluation of formal applications for new or revised permits under the Regulations, the evaluation of other submissions to us (eg BAT assessments), seeking information (including by commissioning R&D or requiring others to do so) and providing information on radioactive substances and contamination. The principles are based on national and international guidance [IAEA, 2000; BRTF, 2005; BERR, 2007].

Principle EIDP1 – Advice on Information Requirements

200. **We should provide advice on the format and content of documents to be submitted to us in connection with permitting and on when these documents should be submitted.**

201. Considerations:

- The information we require should be commensurate with the risks to people and the environment posed by the site, facility or operation.
- The preference should be for electronic submissions, particularly where large amounts of information or data are involved.
- Data formats should be specified to those regulated, bearing in mind the purposes for which we will use the data.
- Sufficient time should be allowed for those regulated to compile information, carry out studies and prepare documents.

Principle EIDP2 – Decision Criteria

202. **Whenever practicable, the principles and criteria on which our regulatory decisions are based should be publicly available.**

203. Considerations:

- There should be principles and criteria for all our major decisions about a facility or site.
- Where practicable these principles and criteria should be available before decisions are made.
- Principles and criteria are needed for revoking RSR permits, as well as granting them.

- Where appropriate, there should be statements about how uncertainties will be dealt with when taking regulatory decisions.

Principle EIDP3 – Evaluation of Submissions

204. **Our evaluations of submissions to us should be consistent with the risks posed by the operation, facility or site.**

205. Considerations:

- Each evaluation should lead to an adequate understanding of how radiological impacts on people and the environment will arise from routine operations and how such impacts could arise from incidents and accidents.
- The level of detail of evaluations should be commensurate with the level of risks to people and the environment from the operation, facility or site.
- Attention should be given to means of control of processes that generate radioactive wastes and means of control of radioactive discharges to the environment.
- When appropriate, evaluations should include means of monitoring radioactive discharges and means of monitoring environmental media.
- Management systems should be evaluated in sufficient detail to ensure that they are fit for purpose.
- When major new technical solutions are proposed at a site or facility there should be an appreciation of the extent to which these have been proven through experience and/or testing elsewhere.
- There should be understanding of why major technical solutions have been chosen and others rejected.
- Gaps and deficiencies in information provided by applicants should be identified and steps taken to rectify them where necessary.

Principle EIDP4 – Requiring Information

206. **Only information that we believe to be necessary to carry out our functions should be sought from those regulated.**

207. Considerations:

- When requiring information, efforts should be made to avoid duplication, either within the Environment Agency or with other regulators.
- Means of sharing data within the Environment Agency and with other regulators should be kept under review and improved when necessary.
- We should give advance warning of our information requirements whenever practicable.
- As a general rule, the information already received should be evaluated before additional information is sought.
- Whenever practicable, relevant stakeholders should be consulted before new or modified forms are introduced.

Principle EIDP5 – R&D

208. **R&D should be carried out to improve levels of environment protection, fill knowledge gaps and reduce or better characterise uncertainties.**

209. Considerations:

- As appropriate, we should commission R&D, require those regulated to carry out R&D and influence the R&D programmes of other organisations in the UK and in other countries.
- We should aim to ensure that there is enough appropriate R&D on:
  - new technologies for key aspects of managing radioactive substances and radioactive wastes (eg reducing discharges, monitoring discharges, conditioning wastes, packaging wastes);
  - key aspects of assessing potential radiological impacts on people and the environment (eg movement of radionuclides through environmental media, effects of radiation on plants and animals).
- A good understanding of past, current and planned future R&D should be gained before commissioning new studies or causing them to be commissioned.
- The benefits of participating in national and international R&D programmes should be recognised and maximised.
- R&D results should be made publicly available where practicable, subject to security and commercial confidentiality considerations.

Principle EIDP6 – Providing Information

210. **Information about radioactive substances, radioactive wastes and radioactively contaminated land and groundwater should be made available in appropriate forms.**

211. Considerations:

- We should provide information and encourage other organisations to do so. We should co-ordinate its information provision with others.
- Information should be readily accessible (eg via our website, as paper documents, etc).
- Information should be kept up-to-date.
- Reasons should be given when it is not practicable to make information publicly available. These reasons could be related to commercial confidentiality, national security or the potential to prejudice legal proceedings against an operator.

6.4 Enforcement

212. These principles are taken from our Enforcement Policy and from the Regulators' Compliance Code [EA, 2008; BERR, 2007]. Reference should be made to these for further details and to our Guidance for the Enforcement and Prosecution Policy [EA, 2009].

Principle EFDP1 - Proportionality

213. **Enforcement action should be proportionate to the risks posed to people and the environment and to the seriousness of any breach of the Radioactive Substances Act.**

214. Considerations:

- Our guidance for our enforcement and prosecution policy should be followed in all circumstances.

- Following the guidance will ensure consistent decision making for enforcement responses.

Principle EFDP2 – Transparency

215. **Enforcement should be carried out in a transparent manner.**

216. Considerations:

- We should provide an opportunity to discuss what is required to comply with the law before formal enforcement action is taken, unless urgent action is required (eg to protect the environment or to prevent evidence being destroyed).
- Unless the action is urgent, clear reasons should be given for any formal enforcement action at the time that the action is taken. These reasons should be confirmed in writing at the earliest opportunity.
- Where urgent action is needed, a written explanation of the reasons for it should be provided as soon as practicable after the event.

Principle EFDP3 – Fairness and Consistency

217. **Legal requirements and the enforcement policy should be interpreted and applied fairly and consistently.**

218. Considerations:

- Enforcement should be consistent across similar sites and sectors.
- Our regulators should aim to be self-consistent and consistent with each other.

Principle EFDP4 – Sufficiency of Evidence

219. **No prosecution should be commenced or continued unless there is sufficient admissible and reliable evidence that an offence has been committed and there is a realistic prospect of conviction.**

220. Considerations:

- No case should go ahead if it does not pass the evidence test, no matter how serious the offence.
- No case should go ahead if it would not be in the public interest for it to do so.

Principle EFDP5 – Public Interest Factors

221. **All the relevant public interest factors should be considered when deciding whether or not to prosecute.**

222. Considerations:

- The public interest factors that should always be considered are:
  - the actual or potential environmental effect of the offence
  - the nature of the offence
  - whether there was financial motivation or gain
  - impact on legitimate business or activities
  - deterrent effect of a prosecution
  - intent of the offender
  - previous history of the offender
  - attitude of the offender
  - personal circumstances of the offender
  - forseeability of the offence

- impact of a prosecution on our resources.

- The importance of each factor will vary with the offence and the circumstances.

7. List of Generic Developed Principles

223. For ease of reference, the fundamental principles and the developed principles for each of the generic topic areas are listed in Table 2.

Table 2 RSR Fundamental and Generic Principles

RSR Fundamental Principles

Label	Topic	Para. No.
A	Sustainability	25
B	Stakeholders	26
C	Integrated Planning	27
D	Selecting and Implementing Management Options	28
E	Protecting Human Health and the Environment	29
F	Regulation	30
G	Best Scientific Knowledge	31
H	Uncertainties and the Precautionary Principle	32
I	Polluter Pays	33
J	Justification	34

RSR Generic Developed Principles

Label	Topic	Para No.
	REGULATORY ASSESSMENT	
	Management and Leadership for the Environment	
MLDP1	Establishing and sustaining leadership and management	39
MLDP2	High standards	41
MLDP3	Capability	43
MLDP4	Decision making	45
MLDP5	Learning from experience	47
	Radioactive Substance Management (including Waste Disposal)	
RSMDP1	Radioactive substances strategy	51
RSMDP2	Justification	53
RSMDP3	Use of BAT to minimise waste	55
RSMDP4	Processes for identifying BAT	57
RSMDP5	Actions with irreversible consequences	59
RSMDP6	Application of BAT	61
RSMDP7	BAT to minimise environmental risk and impact	63
RSMDP8	Segregation of wastes	65
RSMDP9	Characterisation	67
RSMDP10	Storage	69

Label	Topic	Para No.
RSMDP11	Storage in a passively safe state	71
RSMDP12	Limits on discharges	73
RSMDP13	Monitoring and assessment	75
RSMDP14	Record keeping	77
RSMDP15	Conditions for disposal of waste	79
	Radiological Protection	
RPDP1	Optimisation of protection	83
RPDP2	Dose limits and constraints	85
RPDP3	Protection of non-human species	87
RPDP4	Prospective dose assessments	89
	Site Evaluation	
SEDP1	General RSR siting principle for new facilities	93
SEDP2	Movement of radioactive material in the environment	95
SEDP3	Ambient radioactivity	97
SEDP4	Multi-facility sites	99
SEDP5	On-going evaluation	101
	Engineering Principles	
ENDP1	Inherent environmental protection	105
ENDP2	Avoidance and minimisation of impacts	107
ENDP3	Defence in depth	109
ENDP4	Environment protection functions and measures	111
ENDP5	Human factors	113
ENDP6	Engineering codes and standards	115
ENDP7	Reliability	117
ENDP8	Ageing and degradation	119
ENDP9	Fault sensitivity	121
ENDP10	Quantification of discharges	123
ENDP11	Maintenance, inspection and testing	125
ENDP12	Commissioning	127
ENDP13	External and internal hazards	129
ENDP14	Control and instrumentation	131
ENDP15	Mechanical containment systems	133
ENDP16	Ventilation systems	135
ENDP17	Civil engineering	137
ENDP18	Essential services	139
	Emergency Preparedness and Response	
EPRDP1	Facility design	142
EPRDP2	Emergency plans	144

Label	Topic	Para No.
EPRDP3	Remediation	146
	Decommissioning	
DEDP1	Decommissioning strategy	150
DEDP2	Decommissioning plan	152
DEDP3	Considering decommissioning during design and operation	154
DEDP4	Effluent discharges during decommissioning	156
DEDP5	Historic wastes	158
	Contaminated Land and Groundwater	
CLDP1	Prevention of contamination	162
CLDP2	Strategy for management of contaminated land and groundwater	164
CLDP3	Approach to management of contaminated land and groundwater	166
CLDP4	Justification and optimisation of interventions under Part 2A	169
CLDP5	Remediation objectives under Part 2A	171
	REGULATORY PROCESS	
	Regulatory Framework	
RFDP1	Independence	176
RFDP2	Clarity	178
RFDP3	Cost-effectiveness	180
RFDP4	Consistency	182
RFDP5	Prioritisation on the basis of risk	184
RFDP6	Stakeholder engagement	186
RFDP7	Reviewing	188
	Compliance Assessment	
CADP1	Compliance assessment programmes and plans	191
CADP2	Inspections and visits	193
CADP3	Documentation and feedback	195
CADP4	Advice	197
	Evaluation and Information	
EIDP1	Advice on information requirements	200
EIDP2	Decision criteria	202
EIDP3	Evaluation of submissions	204
EIDP4	Requiring information	206
EIDP5	R&D	208

Label	Topic	Para No.
EIDP6	Providing information	210
	Enforcement	
EFDP1	Proportionality	213
EFDP2	Transparency	215
EFDP3	Fairness and consistency	217
EFDP4	Sufficiency of evidence	219
EFDP5	Public interest factors	221

8. Glossary

8.1 Acronyms

ALARA	as low as reasonably achievable
ALARP	as low as reasonably practicable
BAT	best available techniques
BERR	Department for Business, Enterprise and Regulatory Reform
BPEO	best practicable environmental option
BPM	best practicable means
BREF	BAT reference (note, document)
BRTF	Better Regulation Task Force
BSSD	basic safety standards direction
CCF	common cause failure
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DNSR	Defence Nuclear Safety Regulator
DP	developed principle
DTI	Department of Trade and Industry, abolished in 2007; responsibilities for nuclear matters transferred to BERR and, more recently, transferred to DECC.
EA95	Environment Act 1995
EU	European Union
GRA	Guidance on Requirements for Authorisation (of disposal facilities for solid radioactive wastes)
HEPA	high efficiency particulate activity filter
HSE	Health and Safety Executive
HSWA	Health and Safety at Work etc Act
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IRRs	Ionising Radiations Regulations 1999
IWS	integrated waste strategy
mSv	millisievert (a unit of radiation dose)
MoD	Ministry of Defence
NIA65	Nuclear Installations Act 1965
NII	Nuclear Installations Inspectorate (of HSE)
OCNS	Office of Civil Nuclear Security
OECD	Organisation for Economic Cooperation and Development
OSPAR	Oslo and Paris Convention on Protection of the Marine Environment of the North East Atlantic
PPC	Pollution Prevention and Control (regulated under the Environmental Permitting Regulations 2010))
REPs	radioactive substance regulation environmental principles
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations 2001

RPA	radiation protection adviser
RSR	radioactive substances regulation (formerly under the Radioactive Substances Act 1993 and now under the Environmental Permitting Regulations 2010).
SAPs	HSE Nuclear Directorate's safety assessment principles
SEPA	Scottish Environment Protection Agency
SNIFFER	Scotland and Northern Ireland Forum for Environmental Research
SSSI	site of special scientific interest

8.2 Definitions

collective dose	The sum of the radiation doses to all the individuals in a population.
commissioning	The process of making a new facility operational once it has been built, including verifying that it meets design and performance criteria.
critical group	The group of people who receive, or are likely to receive, the highest radiation doses in a particular situation.
decommissioning	Administrative and technical actions at a facility to reduce hazards and allow removal of some or all regulatory controls.
environment protection	A shorthand term for protection of people and the environment
environment protection function	A function that is necessary to a facility for the avoidance and/or minimisation of radiological impacts on people and the environment.
environment protection measure	A measure that delivers an environment protection function.
environment protection system	An integrated system of environmental protection measures, associated instrumentation and controls, communications and relevant instructions and computer software.
facility	A part of a site that is identified as being a separate unit for the purposes of radioactive substance regulation. A facility may be a single plant, a group of plants or an area containing various buildings.
hazard	The identification of a potential for causing harm, arising from an intrinsic property or disposition of something to cause detriment, and an assessment of its magnitude.
historic waste	Historic (or legacy) wastes are those that were produced by past activities on nuclear sites and which have been stored for several years (in some cases decades), often in raw form.
intervention	An intervention is a human activity that prevents or decreases the exposure of individuals to radiation from sources which are not part of a practice or which are out of control, by acting on the sources, transmission pathways and individuals themselves.
justification	The process of showing that the benefits of a practice or intervention outweigh its detriments. The benefits and detriments to be considered are those to health and those of an economic, social or other nature.
legacy waste	See historic waste.
lifecycle	All the phases in the lifetime of a facility, including construction, commissioning, operation and decommissioning.
nuclear-licensed site	As defined in the Nuclear Installations Act 1965, as amended, ie: any site in respect of which or part of which a nuclear site licence is for the time being in force; or any site in respect of which, after revocation or surrender of a nuclear site licence, the period of responsibility of the licensee has not come to an end.

optimisation	The process of maximising the net benefit of a practice, activity or intervention. The net benefit is the sum of the benefits minus the sum of the detriments. The benefits and detriments to be considered are those to health and those of an economic, social or other nature.
Part 2A	Part 2A of the Environmental Protection Act 1990 (legislation for contaminated land).
permit	Permission usually in the form of a written document that is issued by the Environment Agency under relevant legislation that allows an operator to carry out certain activities or actions – including for example, authorisations, registrations, licences, consents and permits.
practice	A practice is any human activity that increases radiation exposures and where these exposures can be introduced in a controlled way.
radioactive contaminated land	As defined in regulations and statutory guidance for Part 2A of the Environmental Protection Act 1990, ie land on which long-term radiation doses to individuals are currently 3 mSv per year or greater.
radioactively contaminated land	As defined in the HSE SAPs 2006, ie land on which the radioactive contamination is such as to preclude HSE agreeing to de-licensing. (Individual risks greater than 1 in a million per year.)
radioactive materials	As defined in the Schedule 23 of the Environmental Permitting Regulations 2010.
radioactive substances	Radioactive materials and radioactive wastes.
radioactive substances management	All the activities involved in the creation, treatment, storage and disposal of radioactive materials and wastes.
radioactive wastes	As defined in Schedule 23 of the Environmental Permitting Regulations 2010.
remediation	For contaminated land, as defined in Part 2A of the Environmental Protection Act 1990. Remediation includes assessing the condition of the land, doing any work to remove or control the movement of contamination, and inspections to keep the condition of the land under review.
risk	In this context, an assessment informed by: o the identification of a potential for causing harm, arising from an intrinsic property or disposition of something to cause detriment, and an assessment of its magnitude – "the hazard"; and o an evaluation of the likelihood that this hazard might occur. In assessing risk appropriate attention should be given to each of these factors.
stakeholder	Anyone with an interest in RSR, including operators, other regulators, NGOs, other groups and individual members of the public.
validation	In this context, showing that a product, system, set of measures or service fulfils its purpose. For example, showing that a model represents the real world adequately, or showing that remediation of contaminated land has reduced human health risks to the required extent.
verification	In this context, showing that a product, system, set of measures or service meets the objectives set for it. For example, showing that a computational model implements a mathematical model correctly, or showing that remediation of contaminated land has been carried out as planned.

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Appendix A: Related Regulatory Regimes and Regulators

A.1 Related Regulatory Regimes

On many sites where we are regulating radioactive substances activities we may also be regulating other activities under these regulations or under other legislation. These other activities are listed in Table A1, with brief notes on our regulatory role in each case.

Table A.1 Regulatory Regimes

Regime	Our role
Radioactive contamination and wastes	
Radioactive contaminated land, Part 2A	We are the regulator for land where doses are above 3 mSv/y in the current use of the land, excluding land on nuclear licensed sites. Such 'radioactive contaminated land' is designated as a 'special site' under Part 2A of the Environmental Protection Act 1990. Our role is to ensure that appropriate remediation is carried out (see Section 5.8 of the main text).
Transfrontier shipments of radioactive wastes	We are the approving authority for radioactive waste shipments into and out of England and Wales. The current regulations are being revised and new ones will come into force by the end of December 2008. Shipments must be to EU and OECD countries.
Non-radioactive discharges, solid wastes and contamination	
Pollution Prevention and Control (PPC) installations	We regulate non-radioactive discharges to air and water, and disposals of solid non-radioactive wastes from installations. In April 2008 PPC permits were replaced by Environmental Permits.
Hazardous wastes	We regulate the production, movement, storage, treatment, recovery and disposal of hazardous wastes (as defined in the Hazardous Waste and List of Waste Regulations).
Non-hazardous wastes	We register waste carriers and brokers, issue Environmental Permits for waste recovery, re-use and disposal (previously Waste Management Licences), register exemptions from these permits, inspect premises and authorise transfrontier shipments of wastes for recovery.
Landfills	We issue landfill permits with conditions for waste acceptance and for landfill operation and monitoring. We also regulate closure and aftercare of landfills.
Contaminated land, Part 2A	We are the regulator for non-radioactively contaminated land that is 'contaminated land', as defined in Part 2A and related regulations, including such land on nuclear licensed sites. Our role is to ensure that appropriate remediation is carried out.
Water pollution, resources and use	We regulate water pollution and use, and manage water resources. This role includes surface water and groundwater.

A.2 Other Regulators

There are several other regulators with whom we interface during our RSR activities. These regulators are listed in Table A2, with notes on their responsibilities and the nature of our interface with them.

Table A.2 Regulators

Regulator	Responsibilities and interface
Nuclear sites	
HSE Nuclear Installations Inspectorate (NII)	NII regulates nuclear safety, including the safe management, conditioning and storage of wastes on nuclear licensed sites, accident prevention, protection of the workforce and control of direct irradiation of the public from nuclear facilities. We take full account of NII responsibilities during our RSR decision making. We have a Memorandum of Understanding with NII that provides a framework for ways of working with them.
HSE Office of Nuclear Security (OCNS)	OCNS regulates the security of nuclear materials, facilities, personnel, technologies, information and IT on nuclear licensed sites. We take full account of OCNS responsibilities during our RSR decision making.
HSE UK Safeguards Office	The Safeguards Office is responsible for UK obligations under the Euratom Treaty and the United Nations Non-Proliferation Treaty. It ensures that operators of nuclear sites have appropriate safeguards arrangements. We take full account of its responsibilities during our RSR decision making.
Defence Nuclear Safety Regulator (DNSR)	DNSR regulates nuclear and radiological safety for defence nuclear programmes (submarines and weapons). It focuses on aspects that are exempt from NIA65 and the Environmental Permitting Regulations. We have a formal agreement with DNSR under which the establishments it regulates make voluntary submissions to us about proposals for disposals of radioactive waste and we issue letters of authorisation. This ensures that standards of environment protection at these establishments are comparable to those at nuclear licensed sites.
Other sites	
HSE	HSE regulates the protection of the workforce and others under the Ionising Radiations Regulations 1999 (IRRs). The Radiation Protection Advisers (RPAs) appointed by organisations under the IRRs typically also advise on responsibilities in relation to radioactive substances activities under the Environmental Permitting Regulations. We work with HSE and RPAs to avoid imposing overlapping or conflicting requirements on the organisations.
Ministry of Defence (MoD)	MoD is exempt from the Environmental Permitting Regulation in relation to radioactive substances activities but we have a formal agreement with it aimed at ensuring that, as far as practicable, it meets our usual standards. MoD sites make voluntary submissions to us about proposals for disposals of radioactive waste and we issue letters of authorisation.
Local Authorities	We interface with Local Authorities in various ways during our RSR activities. Interactions are frequently as a result of their responsibilities under Planning legislation or under the Part 2A contaminated land regime.

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