

PRINCIPLES FOR THE REGULATION OF RADIOACTIVE WASTE DISPOSAL FACILITIES IN THE UNITED KINGDOM

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INTRODUCTION

In the United Kingdom, the Radioactive Substances Act 1993 (RSA 93) provides the framework for controlling the creation and disposal of radioactive wastes so as to protect the public from hazards which may arise from their disposal to the environment. The Act imposes requirements for registration of the use of radioactive materials and for authorisation of accumulation or disposal of radioactive wastes. The responsibilities for determining applications for authorisation are different in each of the four countries of the United Kingdom.

Her Majesty's Inspectorate of Pollution (HMIP) has responsibilities in respect of England and Wales and has in preparation, a document setting out the principles and requirements against which any application for a specialised land disposal facility for radioactive waste will be assessed. This paper sets out the background to the document (referred to here as 'the principles document') and its main features and requirements.

On 1 April 1996, HMIP will become part of a new Environment Agency.

BACKGROUND AND SCOPE

The principles document was first issued for public consultation in 1994, in parallel with a consultation document issued by the UK Department of the Environment, setting out the preliminary conclusions of a review of radioactive waste management policy. The policy review has been completed and a White Paper (Cm 2919) was published in 1995 as a firm statement of Government policy (1). The policy is based on the same basic principles as apply more generally to environment policy in the UK and, in particular, on that of sustainable development. The White Paper gives a widely quoted definition of this concept as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This requires that:

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

More specifically, and consistent with the above, the Government states in Cm 2919 that radioactive wastes should be managed and disposed of in ways which protect the public, workforce and the environment.

Following publication of the White Paper, the principles document was revised and issued in late 1995 for further consultation. The radiation protection principles and criteria are designed to ensure that there is no unacceptable risk associated with radioactive waste management. In defining these principles and criteria and in their application by the regulators, it is recognised that a point is reached where additional costs of further reductions in risk exceed the benefits arising from the improvements in safety achieved, and that the level of safety and the resources required to achieve it should be consistent with those accepted in other spheres of human activity.

The revised principles document describes the regulatory framework in the UK and the procedures for authorisation of radioactive waste disposal. There is a key chapter setting out four fundamental principles and two chapters containing more detailed requirements that will be taken into account by the regulators when assessing compliance with the fundamental principles. Another issue considered by the regulators to be central to their ability to determine an application for authorisation of a disposal facility is the timely supply of information by the developer. A chapter of the document provides guidance on the scope of the information HMIP considers it will need. The document emphasises the need for a range of technical assessments, that would include but not be confined to a risk assessment, to inform the judgements that the regulators will need to make.

PRINCIPLES AND REQUIREMENTS

Within the approach outlined above, HMIP has the duty to ensure that all disposals of radioactive waste to facilities on land are undertaken so as to safeguard the interests of present and future generations and the wider environment, in a manner that commands public confidence and takes due account of costs. For this purpose, four fundamental principles are defined, taking account of the principles of radioactive waste management set out in the IAEA Safety Fundamentals document issued under the RADWASS programme (2). A prospective developer will need to show that the proposals conform with the four fundamental principles.

Principle No. 1 - Independence of safety from controls

Following the disposal of radioactive waste, the closure of the disposal facility and the withdrawal of controls, the continued isolation of the waste from the accessible environment shall not depend on actions by future generations to maintain the integrity of the disposal system.

The objective of disposal of radioactive waste is to provide sufficient isolation of the waste from the accessible environment so as to ensure the long-term radiological protection of humans and of the environment. However, HMIP recognises that there are mechanisms and events that, at some future time or at some low probability, can result in some release of radionuclides into the environment. The practical implication of this principle is that authorisations for disposal will not be given until it is shown that the overall degree of containment provided by the disposal system after closure is such that the continued safety of future generations does not depend on monitoring, surveillance, preventative or remedial actions after control over the facility is withdrawn.

Principle No. 2 - Effects in the future

Radioactive wastes shall be managed in such a way that predicted impacts on the health of future generations will not be greater than relevant levels of impact that are acceptable today.

Underground disposal facilities can provide a period of isolation which may be some thousands of years for near-surface disposal or some tens of thousands of years or even longer for deep disposal. The degree of isolation required, and therefore the type of facility chosen, depends on the concentrations and radioactive half-lives of the radionuclides present in the wastes, among other factors.. Eventually, some release of radioactivity to the accessible environment may occur, leading to a radiological risk to any human communities in the vicinity of the site. In specifying radiological requirements, the time over which assessments are to be undertaken is not defined since the view is taken that this is a matter for the developer to justify.

Principle No. 3 - Optimisation

The radiological detriment to members of the public that may result from the disposal of radioactive waste shall be as low as reasonably achievable, economic and social factors being taken into account.

In UK terms, this will involve demonstration that the best practicable means are being employed to restrict the radiological detriment to members of the public both before and after withdrawal of control over the facility. It will need to be shown that, among other things, the safety case has a sound scientific and technical basis and that good engineering principles are being applied in facility design, construction, operation and closure.

Principle No. 4 - Radiological protection standards

The assessed radiological impact of the disposal facility before withdrawal of control over the facility shall be consistent with source-related and site-related dose constraints and, after withdrawal of control, with a risk target.

The radiological protection standard for members of the public for the period up to withdrawal of control over the facility is expressed in terms of source-related and site-related dose constraints. During this period, the releases will be monitored and control measures applied to ensure that protection standards are achieved. The Government has accepted that the value of the source-related constraint should not exceed 0.3 mSv/y.

For the period after withdrawal of control, the safety case depends entirely on current assessments of the future performance of the disposal system. Because of the uncertainties inherent in such assessments, they are usually based on probabilistic techniques and the protection standard is more appropriately expressed in terms of radiological risk rather than dose. However, in this case, the standard is expressed as a target on risk to the individual, rather than a limit or constraint, in recognition of the more limited level of assurance of conformity that can be achieved. The risk target is set at 10^{-6} per year.

The release of radioactivity and its impact are dictated by the contents of the facility, its engineering design, the characteristics of the waste and the nature of the site. A number of technical requirements are included which are intended to provide guidance on the aspects that the regulators consider important to the safety case.

SUPPLY OF INFORMATION

Under UK legislation, the developer of a disposal facility is under no obligation to supply information to the regulators until an application for authorisation is made. However, it is envisaged that for a major disposal facility, a developer may choose to make early application and this will allow a programme and structure for the supply of information to be agreed. This aspect is considered to be fundamental to the process of authorisation of a specialised disposal facility for radioactive waste and a chapter of the document sets out the regulators' requirements. This covers a wide range of information related to the site, the facility and the waste, as well as results and supporting information from modelling studies and safety assessments.

The treatment of uncertainty is central to the establishment of the post-closure safety case for a radioactive waste disposal system and a requirement is placed on the developer to demonstrate that the safety case takes adequate account of all relevant uncertainties. This will entail:

- definition of the scope of the assessment;
- systematic identification of all relevant sources of uncertainty;
- quantification of significant uncertainties, where practicable;
- implementation of measures to reduce uncertainty; and
- maintenance of a detailed audit trail.

ADDITIONAL FACTORS

The UK takes the view that consideration of risk analysis alone cannot determine whether a disposal facility is safe. Whilst such calculations can inform a judgement about the safety of a facility, other technical factors, including some of a more qualitative nature, will also need to be considered in arriving at the decision. Sufficient assurance of safety over the very long timescales that need to be considered is likely to be achieved only through multiple and complementary lines of reasoning. Examples of performance indicators other than risk that might be used in technical assessments are given in the report of an IAEA Working Group(3) and include radiation dose, radionuclide flux, time, environmental concentration and radiotoxicity.

Each technical assessment such as a risk assessment is to be seen as a one of the inputs informing the judgements that the regulators must make. To support the judgements, the regulators may need to undertake their own performance assessments, based on information supplied by the developer. HMIP has developed a capability for such assessments, to ensure that it understands fully the issues to be addressed in any such assessment, and to ensure that it can perform such an analysis should the need arise.

CONCLUSIONS

A document is in preparation setting out guidance on the principles and requirements against which the environmental regulators will assess any application for authorisation of a specialised disposal facility on land for low- and/or intermediate-level solid radioactive waste. A draft of the document has been issued for public consultation and formal publication is expected in the near future.

REFERENCES

- (1) Command 2919. Review of radioactive waste management policy. Final Conclusions. HMSO, 1995.
- (2) IAEA. Safety Fundamentals. The principles of radioactive waste management. RADWASS, 1995.
- (3) IAEA. Safety indicators in different time frames for the safety assessment of underground radioactive waste repositories. First report of the INWAC Subgroup on principles and criteria for radioactive waste disposal. IAEA-TECDOC-767, 1994.