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REGULATORY ASPECTS OF UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE

PROCEEDINGS OF A TECHNICAL COMMITTEE
ON REGULATORY ASPECTS
OF UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE
ORGANIZED BY THE
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REGULATORY ASPECTS OF UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE
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FOREWORD

Management and disposal of radioactive waste is one of the major issues associated with the use of nuclear power. Various concepts for the disposal of these wastes have been proposed, studied or practiced. It is generally agreed that disposal of radioactive wastes is an activity which should be appropriately regulated by the national governments, in order to achieve and maintain the necessary protection for man and his environment from the potential hazard they pose. Regulatory aspects play, therefore, a key role in studying,implementing and controlling an appropriate national waste disposal system.

The IAEA convened a Technical Committee meeting on regulatory aspects of underground disposal of radioactive waste from 25-29 September 1978 in London, U.K., to collect information on national regulations and regulatory approaches and to discuss the various aspects and issues involved. Representatives from 16 Member States delivered presentations describing, as requested by the IAEA Secretariat, relevant national regulations, the role and responsibilities of the organizations involved, licensing, inspection and other related problems. These presentations and the main results of the discussions are compiled in these proceedings,[1/] which provide information that is often not available from other publications. It will be of interest not only for bodies directly engaged in regulating radioactive waste disposal as part of regulating nuclear activities, health and safety, environmental protection, mining activities etc., but also to those that are responsible for planning and implementing appropriate underground waste disposal systems. The term 'underground' disposal thereby includes the depositing of radioactive waste into the terrestrial subsurface in various ways, ranging from burial at shallow depth, through disposal in rock caverns at various depths to disposal in deep, continental geological formations.

The subject Technical Committee also commented on and revised a draft document on the 'Development of Regulatory Procedures for the Disposal of Solid Radioactive Waste in Deep, Continental Geological Formations' which is part of the Agency's programme to develop guidelines regarding the safe underground disposal of radioactive waste. This document has been published after a final review by the Agency's Technical Review Committee on the Underground Disposal of Radioactive Waste in Safety Series No. 51 (Feb.1980).

1/ It should be noted that this document reproduces the original contributions as received at the meeting, without editing.

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REGULATORY ASPECTS OF UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE* IN THE UNITED KINGDOM

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Abstract

Government policy towards radioactive waste management in the United Kingdom of Great Britain and Northern Ireland is based on the system of dose limitations laid down by ICRP as interpreted by the National Radiological Protection Board for use in the United Kingdom.
The paper describes the legislative and administrative arrangements by which this policy is enforced, including the work of the principal inspectorates, the Nuclear Installations Inspectorate and the Radiochemical Inspectorate together with the latter's equivalents in Scotland and Northern Ireland. It is concluded that the present legislation, including that relating to planning and the setting up of public inquiries, is sufficiently all-embracing to ensure both strict control of the disposal of all the radioactive waste currently arising or which will arise in the future and a high degree of public involvement in the necessary decisions.

Government Policy

1. It is a basic principle of radioactive waste management in the United Kingdom of Great Britain and Northern Ireland to comply with the system of dose limitations laid down by the International Commission on Radiological Protection. The ICRP published a major review of their recommendations (ICRP Publication 26) in July 1977, which took account of the new information on radiation effects which had become available since its last general review (ICRP Publication 9), in 1966.

2. Recommended dose limits for workers and members of the public have not been significantly altered, but the emphasis has changed from enforcing these specific numerical limits to the principle of minimising exposures. In ICRP 26, the Commission stress that every procedure involving radiation exposure must be justified and that measures to reduce radiation exposure should be optimised, so that exposures are kept as low as reasonably achievable, taking economic and social considerations into account.

3. The National Radiological Protection Board are responsible for advising regulatory bodies on the application of ICRP recommendations in the United Kingdom. They have issued a summary and two statements on ICRP 26. They have endorsed the basic system of dose limitations, but consider that there are many specific points which require further interpretation and on which they hope to make statements at a later stage. Discussions with the ICRP on detailed points of interpretation are under way.

*It is important to note that, in the United Kingdom, the term "radioactive waste" includes liquid and gaseous effluents as well as solid waste, and no distinction is drawn between the three in the relevant legislation, except where specified.

4. The report of an expert group, published as an annex to the White Paper, "The Control of Radioactive Wastes", issued as Cmnd 884 in 1959, provided the basis for United Kingdom policy on the management of radioactive waste, and the resulting permissible levels of radiation exposure. First, Cmnd 884 took one-tenth of the ICRP maximum permissible doses recommended at that time for occupational exposure as the dose limit for individual members of the public which should not be exceeded; regardless of the cost of the control measures required. The second objective was that, also irrespective of cost, the whole population should not receive an average dose of more than 1 rem per person per 30 years from waste disposals; although it was expected that actual exposure would not exceed one-tenth of that value. (The ICRP recommended maximum genetic dose at that time was 5 rem per generation from all man-made (except medical) radiation sources). The third recommendation was that radiation doses from waste disposal should be reduced as far as reasonably practicable below those levels; in judging how far below, cost, convenience and national considerations should be taken into account.

5. The Government accepted the recommendations of this report and subsequently enacted the legislation and made the administrative arrangements necessary to achieve its objectives.

6. There are two possible approaches to implementing the dose limitations derived from those recommended by the ICRP. One approach involves the adoption of ICRP dose equivalent limits as the appropriate standards and then deciding what is "as low as is reasonably achievable" on a case-by-case basis; taking account of the particular circumstances relating to each discharge. An alternative approach is for national authorities, while accepting ICRP recommendations, to publish "standards" specific to a particular type of practice or environment, which incorporate a general judgement on what is as low as reasonably achievable. Such "standards" take the form of specific numerical limits, relating radiation doses to people or to amounts of radioactive material released into the environment. They are often derived on general grounds and do not therefore always take full account of variations in local circumstances.

7. The UK has adopted the first approach described above. The authorising Departments estimate the capacity of the local environment safely to receive waste, in terms of the resulting doses to the most exposed individuals in the critical group(s) and to the population as a whole. They then make an assessment of what is "as low as reasonably achievable" taking into account such factors as operational needs, the cost and availability of waste treatment technology, social acceptability etc. Authorisations derived from these considerations are applicable only to the particular circumstances considered and can be withdrawn or altered as necessary.

Legislative and Administrative Responsibilities for Radioactive Waste Management in the United Kingdom

i. Radioactive Substances Act 1960

8. The main piece of legislation governing the management of radioactive wastes in the United Kingdom is the Radioactive Substances Act 1960. It came into force on 1 December 1963 and is administered by the Secretaries of State for the Environment, Scotland, Wales and Northern Ireland and in certain respects by MAFF in the United Kingdom. The Act prohibits the keeping or use of radioactive substances on premises used for the purpose of an undertaking, unless the premises are registered with or exempted by the appropriate Secretary of State. Mobile radioactive apparatus is dealt with similarly. Secretaries of State may attach conditions to the registration, but in considering applications, may have regard only to the amount and nature of the wastes likely to arise, and not to the desirability of the process which produces the waste.

9. There are a number of exemptions to these requirements: Crown establishments, which are expected to comply with the statutory provisions by administrative arrangement; premises subject to equivalent control under other legislation (namely those of the United Kingdom Atomic Energy Authority (UKAEA) and sites licensed under the Nuclear Installations Act 1965 (see para 15 below); and premises where clocks and watches with radioluminosity are kept and used (but not where they are repaired and manufactured)).

10. Some other premises and materials are specifically exempted by Order from the requirement to register, for example; certain categories of hospital, schools, luminous articles etc; although in most cases the exemption is subject to detailed conditions to ensure that no radiological harm arises. The keeping or use of

radioactive substances other than on premises used for the purposes of an undertaking is also excluded from the Act, mainly because it would not be practicable to exercise detailed control over individual users. The Consumer Safety Act 1978 gives the Secretary of State for Prices and Consumer Protection powers to ensure the safety of goods containing radioactive substances.

11. The Act also prohibits the accumulation of radioactive waste on premises, subject to certain exemptions, without the authorisation of the appropriate Secretary of State. Crown establishments, UKAEA premises and licensed nuclear sites are again exempt. Most importantly, the Act prohibits the disposal of radioactive waste on or from all premises (except those belonging to the Crown) unless authorised by the appropriate Secretary of State. In the case of UKAEA premises and licensed nuclear sites, an authorisation from the appropriate agriculture Minister is also required. Before granting an authorisation, Ministers are obliged to consult such local and public authorities as they consider fit.

12. As in the case of exemption from registration, certain premises and materials are exempt by subordinate legislation from the need to obtain authorisations for accumulation and disposal. The exemption orders normally contain detailed conditions so as to ensure adequate radiological protection.

13. Local authorities have a duty under the Act to accept radioactive waste sent to their refuse tips and to deal with it in accordance with the terms of the authorisation, but they may refuse it on grounds other than its radioactivity, under other powers relating to nuisance, pollution and the discharge of waste.

14. The Secretaries of State for the Environment and Wales are assisted in the administration of the Act by the Radiochemical Inspectorate, who have inspection, enforcement and advisory duties in respect of all radioactive waste discharges and disposals. In Scotland and Northern Ireland, the Secretaries of State are assisted by unified Pollution Inspectorates. In cases where authorisation from the Ministry of Agriculture, Fisheries and Food is also required, an Inspectorate within that Ministry operates. Where atmospheric discharges are concerned, Her Majesty's Alkali and Clean Air Inspectorate, part of the Health and Safety Executive (HSE) (see para 16 below) advises both the Radiochemical Inspectorate and the operator direct.

ii. Nuclear Installations Act 1965 and Health and Safety at Work etc Act 1974

15. The Nuclear Installations Act 1965 prevents anyone from installing or operating a nuclear reactor, or any other installation for the production or use of atomic energy, any ancillary processes or the storage, processing or disposal of nuclear fuel or associated radioactive matter; unless licensed by the Health and Safety Executive (HSE) in Great Britain, or the Department of Commerce in Northern Ireland. Crown and UKAEA establishments are exempt. The licensing authorities have powers to attach conditions in the interests of safety to a site licence with respect to discharges of any substance and to the handling, treatment and disposal of nuclear materials, but any conditions relating to discharges must be without prejudice to those sections of the Radioactive Substances Act 1960 regulating the disposal of radioactive wastes.

16. The provisions of the Nuclear Installations Act are enforced by the Nuclear Installations Inspectorate (NII) of the HSE. The HSE is responsible to the Health and Safety Commission, established under the Health and Safety at Work etc Act 1974. This Act places a duty on every employer, (with the active co-operation of his employees) so far as is reasonably practicable, to ensure the health, safety and welfare at work of his employees and similarly to conduct his undertaking in such a way that no -one else is thereby exposed to risks to his health or safety. Corresponding duties are placed on self-employed persons. There is separate but similar legislation covering Northern Ireland. The NII enforce the Health and Safety at Work Act as it applies to nuclear installations.

17. The general responsibility for oversight of the HSE and its organisation and financing rests with the Secretary of State for Employment, except in respect of emissions to the air, which is under the policy direction of the Secretaries of State for the Environment, Scotland and Wales and for the safety of nuclear installations which is under the policy direction of the Secretary of State for Energy (in England and Wales) and for Scotland (in Scotland). In Northern Ireland, policy in relation to emissions to the air, is the responsibility of the Department of the Environment for Northern Ireland.

iii. International Treaties and Conventions

18. The United Kingdom is a party to the 1974 Paris Convention for the Prevention of Marine Pollution from Land Based Sources, which it ratified in March 1978. This

Convention requires contracting parties to take steps to eliminate pollution of the sea from land-based sources by specified substances, including radioactive material and wastes. It applies only to the North-East Atlantic area. Dumping at Sea as such is governed by the London Dumping Convention of 1972 which came into operation in August 1975.

19. On joining the European Community in 1973 the United Kingdom also became a party to the Euratom Treaty; Article 30 of which requires the European Commission to lay down basic standards for the protection of the health of workers and the public against the dangers arising from ionising radiation. Member States are required to make the necessary legal or administrative arrangements to ensure compliance with the standards promulgated in the consequent Directive 76/579/EURATOM, made under Article 31. Article 37 of the Treaty requires Member States to provide the Commission with such general data relating to plans for the disposal of radioactive waste so as to enable the Commission to determine whether implementation of these plans is liable to result in radioactive contamination of the water, soil or air space of another Member State.

Present Practice in the Disposal of Radioactive Waste

20. In the case of solid radioactive waste of very low activity it is satisfactory for disposal to take place with ordinary refuse. Authorisations permitting this are granted under the Radioactive Substances Act. These authorisations specify that the waste must either be removed by a refuse disposal authority, in which case the disposal route is not specified, or by private contractors, in which case it is specified that it should go to a landfill tip used for substantial quantities of non-radioactive waste. Where refuse is taken by a disposal authority, it will go either to a landfill tip or an incinerator; either route is acceptable and calls for no control beyond the point at which the disposer puts it in his dustbin.

21. Wastes of somewhat higher activity can still be disposed of to a landfill tip provided certain precautions are taken. Authorisations for such disposals specify the tip, which is chosen after consideration of its management, its expected life, the probable subsequent use of the land, whether it is liable to catch fire, drainage, local water supplies and any other special features. The authorisations are granted after consultation with the appropriate public and local authorities who may make appropriate charges. The tip operators arrange for the taking of any special measures, such as burial of the wastes to the depth specified in the authorisation. This class includes both packaged wastes and bulk loads such as rubble and soil arising from the demolition of contaminated premises.

22. Authorisations are exceptionally granted for the disposal of solid radioactive waste by burial on the site at which it arises. Although the activity levels are no higher than the previous two classes, this is generally undesirable because the future use of the land cannot always be foreseen. Amongst the additional criteria for disposals of this kind is therefore some assurance of continuity of ownership of the site bearing in mind the activity and half-life of the waste.

23. Solid wastes of higher activity than those described above but still of comparatively low activity are disposed of to the National Disposal Service. The Radioactive Substances Act gives powers to the Secretary of State for the Environment to operate such a service; in practice the United Kingdom Atomic Energy Authority and British Nuclear Fuels Ltd act as his agents. The available routes for disposal are sea-dumping (operated by UKAEA under the surveillance of NEA) for which a licence is also required under the Dumping at Sea Act 1974 and shallow land burial (operated by BNFL).

24. There is at present in the UK only one shallow land burial site for the general reception of radioactive waste. This is at Drigg on the Cumbria coast, near to the Windscale reprocessing plant. It is owned and operated by BNFL. Most of the waste going to the site, where it is buried in trenches, is from Windscale; the authorisation given to BNFL is appended. Authorisations given to other disposers sending waste to the site give little more than a limitation on volume and activity and a requirement to send the waste in such condition and at such time as is specified by BNFL; necessary since BNFL are responsible for management of the site.

25. Where disposal is to landfill tips, there is no requirement on the disposer or the operator of the tip to undertake environmental monitoring. Any necessary monitoring is carried out by the Inspectorates of the authorising departments. In the case of Drigg, it is a condition of the authorisation that BNFL take such measures including the taking and analysis of samples of the waste, ground water and underground water as the authorising Ministers may specify. BNFL carry out a comprehensive system of environmental monitoring which includes measurements of radioactivity in ground water, streams and rivers and in the atmosphere. The results of this are reported regularly to the authorising departments. Inspectors of the authorising departments, in making their regular inspections of the site carry out their own environmental checks.

26. Installations for the disposal of radioactive waste are not, as such, prescribed as nuclear installations. However, the Drigg site is also used for the storage of radioactive waste in certain buildings. Installations for the storage of bulk quantities of radioactive waste may be prescribed as nuclear installations under the Nuclear Installations Act 1965 and it was decided that in the case of Drigg this should be done. Consequently the site is licensed under the Act. As a result, the management other than disposal, of wastes on the Drigg site and measures relating to radiological protection of the workers are controlled by conditions in the licence. Enforcement of the licence conditions is supervised by the Nuclear Installations Inspectorate whose staff are also responsible for the enforcement of other legislation relating to the safety of workers.

27. The inspectors of the various Government Departments who visit Drigg work in close co-operation with each other on all matters of mutual interest. The system of control outlined above has worked well in practice.

RECENT DEVELOPMENTS AND THE FUTURE

General Policy

28. In September 1976, the Standing Royal Commission on Environmental Pollution (RCEP) published its Sixth Report on "Nuclear Power and the Environment". Among its recommendations were that the responsibility for developing the best strategy to deal with radioactive wastes should lie with the Government Department(s) concerned with the protection of the environment. In its response to this recommendation, the White Paper Cmnd 6820, the Government stated that the Secretary of State for the Environment would in future be responsible, together with the Secretaries of State for Scotland and Wales, for nuclear waste management policy. The main elements in this new responsibility were to:

i. ensure that the creation of wastes from nuclear activity is minimised;

ii. ensure that waste management problems are dealt with before any large nuclear programme is undertaken;

iii. ensure that the handling and treatment of wastes is carried out with due regard to environmental considerations;

iv. secure the programmed disposal of waste accumulated at nuclear sites;

v. ensure that there is adequate research and development on methods of disposal;

vi. secure the disposal of wastes in appropriate ways, at appropriate times and in appropriate places.

The new responsibility is to be exercised in close consultation with the Secretary of State for Energy and the other Ministers who have responsibilities in this field. The Government are at present considering whether the Secretaries of State for the Environment, Scotland and Wales will need further statutory powers to help them in carrying out this new responsibility.

29. The RCEP also recommended that an independent Radioactive Waste Management Advisory Committee be set up to advise the Secretaries of State in carrying out their new role. The Government has also accepted this recommendation and the first meeting of the Advisory Committee is to be held on 26 September. The Committee will make an annual report to Parliament through the Secretary of State for the Environment. Its terms of reference are:

"To advise the Secretary of State for the Environment and the Secretaries of State for Scotland and Wales on major issues relating to the development and implementation of an overall policy for the waste management implications of nuclear policy, the design of systems, research and development, and including the environmental aspects of the handling and treatment of wastes."

30. As explained above, the present system of controls over radioactive waste is based on a White Paper issued in 1959. Important changes in the nuclear field have of course occurred since then and a group of experts from the relevant bodies have recently been engaged in reviewing the White Paper. Their report will be considered by the Radioactive Waste Management Advisory Committee and published in due course.

Additional facilities likely to be required

31. The main wastes in the UK for which disposal routes have not been fully evaluated are:

i. high level liquid wastes arising from reprocessing and stored in stainless steel tanks. There is something like 750 m^3 of these wastes, in concentrated form, at Windscale and 800 m^3 of less concentrated wastes at Dounreay;

ii. fuel cladding, high level solid Magnox and Zircaloy stored under water in concrete silos, plus stainless steel hulls stored dry. About 7000 m^3;

iii. plutonium contaminated wastes;

iv. wastes stored at nuclear power stations which include fuel element and reactor core components, wet materials such as sludges and contaminated large engineering items. A total of about 17,500 m^3;

v. sludges and miscellaneous wastes from reprocessing, stored in silos at Windscale. About 11,000 m^3;

In addition, the future will see arisings of large amounts of waste from the decommissioning of reactors and other plant. Such wastes will include graphite concrete and steels contaminated with radioactive materials and also activated by neutron irradiation.

32. In terms of activity, the most important of these wastes are the high level liquid wastes. At present these are safely contained and they can continue to be for many years. However, it is now agreed that their management could be more efficient if they were in a solid low leachable form. Accordingly, research is proceeding towards the vitrification of these wastes and results are encouraging. It should be stressed that vitrification is an important measure in its own right and is not being undertaken merely as a step to disposal, although this must remain the long-term objective.

33. Research is also being undertaken on the treatment of other classes of wastes to get them in a form suitable for disposal. Costed feasibility studies of disposal options will be carried out for each type of waste currently in store. Such studies will obviously have to be conducted in parallel with studies on the types of disposal facility which will be appropriate. This will also include studies of the use of the sea as a disposal route especially for the large quantities of wastes expected to arise from decommissioning operations. It is therefore too early to say what land-based facilities will be found appropriate for the United Kingdom. It is however possible that provision for the disposal of three types will be necessary. These will be:

i. high level waste;

ii. intermediate level solid wastes;

iii. low level wastes of the type now disposed to Drigg.

The sites may or may not also have treatment and long-term storage facilities.

34. The environmental Ministers already have powers under the Radioactive Substances Act 1960 to provide, or arrange for the provision of, facilities for the disposal of radioactive wastes.

NUCLEAR WASTE DISPOSAL CORPORATION

35. The Royal Commission on Environmental Pollution saw a need for an executive body, to develop and manage new and possibly existing radioactive waste disposal facilities. They recommended the setting up of a Nuclear Waste Disposal Corporation for this purpose. In its response to the Royal Commission, the Government said that it did not think it was necessary to come to a decision immediately on whether such a body should be set up, what its functions should be, and how it would interact with the other nuclear agencies. There are of course other organisational options for managing any new disposal facilities which may be required and these will be considered, along with the Royal Commission's recommendation, in the light of studies into the various disposal options, and with the aid of advice from the Radioactive Waste Management Advisory Committee.

Possible methods of control of the disposal of radioactive waste.

36. The major decision affecting the legal controls over the construction and operation of an underground waste disposal facility will be whether it is prescribed as a nuclear installation. If it is, then it will be subject to the licensing procedure of the Nuclear Installations Act. Even if one type of facility is prescribed it is still possible that other types will not be. In what follows, both cases are considered.

37. In all cases, the disposal of the waste will take place under an authorisation granted under the Radioactive Substances Act 1960 or legislation replacing it. Even should the facility be operated by a Government department then the same procedures will be required as though a formal authorisation were necessary and the conditions relating to disposal will be defined as strictly.

38. It is possible that the disposal will be authorised in two stages, an authorisation to the originator of the waste permitting him to send his waste to the disposal facility and an authorisation giving to the facility permitting disposal. In this way the necessary conditions can be made to apply where they are appropriate. The originator's certificate of authorisation could contain conditions controlling the activity and radionuclides present, the amount of waste to be sent to a particular facility, how and when it is to be delivered and any necessary conditioning, including packaging. That of the facility could contain conditions relating to the actual disposal such as depth, spacing, age, activity, rate of disposal, monitoring and so on.

39. The control of the management of radioactive wastes prior to disposal will depend on whether the site is licensed or not. If it is not, then it will be subject both to registration and to authorisation for the accumulation of the waste, both under the Radioactive Substances Act. Conditions imposed as a result of registration can lay down necessary requirements regarding any structure on the premises or any apparatus, equipment or appliance used. The conditions must have regard to the amount and character of the radioactive waste. Conditions in the authorisation to accumulate would give the necessary powers to ensure disposal at the appropriate time. Enforcement of registration and authorisation would be by the Radiochemical Inspectorate in England and Wales and by HM Industrial Pollution Inspectorate in Scotland.

40. If the site is licensed under the Nuclear Installations Act 1965, it will not be registered under the Radioactive Substances Act 1960 although the authorisation for disposal will be given under that Act, in the case of England jointly by the Department of the Environment and MAFF. It is possible that in view of the Environmental Ministers' new responsibilities in the field of radioactive waste management, the present exemption from registration in the case of licensed sites may be made subject to conditions equivalent to those in a certificate of registration. Such conditions would be given to the site operator in the form of a directive. Whether or not this amendment is made to the Radioactive Substances Act, the very wide powers in the Nuclear Installations Act would ensure that there are no gaps in the system of control and any necessary conditions relating to waste management could be attached to the site licence.

41. Safety of the workers during the construction and operation of a radioactive waste facility is covered by general worker-protection legislation, namely the Health and Safety at Work Act 1974, the associated Factories Act 1961 and regulations made under these Acts such as the Construction (General Provisions) Regulations 1961. Radiological safety of the workers is covered in the case of non-licensed sites by the Sealed and Unsealed Source Regulations made under the Factories Act; in the case of licensed sites by conditions in the site licence issued under the Nuclear Installations Act. These Acts and Regulations are enforced by the Health and Safety

Executive which contains a number of individual inspectorate organisations including those responsible for factories, mines and quarries and nuclear installations. On licensed sites the Nuclear Installations Inspectorate is responsible for the enforcement of all the legislation relevant to safety and for the associated inspection. The Inspectorate can call on other branches within the Executive for expert specialist advice where necessary.

Stages in the Procedure

42. There are many possible permutations of the existing legislation which could be used to control the construction and operation of a disposal facility. An example will therefore be chosen and certain assumptions made:

i. disposal is to be of highly active solid wastes to a deep rock formation;

ii. the site will have waste storage and treatment facilities of such nature that it would be prescribed under the Nuclear Installations Act and therefore subject to the licensing procedures of that Act;

iii. any general public debate on the concept which the Government felt to be necessary;

iv. the site is in England.

References in this section to the Radiochemical Inspectorate should be taken to include, where appropriate, the technical officers of the Ministry of Agriculture, Fisheries and Food.

Site Selection and Suitability

43. The general site area would be selected on the basis of geological considerations and at an early stage it would also be necessary to carry out exploratory drillings and other investigations to establish if the site characteristics satisfied the criteria established for the safe disposal of radioactive waste underground.

44. Such exploratory operations are classified as "development" under the Town and Country Planning Act 1971 and consequently planning permission is required. This could be the opportunity for the Secretary of State for the Environment to use his powers under the Planning Act in order to set up a public inquiry into the use of the proposed site. Obviously, no decisions on the exact mechanism have been taken, but the existing planning inquiry system is sufficiently flexible to provide the right forum for public examination of the major issues involved.

45. At this stage the Nuclear Installations Inspectorate and the Radiochemical Inspectorate would have satisfied themselves as to the suitability of the site in relation to the siting criteria for the type of facility proposed.

Construction of Facilities at the Site

46. Planning permission would be required for this phase of the work. It may be that it would be felt more appropriate for further public examination of the project to take place at this stage rather than attaching it to the earlier planning permission necessary for site proving; decisions such as this will be taken nearer the time.

47. Before construction started, the proposed operator would provide the Nuclear Installations Inspectorate and the Radiochemical Inspectorate with sufficient information to enable them to satisfy themselves as to the safety and waste management considerations of the proposed plant. Provided that the assessment proved satisfactory the applicant would be advised to make formal application to the Health and Safety Executive for a licence to construct the plant and to the Secretary of State for the Environment and the Minister of Agriculture, Fisheries and Food for an authorisation to dispose of waste. Rules attached to the making of these applications provide for consultation with the appropriate public and local authorities who have the right to make representation on them. If necessary there would be a public inquiry but this would be unlikely if there had been an earlier inquiry under the Planning Act. What is more likely is that all these aspects would be considered together at one inquiry.

48. The licence may be varied at the discretion of the Health and Safety Executive making it possible to amend, add or revoke licence conditions at any time. This provides a flexible system in which only those conditions appropriate to the current state of the plant are attached.

49. During this period, the very strict regime of controls on standards and materials inherent in the legislation described in paras 15 and 16 would be enforced by the Nuclear Installations Inspectorate with advice as necessary from specialists in other Inspectorates of the Health and Safety Executive.

50. At least six months before the plant becomes operational, details of it will have to be submitted to the Commission of the European Communities in order for it to be considered by the Group of Experts appointed under Article 37 of the Euratom Treaty, who will have to assess whether its operation would be liable to result in the radioactive contamination of the water, soil or airspace of another Member State. At this time the final form of the authorisation will probably have been agreed although it may not necessarily have been issued. It will be necessary for it to have been issued by the authorising departments on the recommendation of the Radiochemical Inspectorate before disposals start.

51. Before construction is complete, extensive environmental monitoring will be necessary in order to establish a base-line for the monitoring undertaken during and after the operation. Check monitoring will also be carried out by the Radiochemical Inspectorate.

52. On completion of construction and before routine operations covered by the licence start, the operator will have had to demonstrate to the Nuclear Installations Inspectorate that the plant can be operated in a safe manner. This will form part of the formal commissioning of the plant and an operating licence will not be granted until it is completed.

Operation

53. Disposals of waste will be made in accordance with the conditions in the certificate of authorisation. These will be enforced by the authorising departments in the course of regular site inspections. The environmental monitoring regime established before operation began will be continued, together with any other monitoring which is specified. The Radiochemical Inspectorate will carry out its own independent checks on the environment.

54. The safety of the operations at the plant will be controlled by operating rules specifying the safe operating limits of the plant and such matters as the availability and frequency of testing of essential safety equipment. Any changes to the rules or modifications to the plant would be carefully considered before they take place and for this purpose it would be a condition of the site operating licence that a Safety Committee be set up to advise on the safety of any such proposal. Changes or modifications would have to be approved by the Health and Safety Executive. If there were waste management considerations in the changes, discussions between the Radiochemical and Nuclear Installations Inspectorate would precede the approval.

55. Experience from present licensed sites gives confidence in forecasting that there will be the necessary co-operation between the two Inspectorates.

Closure

56. When the last disposal has been made there will still be some essential engineering work to be carried out in connection with the final sealing of the waste. It may be that any waste treatment plant on the site will continue to operate, conditioning waste for disposal elsewhere. There will eventually come a time, however, when all activity on the site has finished, when the ground installations have been decontaminated and dismantled and when the use of the site for other purposes is perhaps being considered. The operators responsibility does not end at this stage; it lasts beyond the revocation or surrender of the nuclear site licence until in the opinion of the Health and Safety Executive there has ceased to be any danger from ionising radiations from anything on the site or until the authorisation is cancelled.

57. Eventually, however, it seems clear that responsibility for the effects of the site will have to be assumed by the Government, who would then assume responsibility for monitoring and any action flowing from the results of monitoring.

58. It has to be faced that no legislation, control or monitoring can be guaranteed to last the life of long-lived waste. The safety of the operation is governed by the precautions imposed at the time of disposal.

DEPARTMENT OF THE ENVIRONMENT

Radioactive Substances Act, 1960

CERTIFICATE OF AUTHORISATION FOR THE DISPOSAL OF RADIOACTIVE WASTE

1. This is to certify that British Nuclear Fuels Limited (hereinafter called "the Company") is authorised under sections 6(1) and 6(3) of the Radioactive Substances Act 1960, with effect from 1 April 1971, to dispose of solid radioactive waste, including sludges, on the premises occupied by the Company at Drigg in the County of Cumberland (hereinafter called "the premises") subject to the conditions specified in paragraph 2 below.

2. The conditions are -

a. that the waste is buried in the ground beneath at least one metre of soil;

b. that no burial excavation penetrates through the boulder clay stratum;

c. that the dose-rate at the surface of substantially unshielded waste containing radionuclides emitting one or both of the following, that is to say, beta particles or gamma radiations does not exceed 0.75 rads per hour in air;

d. that in all the matter (whether or not consisting wholly of the waste) buried on the site in any one day;

i. the alpha activity on the average does not exceed 20 millicuries per cubic metre; and

ii. the beta activity of beta emitting radionuclides which do not emit gamma radiation on the average does not exceed 60 millicuries per cubic metre;

e. that, for the purpose of ascertaining the effect of the disposals on the environment the Company take such measures, including the taking and analysis of samples of the waste, ground water and underground water, as may be specified on behalf of the Secretary of State for the Environment; and

f. that the Company keep records of all the wastes buried or deposited on the premises, including their location and estimated activity.

3. In this Certificate "radioactive waste" has the same meaning as in the Radioactive Substances Act 1960.

Signed by authority of
the Secretary of State
for the Environment

E R GORDON
A Principal in the Department
of the Environment

Date 19 March 1971

Authorisation under the Radioactive Substances Act 1960 does not authorise the disposal of waste in contravention of any other enactment or any order, regulation or other instrument made, granted or issued under any enactment, in contravention of any rule of law or in breach of any agreement.

REGULATING UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE IN THE UNITED STATES

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ABSTRACT

In 1974 the Nuclear Regulatory Commission (NRC) was established and given authority for licensing and regulating management and disposal of radioactive wastes. NRC authority to regulate radioactive waste is limited. Legislation to extend and expand NRC licensing and regulatory authority over management and disposal of radioactive wastes is being considered.

A principal thrust of the program has been in the area of high-level waste management, with emphasis on having appropriate standards and regulations in place in time to provide guidance to DOE in developing its high-level waste repository program. Efforts are also underway in the areas of low-level waste, uranium mill tailings, radioactive gases, and decommissioning of nuclear facilities. With regard to the permanent disposal of either solidified high-level waste or spent fuel, the principal option being examined by DOE is emplacement of waste in deep geological repositories using normal mining techniques. NRC regulation development efforts are currently directed at providing guidance specific to such repositories. Finally, NRC is developing a capability to independently assess how a proposed site and design will perform and whether the predicted actions will meet the minimum acceptable performance required by our regulations.

Since effective management of radioactive wastes is a common objective of the several Federal agencies, the NRC is working closely with these agencies to help ensure a sound national program for dealing with nuclear waste. In addition, the NRC is taking an active role within international groups, such as the IAEA and the NEA in establishing acceptable worldwide policies, standards, and procedures for handling nuclear wastes.

History

From the beginning of plutonium-weapons programs in the early 1940s, it was recognized that the radioactive by-products of those programs would require careful management. Facilities were designed and built to safely store high-level wastes*, until a program for

*The U.S. Department of Energy (DOE), operates three facilities - the Hanford Plant in Washington, the Savannah River Plant in South Carolina, and the National Reactor Testing Station [now the Idaho Nuclear Engineering Laboratory (INEL)] in Idaho - to produce plutonium for the weapons program or to process irradiated fuel from experimental and naval reactors. High-level reprocessing waste was (and continues to be) stored in tanks at these facilities. Some of the waste at the INEL has been converted to calcined, granular solids and in stored in stainless-steel bins housed in concrete silos.

ultimate disposition could be developed. Materials with less radioactivity were consigned to shallow burial grounds, with methods similar to those used for sanitary landfill, but with much greater care being exercised. Shallow burial trenches used for low-level military wastes performed more or less as expected, and the same approach was adopted for the disposal of commercially generated low-level wastes. In the earliest days of the program, some low-level wastes were disposed of at sea. In the 1960s this practice was stopped by the United States.

There is now a well funded federal program designed to provide a geologic disposal facility for high-level radioactive wastes. Salt and other geological formations throughout the continental United States are being investigated and evaluated. Experimental work on a surface storage concept is being conducted. There is also support of an ongoing international effort to determine whether it is practical to dispose of high-level radioactive waste in the ocean bottoms. Before its functions were transferred to DOE, ERDA published a document describing the technical alternatives for disposal of commercial wastes, and DOE is now preparing to publish a draft Generic Environmental Impact Statement on its program for management of commercially generated radioactive wastes. In addition, the 1974 Energy Reorganization Act, which split the AEC into ERDA and NRC, has for the first time provided for an independent regulatory review of the Federal program for disposal of high-level wastes and a mechanism for early public participation in the decision-making process.

Role of Federal Agencies

A number of Federal agencies have substantive regulatory, research or operational responsibilities in the area of nuclear waste management. Figure 1 illustrates the respective responsibilities of the DOE, the U.S. Enviornmental Protection Agency (EPA) and NRC in nuclear waste management.

The DOE is responsible for developing and operating a program to dispose of all high-level wastes. This includes research and development necessary to establish this program. DOE is also respon-

sible for management and disposal of all wastes, both high and low-level, produced in connection with DOE programs.

The NRC licenses and regulates the uses of nuclear energy to protect the public health and safety and the environment. It does this by licensing persons and companies to build and operate nuclear reactors and to own and use nuclear materials The NRC makes rules and sets standards for these types of licenses. NRC also carefully inspects the activities of the persons and companies licensed to ensure that they do not violate the safety rules of the Commission.

The purpose of the EPA is to protect and enhance the environment today and for future generations to the fullest extent possible under the laws enacted by Congress. The Agency's mission is to control and abate pollution in the areas of air, water, solid waste, pesticides, noise and radiation. EPA's mandate is to mount an integrated, coordinated attack on environmental pollution in cooperation with State and local governments.

The broad objectives of the United States Geological Survey (USGS), under the Department of Interior, are to perform surveys, investigations, and research of the U.S., classify land as to mineral character and water and power resources, enforce departmental regulations applicable to oil, gas and other mining leases, permits, licenses, development contracts, and gas storage contracts, and publish and disseminate data relative to the foregoing activities. The USGS is actively engaged in studies relating to the geologic disposal of radioactive wastes.

The U.S. Department of Transportation (DOT) establishes the Nation's overall transportation policy. Under its umbrella there are seven administrations and the Materials Transportation Bureau whose jurisdictions include highway planning development, and construction; urban mass transit; railroads; aviation; and the safety of waterways, ports, highways, and oil and gas pipelines. Decisions made by DOT in conjunction with the appropriate State and local officials strongly

affect other programs such as land planning, energy conservation, scarce resource utilization and technological change. The delineation of responsibility between NRC and DOT is spelled out in a memorandum of understanding.

NRC Authority To Regulate Radioactive Wastes

NRC authority to regulate radioactive waste is derived from three statutes: the Atomic Energy Act of 1954, the National Environmental Policy Act of 1969, and the Energy Reorganization Act of 1974.

The Atomic Energy Act authorized the NRC's predecessor--the Atomic Energy Commission (AEC)-- to license and regulate the possession and use of source, byproduct, and special nuclear material. The AEC itself, and certain defense activities were exempted from these licensing and regulatory requirements. The Act did not explicitly authorize regulation of radioactive wastes facilities. Therefore, the NRC authority to regulate waste under the Atomic Energy Act is derived from its authority over licensable materials.

Under the National Envornmental Policy Act (NEPA), the Commission has additional implied authority over nuclear wastes management associated with licensed activites. This authority is derived from the environmental mental analysis required under NEPA which permits the Commission to impose license conditions on waste mangement activities to minimize their environmental impacts.

Title II of the Energy Reorganization Act of 1974 transferred the AEC's licensing and regulatory authority to the NRC. The Energy Research and Development Administration, now a part of the DOE, was exempted from NRC licensing authority, except as provided in Section 202 of the Act. Section 202 provides the only explicit statutory authority for NRC licensing of DOE waste facilities. Subsection 3 specifically requires an NRC license for any DOE facility used primarily for the receipt of storage of high-level radioactive waste resulting from activities licensed by the NRC.

Subsection 202(4) of the 1974 Act provides for NRC licensing of DOE facilities authorized for the express purpose of subsequent long-term storage of high-level radioactive waste generated by DOE activities. However, the long-term storage or disposal of DOE-generated high-level waste in a DOE research or development facility currently does not require an NRC license.

Under Section 274 of the Atomic Energy Act, the NRC may by means of a formal agreement with an individual State transfer to the state some regulatory authority. Pursuant to such agreements, several States currently license commercially operated burial sites for low-level radioactive waste, uranium milling operations, and decommissioned facilities.

There are numerous bills before the Congress which would substantially change the NRC authority to manage radioactive waste. The fate of these bills is uncertain at this time.

The NRC Waste Management Program

In mid-1975 the NRC established a separate waste management unit to coordinate all NRC waste management activities. Principal initial efforts have been to (1) establish objective performance goals (technical, social, economic, and environmental) for management of nuclear wastes, (2) develop a regulatory framework (regulations, standards, and guides) that reflects these goals, and (3) prepare licensing procedures (and assessment methodologies) needed to evaluate proposed waste management programs and strategies against these regulations. Initial studies have been completed, tentative regulatory needs have been established, and a program that will allow NRC to make timely licensing decision is under way.

To provide effective guidance (planning base) for DOE and the nuclear industry, a regulatory framework (new regulations and/or policy statement, standards, and guides) will be structured to require conformance with a fixed set of minimum acceptable performance standards for waste management activities while providing for flexibility in technological approach.

The principal thrust of the program has been in the area of high-level waste management, with emphasis on having appropriate standards and regulations in place in time to provide guidance to DOE in developing its high-level waste repository program. However, efforts are also under way in the areas of low-level waste, uranium mill tailings, radioactive gases, and decommissioning of nuclear facilities.

Since effective management of radioactive wastes is not only an objective of NRC, but also a common objective of the several Federal agencies having jurisdictional and programmatic interest in waste management issues (see Fig. 1), the NRC is working closely with these agencies to help ensure a sound national program for dealing with nuclear waste.

The NRC waste management program is divided into two general areas: high-level waste (HLW) management and low-level waste (LLW) management.

High-Level Waste Program

With regard to the permanent disposal of either solidified high-level waste or spent fuel, the principal option being examined by DOE is emplacement of waste in deep geological repositories using normal mining techniques. While some uncertainty still remains regarding repository engineering such as thermal limitations, potential corrosive interaction and retrievability, a review of the available technology leads one to conclude that it is technologically possible that a repository can be successfully located in a geologic medium in the next decade. NRC regulation development efforts are currently directed at providing guidance specific to deep geologic repositories. They will address:

- Waste classification - what wastes must be placed into a HLW repository;
- Waste form performance criteria - what physical and chemical form the wastes must be in;
- Site suitability criteria - what consititutes an acceptable site for a repository;

- o Repository design criteria - what constraints must be placed on development operation of a repository;
- o Repository decommissioning criteria - what constraints must be placed on closing a repository; and
- o Radiological objectives - what level of radiological containment the repository system must provide.

Licensing and other administrative procedures are being developed which will address not only what steps NRC and DOE will have to take in proposing, constructing and licensing a repository but also will include provisions for State participation which are beyond the traditional approaches which have been taken in other NRC licensing proceedings.

Finally, NRC is developing a capability to independently assess how a proposed site and design will perform and whether the predicted actions will meet the minimum acceptable performance required by our regulations.

Low-Level Waste Programs

Low-level radioactive wastes resulting from the commerical nuclear fuel cycle and from other activities utilizing radioactive material (e.g., hospitals and universities) are currently disposed of at shallow land burial grounds owned and operated by commercial companies. The land itself must be owned (pursuant to Commission regulation) by either the Federal government or a State government. There are currently six commercial shallow land burial facilities; only three are in operation (see Table 1).

As indicated earlier NRC regulatory authority over disposal of low-level waste can be relinquished to States by entering into formal agreements. Five of the six commerical burial grounds are located in and regulated by Agreements States.

NRC low-level waste management efforts include standards and assessment capability development as well as licensing actions.

The low-level waste regulations being developed will address:

- o waste form performance criteria,
- o site suitability criteria,
- o design and operation criteria,
- o monitoring criteria,
- o decommissioning criteria,
- o post-operational maintenance criteria, and
- o funding and other institutional requirements.

In addition NRC is performing an in-depth evaluation of the technical, environmental, economic and socio-political aspects of four alternatives to shallow land burial--engineered structures, ocean disposal intermediate depth burial and mined cavities. The four alternatives were selected after screening a comprehensive listing of alternative methods for disposal of low-level wastes.

In the area of mill tailing management, the problem is principally one of safe management of a small concentration of radium in enormous quantities of tailings. Although NRC does not currently have direct regulatory authority over mail tailings, it is seeking such authority and Congress is considering legislation which would expand NRC authority in this area.

The exact nature of the risk to the public from mill tailings, while estimated to be very low, is not known with precision. NRC is investigating improved methods for tailings stabilization and improved regulations for operational and long-term control. A generic environmental impact statement on uranium milling is underway. In the meantime, NRC is requiring that each applicant for a new mill license or license renewal develop a tailings management and reclamation plan which meets interim performance objective developed by the NRC licensing staff and make provisions to assure that funds are available to pay for the reclamation.

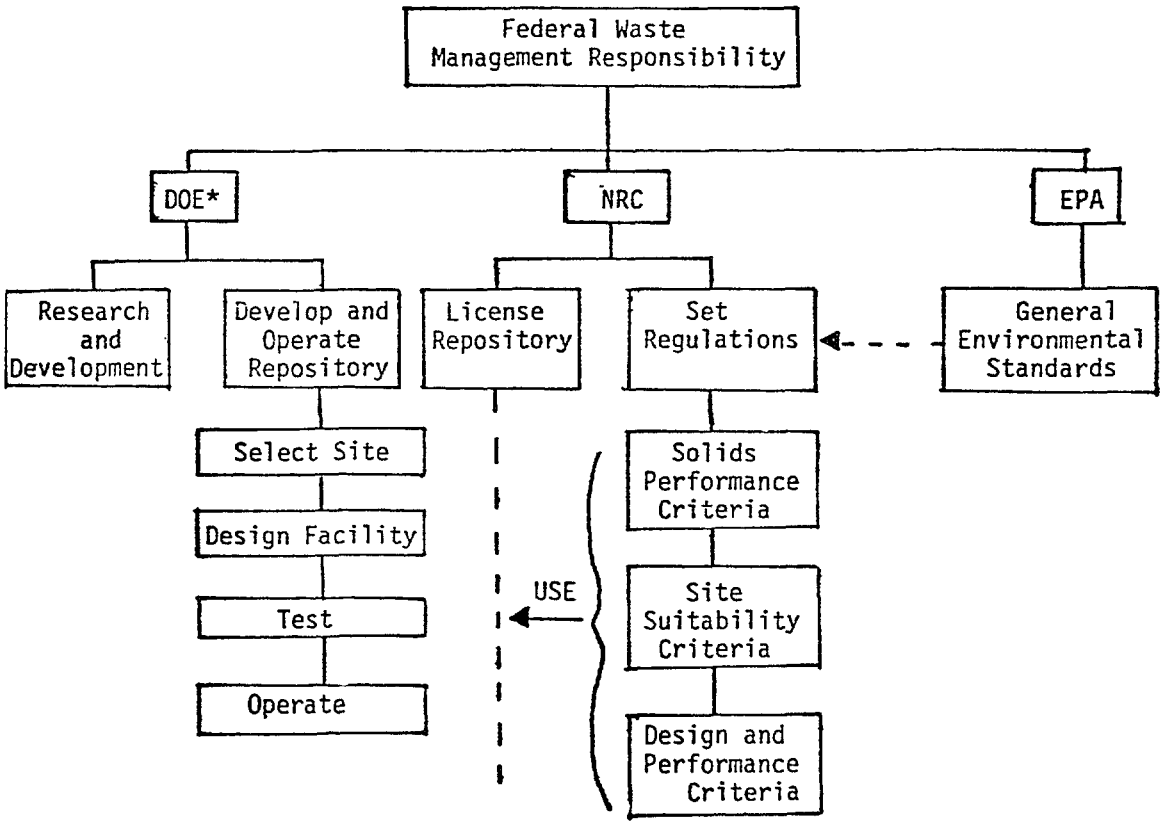
International Implications

The problems of nuclear waste management are international in scope.

Many such problems (e.g., the potential for contamination of the oceans and atmosphere and the need for isolation of some wastes for longer periods than governments and political boundaries have remained stable in the past) require a set of internationally acceptable and accepted solutions. The wastes from the U.S. nuclear industry will account for only about one-third of the nuclear waste generated in the world. Therefore, NRC is taking an active role within international groups, such as the international Atomic Energy Agency and the Nuclear Energy Agency of the Organization for Economic Cooperation and Development, in establishing acceptable worldwide policies, standards, and procedures for handling nuclear wastes.

FIGURE 1

FEDERAL WASTE MANAGEMENT RESPONSIBILITY



* DOE will develop and operate all disposal facilities for high-level nuclear waste disposal. Facilities for other types of nuclear waste may be developed and operated by privately owned commercial companies.

TABLE 1

SHALLOW LAND BURIAL GROUNDS

FOR LOW-LEVEL WASTES

Location	Volume of Waste Buried Through 1977 (ft^3)	Approximate Waste Capacity Remaining (ft^3)	Current Status
Barnwell, South Carolina	5,164,174	50,993,416	OPEN--Limited to 135,000 ft^3/month
Sheffield, Illinois	3,023,000	0	Licensed Capacity Fille
Beatty, Nevada	2,137,460	16,986,034	OPEN
Hanford, Washington	596,023	44,142,500	OPEN
Maxey Flats, Kentucky	4,964,932	15,785,358	CLOSED FOR STUDY
West Valley, New York	2,460,000	1,483,188	CLOSED BY OPERATOR

BASIC REGULATORY REQUIREMENTS FOR CARRYING OUT INVESTIGATIONS, REASONING AND THE APPROVING OF THE DISPOSAL OF RADIOACTIVE AND OTHER INDUSTRIAL WASTE IN GEOLOGICAL FORMATIONS IN THE U.S.S.R.

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Abstract

Legislation and other regulatory standards in force or in preparation in the USSR relating to the disposal and storage of radioactive and other industrial wastes in underground formations are discussed in the report.

A tentative outline of the basic operations involved in the disposal of radioactive and other industrial wastes into geological formations is given. Supervision, control and penalties provided by law are also discussed. Conclusions are made that the comparison of national legislative instruments and regulatory documents and procedures relating to underground disposal of radioactive and industrial wastes into geological formations is timely and urgent.

1. Introduction

During the next two decades industrialized and developing countries are planning to carry out extensive programmes on the development of nuclear power and the construction of nuclear fuel reprocessing plants.

A consequence of this activity will be the production every year of considerable quantities of low-, medium-, and high-level radioactive wastes containing thousands of millions of curies of radioactive substances.

One of the urgent problems in atomic science and technology today is to develop acceptable methods of decontamination and final disposal. Only if this problem is solved satisfactorily both at the national and the international level will it be possible to put into effect the plans for the construction of nuclear power plants and spent fuel reprocessing plants, eliminating the unfavourable effect of radioactivity on the biosphere at present and in future.

Many countries have been engaged for a long time in the study and development of different methods of decontamination and burial of radioactive wastes of all levels. Collaboration in this work is being developed successfully among the States Members of the Council for Mutual Economic Assistance (CMEA).

In recent years scientists and other specialists in most countries leading in nuclear technology and also the international organizations have shown a

preference for the use of geological formations in continental deposits as the most promising approach to reliable and safe disposal of radioactive waste.

The Agency's programme on the underground disposal of radioactive waste into geological formations, which was approved at the Advisory Group meeting in February 1978, has roused great interest and received the support of more than 20 States Members of the Agency, including the Soviet Union. The programme provides for the preparation of codes of practice and guides relating to the different stages of underground repository construction, from siting to sealing and long-term surveillance. This involves a number of disposal alternatives which are already in use in many States or are being developed, such as:

- Emplacement of solid waste in surface deposits at shallow depths (land burial);
- Disposal of high-level and alpha-active wastes into deep geological formations (for example, in deposits of salt, clays, shales, granite etc.);
- Disposal of low- and medium-level solid wastes into disused mines, specially built rock caverns and so on;
- Injection of liquid waste into deep water-bearing horizons;
- Injection of liquid waste/cement mixtures into fractures induced in impermeable strata (by hydraulic fracturing) and so on.

Implementation of this very urgent programme will require a considerable amount of time and effort on the part of specialists in different fields.

Moreover, the problems of operational organization are to a great extent common to most of the underground disposal alternatives. These problems include investigations in connection with justifying the form of disposal, safety evaluations, licensing and clearance procedures for the method chosen, preparation and approval of the design, construction, operation and sealing of the repository.

Although it is very difficult in a short meeting to discuss in detail the numerous problems relating to all the alternatives, we must recognize the importance and timeliness of comparing the national approaches to the regulatory aspects of underground disposal of radioactive wastes and to the preparation of standards documents defining the requirements for clearance, licensing and approval of the repository designs used in the different modes of disposal.

In our opinion, knowledge of the national licensing procedures and practices will enable us to develop the most efficient and rational procedure for licensing and organizing all operations relating to the construction of underground repositories in geological formations and to recommend it to IAEA Member States.

2. Legislative and regulatory instruments in force or in preparation in the USSR relating to the disposal and storage of effluents and other industrial wastes in underground formations

In recent years the Soviet Union has carried out a good deal of work on improving the legislation which lays down general provisions concerning procedures for the use and conservation of underground formations and water, for the protection of the health of the population and so on.

The main legislative instruments in this connection are:

- The basic provisions of the public health legislation of the USSR and the Union Republics (1969) [1];
- The basic provisions of the water legislation of the USSR and the Union Republics (1970) [2];
- The basic provisions of the legislation on the subsurface of the USSR and the Union Republics (1975) [3].

In accordance with these basic laws we have prepared, or are preparing All-Union State Standards (GOST), general standards, instructions, regulations etc., which relate to and specify the main requirements and lay down procedures for obtaining clearance for particular operations and the licensing thereof.

The following instruments are in force:

- The basic health rules for work with radioactive substances and other sources of ionizing radiations (OSP-72) [4], which regulate the basic requirements for ensuring radiation safety;
- The radiation safety standards (NRB-76) [5], which regulate the levels of exposure to ionizing radiations and lay down a system of dose limits and the principles for applying them;
- Instruction on clearance and licensing procedures for special water use [6]. This lays down the procedure for obtaining clearance from the State Inspection authorities for conditions of special water use and for the issue of licences for such purposes by the authorities responsible for regulating the use and conservation of water. The instruction defines the nature of the documents to be submitted for obtaining clearances and licences and also the procedure for withdrawal of licences for special water use and that for modifying the conditions of such use (paragraph 1e of the approved "list of types of special water use" covers "the use of water-bearing formations or parts thereof for the disposal of industrial, communal, domestic and other effluents into underground water-bearing horizons by means of the construction and operation of absorption wells and shafts");
- Regulations concerning the procedure for the use and conservation of subsurface water in the territory of the USSR [7], which include (paragraph 19) the provision that the disposal of effluents containing radioactive substances into absorption wells may be authorized in exceptional cases after special studies have been performed. A similar provision is contained in paragraph 9-5 of OSP-72, which says: "In individual cases, on the basis of health data and subject to the existence of favourable natural and health conditions, underground disposal of liquid radioactive waste may be allowed by special authorization from the Ministry of Public Health and Ministry of Geology of the USSR".

Under the plan of the USSR State Committee on Standards an All-Union State Standard (GOST) entitled "Conservation of nature. The hydrosphere. General requirements for the underground disposal of effluents into deep water-bearing horizons" is being prepared. The draft of this standard is at present in the discussion stage and is being submitted for clearance.

The instruments at the next level (after the legislative and regulatory ones) relate to methods, methodological instructions and other methodological indications which define the conditions under which operations and studies are to be carried out on the subject of underground disposal, safety evaluation of particular modes, preparation of recommendations and of the initial necessary data for obtaining clearance and for the licensing of disposal; also, the preparation of a scientifically justified design of the underground repository.

We can cite, for example, the document entitled "Hydrogeological studies on the disposal of industrial effluents into deep water-bearing horizons. Methodological instructions" [8], which considers a wide range of problems associated with underground disposal.

A number of methodologies have been developed under the plans for collaboration between CMEA Member States:

- Methods of geological, hydrogeological and physico-chemical studies for the prospecting and exploration of geological structures to determine their suitability for the safe disposal of liquid radioactive waste (1973);
- Methods of selecting safe conditions for the disposal of solidified waste, depending on their properties and specific activity (1973);
- Analytical methods of evaluating the radiation safety of nuclear power plant sites, from the point of view of possible accidents during the storage of radioactive waste in surface deposits (1974);
- Analytical methods of substantiating the safety of radioactive waste disposal into salt formations, from the point of view of health, hydrogeology and radiation (1974).

In addition, in accordance with the requirements of OSP-72 (page 3) and in line with the established procedure, various Ministries and Departments are preparing and co-ordinating the rules, technical conditions and regulations relating to individual aspects of operations involving the use of radioactive substances and other sources of ionizing radiation.

As will be seen from the above list and brief description of the legislative instruments, regulatory documents and methodological material, the Soviet Union possesses an adequate legal basis for carrying out operations associated with the underground disposal of radioactive and other industrial effluents into geological formations, subject to compliance with the relevant requirements and conditions.

In the Soviet Union, State ownership of the subsurface forms the basis of the public relationships applicable to the utilization and conservation of underground resources, and enables them to be used in a planned, rational and comprehensive manner. The basic provisions of the legislation of the USSR and the Union Republics applying to the subsurface mention various ways in which it can be used. It is stated that the subsurface may be utilized for ".... the construction and operation of underground installations having no connection with the mining of minerals, including installations for underground storage of oil, gas and other substances and material and disposal of harmful substances, industrial waste and effluents" (Section I, Article 9).

In Section I, Article 12, it is stated, further, that "the subsurface may be made available to be used for the disposal of harmful substances, industrial waste and effluents only in exceptional cases and subject to compliance with special requirements and conditions". Such requirements and conditions for underground disposal include the following:

- Before the start of design work, obtaining clearances on the siting of the underground repository from the executive and administrative bodies of the appropriate Soviets of People's Deputies and the State Mining, Geological and Health Inspection authorities (Section III, Article 21). The subsurface sites made available for the construction of the underground repository are subject to State registration under the common USSR systems (Section VII, Article 42);
- Thorough geological investigations; rational and comprehensive utilization and conservation of the subsurface (Article 14.1);
- Conduct of operations connected with the use of the subsurface in a manner consistent with the safety of workers and the population (Article 14.2);
- Protection of the atmospheric air, lands, forests, water and other components of the environment (Article 14.3);
- Ensuring that the operations connected with the use of the subsurface have no harmful effects on the preservation of mineral resources (Section VI, Article 33);
- Ensuring that the suggestions of public organizations and citizens on the rational use and conservation of the subsurface are taken into account (Section VI, Article 36).

Similar (in many respects) requirements and conditions are contained in the basic provisions of the water and public health legislation.

3. A tentative outline of the basic operations involved in the disposal of radioactive and other industrial wastes into geological formations in the USSR

The outline includes all the basic stages of work on the justification, construction and operation of underground repositories:

- Site selection;
- Preparing a full set of preliminary studies;
- Preparation of techno-economic justification;
- Obtaining clearances and licences for underground disposal;
- Preparing a set of detailed studies and surveys;
- Preparation of the design;
- Construction;
- Operation;
- Sealing of the repository;
- Organization of long-term surveillance.

In the first stage the work is carried out by developed and proven methods, on the basis of the instruction documents which take into consideration the

basic requirements and conditions contained in the legislative instruments and other standards and regulatory documents (GOST, rules, standards, instructions and regulations). The individual types of work at every stage, in accordance with the requirements of the law or standards documents, are subject to clearance and approval. This procedure ensures continuous verification of the progress of the operations, studies and surveys and make possible operational evaluation of the safety conditions and the taking of decisions (where necessary) about changing the pattern of operations.

Annex 1 presents a tentative outline of the operations with detailed descriptions of their nature, the participating organizations and their functions at the different stages. This is approximately the routine that was and is being followed in the operations connected with the underground disposal of radioactive effluents into deep absorbing geological horizons by the Scientific Research Institute of Atomic Reactors (NIIAR at Dimitrovgrad).

4. Supervision and penalties provided for by law

The law provides for the following types of supervision in the performance of the operations connected with the use of the subsurface and water:

- State geological supervision by the USSR Ministry of Geology (or its local branches - territorial geological services);
- State mining inspection by the Committee for Supervision of Industrial Safety and Mining Inspection (Gosgortekhnadzor) of the USSR Council of Ministers;
- State health inspection by the USSR Ministry of Public Health (or its local branches);
- Departmental supervision.

The purpose of the State inspection and supervision of the use and protection of the subsurface is to ensure compliance by all Ministries and Departments, enterprises, organizations, institutions and citizens with the established procedure for the use of the subsurface and water, fulfilment of obligations relating to the protection of the subsurface and water, to the safe performance of the operations connected with the use of the subsurface, to the elimination of harmful effects of these operations on the population and the environment, and also the observance of other rules and standards established by legislation on the subsurface, water and public health.

The State inspection and supervisory bodies have the authority:

- To suspend, restrict or prohibit operations connected with the use of the subsurface and water in cases of violation of the rules and standards relating to the safe performance of operations and to the protection of the subsurface;
- To issue binding instructions designed to eliminate violations of the above rules and standards by enterprises, organizations and institutions using the subsurface and water;
- To investigate, in accordance with established procedure, the circumstances and causes of accidents during the use of the subsurface and, in the light of the results, to take decisions which are binding on the management of the enterprises, organizations, institutions etc. concerned.

Certain violations of the requirements of the legislation on the use of the subsurface and water may involve criminal, administrative or other liability under the laws of the USSR and the Union Republics.

Enterprises, organizations, institutions and citizens are required to make good any losses resulting from the violation of legislation on the subsurface, water etc., in the amounts and according to the procedures established under the laws of the USSR and the Union Republics.

5. Principal conclusions

It is timely and urgent to consider comparing national legislative instruments and regulatory documents and procedures relating to underground disposal of radioactive and other industrial wastes into geological formations.

Given the existence of a large number of general legislative requirements, insufficient attention has been paid to the regulatory and methodological instruments and documents material relating to the conduct of studies, and to the design, construction, operation and sealing of underground repositories, and especially to such alternatives as disposal into salt formations, rocks, impermeable strata by hydraulic fracturing and the like.

It is necessary to continue the consistent implementation of the Agency's programme on the underground disposal of radioactive waste, as this will ensure successful development of nuclear power and preservation of the environment from the harmful effects of radioactivity.

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[4] Osnovnye sanitarnye pravila raboty s radioactivnymi veshchestvami i drugimi istochnikami ioniziruyushchikh izluchenij (The basic health rules for work with radioactive substances and other sources of ionizing radiation). OSP-72, Atomizdat, Moscow (1973).

[5] Normy radiatsionnoj bezopasnosti NRB-76 (Radiation safety standards NRB-76), Atomizdat, Moscow (1978).

[6] Instruktsiya o poryadke soglasovaniya i vydachi razreshenij na spetsial'noe vodospol'zovanie (Instruction on clearance and licensing procedures for special water use), Ministry of Land Reclamation and Water Management, USSR, Moscow (1978).

[7] Polozhenie o poryadke ispol'zovaniya i okhrane podzemnykh vod na territorii SSSR. V knige "Instruktsiya po primeneniyu klassifikatsii ehkspluatatsionnykh zapasov podzemnykh vod" (Regulations relating to groundwater use and protection procedures in the territory of the USSR, in the book entitled: Instruction relating to the use of the classification of exploitable groundwater reserves), Gosgeoltekhizdat, Moscow (1962) 46-63.

[8] Gidrogeologicheskie issledovaniya dlya zakhoroneniya promyshlennykh stochnykh vod v glubokie vodonosnye gorizonty (metodicheskie ukazaniya) (Hydrogeological studies on the disposal of industrial effluents into deep water-bearing horizons (Methodological Instructions)), Nedra, Moscow (1976).

ANNEX 1

Tentative outline of the basic operations connected with the underground disposal of radioactive and other industrial wastes into geological formations in the USSR

Serial No.	Description of operation	Authority	Basic documents to be considered in carrying out operations, (standards, instructions, regulations, etc.)	Organizations and their functions				
1	2	3	4	5				
				Executing bodies				Policy-making body
				Departmental Commission	Public organizations	Inter-Departmental Council	Ministries/ Departments	USSR Council of Ministers
1.	Selection of repository site and of the method of waste treatment and disposal	Order of Ministry/ Department	(1) SN-202-76; (2) OSP-72; (3) NRB-76; (4) Instruction of the USSR Ministry of Land Reclamation and Water Management (5) Basic Provisions of the legislations of the USSR and the Union Republics on the sub-surface; (6) Basic provisions of the water legislations of the USSR and the Union Republics	Selection and justification of site and of the method of waste decontamination and disposal	Preparation of proposals, account being taken of environmental protection requirements	Consideration of the recommendations of the Departmental Commission and of the proposals of public organizations. Preparation of proposals for the authorities of the Ministry/ Department	Consideration of the proposals of the Inter-Departmental Council. Drafting of decision to be approved by the USSR Council of Ministers	Decisions adopted on the site and on the construction schedule (taking into account the waste disposal method)

1	2	3	4	5				
				Executing bodies				Supervising bodies
				Field trips of the USSR Ministry of Geology	Institutes of the USSR Ministry of Public Health	Institutes of the USSR Academy of Sciences	Institutes of other Ministries and Departments	USSR Ministry of Geology USSR Ministry of Public Health USSR Academy of Sciences Councils of Institutes
2.	Preliminary comprehensive studies on the selection of the site and the justification of its suitability for the disposal of waste into geological formations	(1) Orders of Ministries/ Departments (2) Comprehensive co-ordination plan	(1) Approved methodologies (2) GOST, standards, instructions and regulations in force (3) Basic provisions of legislation on water and on the subsurface (4) Factors governing the selection of a site for long-term storage or disposal of solidified high-level and alpha-bearing waste in geological formations	Analysis and correlation of basic data on the region. Performance of the indispensable minimum of studies. Preparation of a report with recommendations and initial data for a technological-economic justification	Study of the health situation in the region. Preparation of a report with recommendations and initial data for establishing a health protection zone in the region of the waste repository	Evaluation of the physico-chemical and radiation processes occurring in connection with the disposal of waste into geological formations. Preparation of a report with initial data for a technological-economic justification	Engineering and technical studies on problems and modes of underground disposal into geological formations. Preparation of a report and recommendations for technological-economic justification	Consideration and approval of studies, recommendations and initial data for preparation of a technological-economic justification

1	2	3	4	5
				Executing bodies
3.	Preparation of a technological-economic justification for the construction of facilities for the disposal of waste into geological formations (with proof of the admissibility and safety of the underground disposal)	Technical specifications approved by the authorities of the Ministry/ Department	(1) Regulations on the procedure of preparing the technological-economic justification (2) Reports, recommendations and initial data from Serial No. 2	Design Institutes of Ministries and Departments

1	2	3	4	5		
				Organization giving clearance		
				USSR Ministry of Public Health (or its branches in the Republics)	USSR Ministry of Geology (or its territorial geological services)	Gosgortekh-nadzor of the USSR Council of Ministers
4.	Approval of the possibility of disposal into geological formations (on the basis of the technological-economic justification data)	(1) Decision of the USSR Council of Ministers of 10.6.77 (2) Instruction of the USSR Ministry of Land Reclamation and Water Management (1978)	(1) Basic provisions of legislation on the sub-surface (2) Basic provisions of legislation on water (3) OSP-72 (4) NRB-76	Evaluation of compliance with health and radiation safety requirements	Evaluation of the conditions of geological and hydro-geological isolation of the reservoir structure	Evaluation of the conditions of safe operation in regions containing water and mineral resources and mining allotments

1	2	3	4	5			
				Licensing bodies		Bodies considering and approving the technological-economic justification	
				USSR Ministry of Land Reclamation and Water Management (in the case of disposal into water-bearing formations)	USSR Ministry of Geology and Gosgortekhnadzor (in the case of disposal into non-water-bearing geological structures)	Inter-Departmental Council	Ministry/ Department
5.	Obtaining a licence for the underground disposal of waste into geological formations and approval of the technological-economic justification (after the clearance as per Serial No. 4 has been obtained)	(1) Decision of the USSR Council of Ministers of 10.6.77 (2) Instruction of the USSR Ministry of Land Reclamation and Water Management (1978)	(1) Basic provisions of legislation on the sub-surface (2) Basic provisions of legislation on water (3) OSP-72 (4) NRB-76			Consideration and discussion of the technological-economic justification. Preparation of the recommendations of the Ministry/ Department	Issue of order approving the technological-economic justification

1	2	3	4	5				
				Executing bodies				Supervising bodies
				Field trips of the USSR Ministry of Geology	Institutes of the USSR Ministry of Public Health	Institutes of the USSR Academy of Sciences	Institutes of other Ministries and Departments	USSR Ministries of Geology and Public Health, USSR Academy of Sciences and Councils of institutes
6.	Detailed comprehensive studies in the region and directly at the site for disposal	Approved technological-economic justification	Same as in Serial No. 2	Comprehensive geophysical, geological, hydrogeological and field studies with borehole drilling and testing. Preparation of a report with recommendations and initial design data	Health inspection of the region. Justification of the requirements relating to the extent of the health protection zone, to the health measures and to the methods of surveillance of disposal. Preparation of a report with recommendations and initial design data	Laboratory and field studies on the compatibility of the waste with the rocks of the geological structure. Determining requirements in respect of the composition and properties of the waste. Preparation of a report with recommendations and initial data	Preparation of designs for the structures and equipment needed for underground repositories. Development of methods for calculating and modelling them, and for the mechanization and automation of operations. Design of control and monitoring processes. Preparation of technical specifications for designing the installations	Consideration and discussion of the results of studies. Approval of the recommendations and initial data for preparing the design

1	2	3	4	5		
				Bodies preparing the design	Bodies giving clearance for the design	Bodies approving the design
7.	Preparation of the design of the underground repository (including the health protection zone)	(1) Approved technological-economic justification (2) Approved technical specifications	(1) SN-202-76 (2) Reports, recommendations and initial data from Serial No. 6	Design institutes of Ministries/Departments	See Serial No. 4	Ministries and Departments (after expert examination of the design)
				Organizations carrying out construction	Body accepting the repository upon completion of construction	
8.	Construction of the underground repository	Approved design	Requirements in respect of construction standards and rules (SNiP)	Organizations of the USSR Ministry of Geology and other Ministries and Departments	State Commission appointed by the Ministry/Department	

1	2	3	4	5				
				Organizations operating the repository	Supervising bodies			
				Nuclear power stations and other nuclear facilities	Departmental supervision	USSR Ministry of Public Health	USSR Ministry of Geology	Gosgortekhnadzor
9.	Operation of the underground repository	Approved acceptance document from the State Commission	(1) Approved design (2) Approved regulations for operation (3) Approved service instructions (4) Safety rules	Compliance with the design specifications and conditions, regulations and safety requirements	Verification of compliance with the specifications and conditions of operation laid down in the design and regulations	Verification of radiation safety during operation and imposition of penalties including stoppage of operation	Verification and evaluation of geological and hydrogeological isolation and safety during operation. Imposition of penalties, including stoppage of operation	Verification and imposition of penalties in case of violation of mining safety requirements

1	2	3	4	5			
				Organization preparing the design	Body giving clearance for the design	Body approving the design	Organization carrying out the sealing
10.	Sealing of the underground repository	(1) Memorandum from the Ministry/ Department (2) Requirements of the supervising bodies	Data on the analysis of operating conditions prepared by a committee of experts	Design institutes of the Ministry/ Department operating the underground repository	USSR Ministry of Public Health USSR Ministry of Geology Gosgortekhnadzor	Ministry/ Department operating the repository	Ministry/ Department operating the repository USSR Ministry of Geology Other specialized Ministries and Departments
				Supervising bodies			
				USSR Ministry of Geology (territorial geological services)	USSR Ministry of Public Health (Republic and local branches of the State Public Health Inspectorate)	Gosgortekhnadzor	
11.	Long-term surveillance in the region of the repository site after sealing	Decision of the supervising bodies	Requirements under the legislation of the USSR and the Union Republics on water and the subsurface	Carries out State geological supervision	Carries out State health inspection	Carries out State mining inspection	

THE REGULATION OF RADIOACTIVE WASTE MANAGEMENT IN CANADA

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Abstract

The concept of radioactive waste disposal involves isolating radioactive materials from the biosphere with no intention of retrieval. The period of isolation should endure at least until the radionuclides have decayed to acceptably low levels.

Canada is one of several countries concerned with finding a suitable method of effecting disposal. To date there is no official policy in Canada which specifies the manner of disposal although a method under serious consideration is that of immobilizing the waste and emplacing the immobilized waste in bedrock deep beneath the earth's surface. A working agreement now exists between the Federal government and the government of Ontario that proposes to "verify that burial in plutonic rock is safe, secure and desirable."

By virtue of the Atomic Energy Control Act of 1946, the Atomic Energy Control Board (AECB) has the authority to regulate atomic energy in Canada. Included among the many facets of this authority is the development of guidelines which provide an applicant with a means by which the Board's requirements can be met. These are now being formulated by the AECB. As presently conceived the guidelines will initially be general in nature for a number of reasons, not the least of which is the fact that, although plutonic rocks are currently thought to be the preferred generic rock type in Canada in which waste could be emplaced, there is, as yet, no firm commitment to that type. Thus Canadian researchers are still considering, although not on as extensive a scale, some other hosts such as salt or argillaceous rocks.

In Canada, before a nuclear facility can be constructed and permitted to operate, the applicant must obtain, in sequential order from the AECB, site approval, a construction approval and an operating licence. In the waste disposal program the addition of a post-operation approval is envisaged.

1. General Provisions of the Regulatory Aspects

The Atomic Energy Control Act was passed by the Canadian Federal Government in 1946. This Act authorizes the Atomic Energy Control Board, already identified as the Federal Government's nuclear regulatory agency, to make regulations governing the development, application and use of atomic energy in Canada. Regulations, designated the Atomic Energy Control Regulations, therefore, have been framed to, among other things, control nuclear facilities and materials in the interest of national and international security and to ensure that the health and safety of workers and members of the public are adequately protected. Both radiological and non-radiological aspects of health and safety are included.

Radioactive waste management facilities are recognized to be nuclear facilities and, as such, are subject to the Atomic Energy Control Regulations under jurisdiction of the AECB and may, as determined by the Board, be licensed according to its licensing procedures.

2. Radioactive Waste Management Principles Applied in Licensing

The Atomic Energy Control Board licenses facilities for the management of radioactive waste, based on certain waste management principles which it has developed. The methods that may be used to meet these principles will vary with the type of waste. Factors such as the physical and chemical from of the wastes the level of activity and the halflives of the isotopes involved will determine what particular form of management is required. However, the position of the AECB is that in performing this assessement there will be a consistent attempt to apply the following principles, regardless of the source of the wastes.

2.1 Method of Management

In all considerations related to waste management the AECB distinguishes between storage which is a method of containment with the intention and the provision for retrieval, and disposal which is a method of management in which there is no intent to retrieve but which, more importantly, does not rely for its integrity on the continued need for human intervention whether this be for treatment, monitoring or restriction of access. The objective, for all wastes, is that the ultimate form of management will be disposal.

Storage is essentially a temporary measure as, for example, in the case of wastes awaiting further treatment or awaiting the development of suitable methods of disposal. As a general rule storage also requires some from of surveillance. Disposal is intended to be a permanent step and, because of this, the concern for viability in the long term is paramount.

Where no recognized methods of disposal are available, then the system in use can only be regarded as storage. In such a situation the use of the method carries with it the normal obligation to provide all necessary surveillance but, in addition, carries a responsibility to search for acceptable means of disposal. The intention is that methods of disposal will be sought and implemented as soon as possible. The principle involved is that, to the extent possible - economic and social conditions being taken into account, continuing problems of management created by the producers of waste will not knowingly be left to future generations.

One of the factors to be considered in discharging this responsibility to future generations is the period of time for which it is reasonable to require that institutional controls be in place to ensure the integrity of the disposal method. The goal that no disposal method should be dependent on the continued presence of humans is an indication of the low probability that institutional controls will survive for the very long periods of time usually associated with radioactive waste management - many thousands of years. On the other hand, surveillance systems are in operation now and will obviously continue to exist for many years to come. The question therefore arises as to where this changeover takes place.

At some time in the future surveillance and control can be assumed to have lapsed. There is, therefore, a necessity to determine the maximum period of time for which future generations should be committed, for their safety and the quality of their environment, to provide for the care of present wastes. The choice of any value will be to some extent arbitrary and sensitivity studies will need to be carried out to determine the cost-benefit of any particular number or range chosen. However, from the regulatory point of view, a period of several decades would appear to be much more acceptable than a period of several centuries. In this context, the AECB selected 100 years as the value to be used in discussions, while further review is carried out.

In general the number of waste management facilities will be kept to a minimum consistent with concern for:

- regional needs
- physical security
- transprotation hazard minimization
- multi-use site development.

Need for a Canadian Radioactive Waste Management Policy

In order that the radioactive waste management principles discussed in the preceding paragraphs may be implemented, it will be necessary for the government of Canada to formulate and adopt a policy for radioactive waste management.

A proposed policy framework may perhaps take the following outline:

Radioactive Waste Policy Statement

a) National Objective Re: Radioactive Waste Management

The objective of the Government of Canada would have to ensure that the safe management of radioactive waste materials is achieved by ensuring that:

1. Exposure to Man

- any exposure of individuals and populations to radiation from radioactive waste, is kept as low as reasonably achievable, economic and social factors being taken into account; and further that

- in no case should the exposure to individuals exceed the maximum permissible levels established on the basis of the best available scientific information and set out in regulations.

2. Impact on the Environment

- any undesirable impact on the environment is avoided by the isolation of radioactive wastes from the biosphere to the maximum extent practical.

- any releases of radioactivity are controlled in such a way that the environment is capable of accepting and rendering them harmless by natural processes.

3. Future Generations

- any hazard to future generations is no greater than today's society would accept.

- the problem of dealing with radioactive wastes is undertaken now and not left to future generations or future technologies.

The Government of Canada would have to:

- undertake to regulate all aspects of radioactive waste management in Canada

- undertake or cause to be undertaken research, development and demonstration in support of both regulation and the development of technologies for the safe management of radioactive waste.

- create or cause to be created such institutions as are necessary to undertake the operational aspects of a complete program of radioactive waste management.

1. Licensing Process

1.1 Licensing Stages

Licensing will normally progress through three approval phases:

- site and construction approval
- licence to operate and
- post-operation approval

The Regulations state that a facility operating licence shall not be issued unless authorization has been granted by the Board for the construction or acquisition of that facility. Subject to all requirements being met by the applicant, construction approval is granted concurrent with the granting of site approval.

The jurisdiction of the Atomic Energy Control Board extends over environmental considerations insofar as they relate to the health and safety of workers and the public. However, in licensing of radioactive waste management facilities, the site

selection and approval phase may be coordinated with the appropriate review processes of the federal and/or provincial agencies concerned with the broader issues of environmental quality and conservation of natural resources. In the absence of public hearings or reviews, which may be conducted a public information program is necessary to advise the local population of the applicants intentions and to answer concerns expressed by the public related to the impact of the proposed facility.

Once site and construction approval has been granted, the Board will not normally require further public participation; however, it continues to stress the importance of the licensee/applicant keeping the public informed of developments.

1.2 Licence Requirements

1.2.1 General Requirements

The following general statements summarize the requirements of the AECB in regard to the operation of all nuclear facilities and as such predetermine the position which is adopted in deciding on the acceptability of an application to operate a radioactive waste management facility.

1.2.2 Maximum Permissible Doses

Nuclear facilities shall be operated in such a manner as to prevent any person from receiving a dose of ionizing radiation in excess of the maximum permissible doses specified in Section 19 of the Atomic Energy Control Regulations Schedule II of the Regulations, Maximum Permissible Doses and Exposures, is appended as Table 1.

1.2.3 ALARA Principle

Exposures of workers or the public to radiation or other toxic substances or releases of deleterious substances to the environment resulting from the operation of a nuclear facility shall be as low as reasonably achievable, economic and social considerations being taken into account.

1.2.4 Compliance with the Requirements of Other Agencies

In addition to AECB requirements there must also be compliance with the requirements of other appropriate agencies of the federal and provincial governments insofar as these requirements are not inconsistent with the Atomic Energy Control Act and Regulations.

2. The Review Procedure

2.1 AECP Staft Review

Board staff will study the application and supporitng documentation, request additional information when requried, meet with the applicant when necessary and make recommendations regarding the application to the Board.

2.2 Safety Advisory Committee Review

The Radioactive Waste Management Safety Advisory Committee (RWSAC) with membership by Board appointment, is composed of senior scientists and engineers chosen for their technical competence and experience. The Committee embodies the advantages of making available a greater breadth and depth of technical expertise and experience and of providing definition and interpretation for the Board. The private sector as well as the various government agencies is normally represented on Safety Advisory Committees.

The function of the RWSAC is to advise the Board on the general policies and practices for managing radioactive waste and it may also be requested to assess the suitability of in-use and/or proposed radioacitve waste management facilities.

The RWSAC may study applications submitted to the Board including any supporting documentation and additional information which Board staff has presented as being relevant to the application under consideration. The

Committee may hold meetings, either with the applicant or in private session to discuss the application. The Committee's recommendations and comments are then submitted to the Board.

2.3 Board Review

The Atomic Energy Control Board, at its regular meetings, considers the application, supporting documentation, and the comments and recommendations of its staff and of the Safety Advisory Committee in deciding whether to issue or deny the requested approval or licence. Licence approval will be subject to any additional conditions deemed necessary by the Board.

2.4 Scheduling of Licensing Activities

The timing of various licensing actions will depend upon the applicant's construction and start-up schedule for the facility, the time required to review the applicant's submissions, and delays necessitated by the need to seek additional information. It is recommended that discussions be held between the applicant and Board staff as early as possible to discuss scheduling of the project and the information required by the Board. One of the purposes of such discussion meetings is to ensure that all activities will be integrated into an overall schedule and to minimize the effect on a project schedule of meeting regulatory requirements (see Figure 4).

2.5 Compliance Surveillance

Routine reports, by the applicant or licensee, on the progress of construction of the facility or on the operation of the facility are generally required under the conditions of the construction approval or operating licence. These reports are reviewed by Board staff and may also be reviewed by the RWSAC. Section 3.8 outlines the information required in the Annual Report which is to be submitted by the Licensee under a condition of the operating licence.

In addition, members of the Board staff or other authorized representatives of the Board may make visits to the waste management facility or to the premises of equipment suppliers in order to satisfy themselves that the policies, principles and procedures described in the licensing documents are being implemented, that the conditions set down in any licence or approval are being followed, and that the requirements of the Atomic Energy Control Regulations are being fulfilled.

The results of this continuing review and inspection program will be considered when the operating licence is presented for renewal. The review procedure for licence renewal is similar to that for approval of an operating licence. Although situation dependent, radioactive waste management facility operating licences are normally valid for a period of one year. The renewal process is initiated by written application to that effect from the licensee which should be addressed to the President of the Atomic Energy Control Board.

3. Standard Conditions of Licence

In addition to the general requirements outlined above, the following conditions are normally included in licences for the operation of radioactive waste management facilities.

3.1 Operation According to Written Submissions

The operation of the facility shall be governed by and shall be in accordance with the Atomic Energy Control Act and Regulations and with the document(s) submitted to and accepted by the Board.

3.2 Ownership and Control of Property

Ownership, control and use of the property described in the document (s) submitted to and accepted by the Board shall not be changed without prior notification to the Board.

3.3 Facility Available for Inspection

Access to the facility and to all plans, drawings, documents and records pertaining to the design, construction, testing and operation of the facility shall be available at all reasonable times for inspection by persons duly appointed by the Board.

3.4 Compliance with Board Requests

All tests, analyses, inventories, inspections, modifications or procedural changes as specified by persons duly appointed by the Board shall be carried out.

3.5 Reports of System Degradation

A preliminary report shall be made as soon as possible to persons duly appointed by the Board, on any significant deviations from or deficiencies in accepted documents, procedures, operating conditions or the integrity of components or systems when such deviations or deficiencies could result or

could have resulted in an increased hazard to the health or safety of any person or to the environment. A complete, written report is to follow as soon as possible after the disclosure.

3.6 Reports of Incidents

A preliminary report shall be made to persons duly appointed by the Board within 24 hours of any incident(s) that results in or is likely to result in an increased hazard to the health or safety of any person or to the environment.

A complete, written report is to follow as soon as possible after the incident(s).

3.7 Reports of Excess Exposure to Toxic Substances

Excess exposure of any person to toxic substances stemming from the operation of the facility shall be reported within 24 hours to persons duly appointed by the Board. A complete, written report is to follow as soon as possible after the occurrence.

3.8 Annual Report

An Annual Report summarizing the operating experience, significant events, changes in procedures and modifications of equipment which occurred or were made in the preceding calendar year, and any information the Board may request shall be submitted to the persons duly appointed by the Board by 28 February of each year.

3.9 Physical Security

Security measures accepted by the Board for protecting the integrity of the facility and preventing theft, loss or any unauthorized use of prescribed substances shall be in force at all times.

3.10 Report of Breach of Security

A preliminary report shall be made to persons duly appointed by the Board within 24 hours of the occurrence of: any attempt at or actual breach of security, threats, and attempted or actual acts of sabotage of the facility, equipment or procedures. A complete, written report is to follow as soon as possible after the occurence.

3.11 Qualified Personnel

There shall be available at all times a sufficient number of qualified personnel to ensure the safe and secure operation of the facility.

3.12 Decommissioning Clause

The decommissioning of the facility shall be governed by and shall be in accordance with the document(s) submitted to and accepted by the Board.

4. GUIDELINES

General Comments

Licensing Guides are provided to publicize approaches and methods which are acceptable to the Atomic Energy Control Board for satisfying the requirements of the Atomic Energy Control Regulations.

Compliance with Licensing Guides, in whole or in part, is not mandatory. Where an applicant chooses to depart from the requirements specified in a Licensing Guide or its provisions, he must accept the responsibility of demonstrating, to the satisfaction of the Board staff and/or advisers, that the alternative approach or method adequately fulfills the intent and requirements of the Atomic Energy Control Regulations.

Comments and suggestions for new Licensing Documents and for improvement of existing Documents are encouraged. New Guides will be issued and existing Guides revised periodically to incorporate accepted suggestions and to reflect developing technology and practice.

SUMMARY

Licensing Document No. 23 is issued as a series, A to F, for specific waste management facilities. Part I of the document is common to all facilities and describes the general requirements for siting, constructing and operating a radioactive waste management facility. Part II is facility specific and offers guidance to the proponent or licensee on siting, constructing and operating a particular waste management facility.

PREFACE TO LICENSING DOCUMENT NO. 23 describes the general procedure to be followed in obtaining authorization from the Atomic Energy Control Board to site and construct a radioactive waste management facility and in obtaining or extending the licence to operate such a facility.

NOTES ON LICENSING DOCUMENT NO. 23

Licensing Document No. 23 is issued as a series, A to F. for the following facilities:

LICENSING DOCUMENT NO.	FACILITY
23A	Facilities for Shallow, Direct-Inground Sto of Low Level Radioactive Wastes
23B	Engineered Structures for Shallow-or-Above Ground Stroage of Radioactive Wastes
23C	Facilities for Deep, Geological Disposal of Radioactive Wastes
23D	Facilities for Retention of Uranium Mine-Mi Wastes
23E	Facilities for Radioactive Waste Volume Reduction - Incinerators and Compactors
23F	Regional Waste Management Facilities

This document is presently undergoing development and preparation by the AECB The following is a description or overview of the approach presently adopted in pursuing this task.

Outline of Proposed Licensing Procedures for Radioactive Waste Disposal

September 1978

AECB

INTRODUCTION

The concept of radioactive waste disposal involves isolating radioactive materials from the biosphere with no intention of retrieval. The period of isolation should endure at least until the radionuclides have decayed to acceptably low levels.

Canada is one of several countries concerned with finding a suitable method of effecting disposal. To date there is no official policy in Canada which specifies the manner of disposal although a method under serious consideration is that of immobilizing the waste and emplacing the immobilized waste in bedrock deep beneath the earth's surface. A working agreement now exists between the Federal government and the government of Ontario that proposes to "verify that burial in plutonic rock is safe, secure and desirable."

As previously mentioned, by virtue of the Atomic Energy Control Act of 1946, the Atomic Energy Control Board (AECB) has the authority to regulate atomic energy in Canada. Included among the many facets of this authority is the development of guidelines which provide an applicant with a means by which the Board's requirements can be met These are now being formulated by the AECB. As presently conceived the guidelines will initially be general in nature for a number of reasons, not the least of which is the fact that, although plutonic rocks are currently thought to be the preferred generic rock type in Canada in which waste could be emplaced, there is, as yet, no firm commitment to that type. Thus Canadian researchers are still considering, although not on as extensive a scale, some other hosts such as salt or argillaceous rocks.

Besides issuing guidelines the AECB is also considering publishing the rationale behind the guidelines because a radioactive waste disposal program should be concerned with public awareness and information as well as with public safety. Furthermore it is hoped that the public will be assured that the safety of the biosphere is paramount when license applications are evaluated.

LICENSING PROCEDURES

In Canada, before a nuclear facility can be constructed and permitted to operate, the applicant must obtain, in sequential order from the AECB, site approval, a construction approval and an operating licence. In the waste disposal program the addition of a post-operation approval is envisaged (Figs 1 and 2). Although these discrete phases do exist, all factors germane to establishing and operating a nuclear facility are to be identified during the period leading to site approval and should be addressed. For the operating license, a complete assessment of the individual and combined factors is required. If the Board's evaluation is favourable then the applicant will receive approval or a license (Fig. 1). If, on the other hand, the evaluation is unfavourable then the license will be denied unless the applicant can provide information which will enable the Board to reverse its decision.

Because all factors, related to a nuclear facility, are identified in the early stages and carried throughout to the final stages, the entire licensing procedure may be thought of as a continuum. Before the onset of each phase in

the licensing procedures certain factors are identified by the Baord as priority items which should receive the greatest emphasis during the phase. However all other factors should still be addressed, though with less emphasis, during that phase. As the program proceeds from one phase to the next the level of attention required of each factor either increases to an intermediate or maximum level or is reduced to zero. This concept is illustrated in Figure 2 for a nuclear waste repository. For example in the site approval phase socio-political and regional and site geological, geographical, meterological and environmental factors are top priority items which should recieve the highest level of attention, whereas the remaining factors would be subjected to a more cursory treatment. In the phase leading to the issuance of a construction license all factors, except the aforementioned ones, become higher priority items with waste repository and backfill designs subjected to the highest level of attention while the others are recieving only an intermediate level. From the Board's point of view the regional and site investigations, along with the socio-political factors, should theoretically have been completed during the site approval phase and therefore need not be considered in the construction phase. During the operational phase, underground geological investigations, within the constructed repository, will be required and will be designated as a top priority item along with all other factors noted in Figure 2. The post-operational phase will feature two areas of concern, all of which should be considered as high-priority items.

Since site approval is the first formal step in the licensing procedure it is critical that the guidelines for this phase be established first. Geological factors, which are of utmost importance, require special attention and as such will be considered throughout the remainder of this paper, except for the last section which presents a preliminary schedule for the issuance of guidelines.

GEOLOGICAL FACTORS

INTRODUCTION

The objective of guidelines concerned with the geological factors of waste management will be to direct the applicant to seek a site possessing natural conditions which will isolate radioactive wastes from the biosphere at least until they have decayed to innocuous levels. An ideal setting would be in an isotropic host rock, situated in a seismically stable area totally free of faults and fluids. Since this situation is unlikely to obtain, the area should be selected so as to optimize the effectiveness of the natural barriers that do exist in the event that waste does escape. The site selection process should involve regional, as well as site specific, investigations.

REGIONAL STUDIES

A well documented knowledge of the regional geology is imperative for both political and technical reasons. Politically it is expedient, to be assured that all phases of the work have been carefully conceived and executed. Any apparent oversight in any portion of the study cast doubts upon the rest of the work and will not aid in gaining and/or retaining public confidence. Thus even though geologically old events may have no apparent impact on present day site selection, knowledge of these events and the conditions under which they formed will help convince the public of the thoroughness and care with which the work has been performed.

Technically a regional study is necessary for several reasons. First of all it permits first order selection of potential sites from which a final choice may be made. Secondly, since fault length is one of the most critical parameters in estimating earthquake potential, the true lengths of faults must be determined which necessitates tracing within the region (Slemmons, 1977, p. 69). This is due to concealment, sinuosity, branching or any other complexities inherent in any fault or fault system. Thirdly a regional study provides a more complete picture of the geological framework than a study restricted to a site. This is because any region is characterized by geological features and, hence, elements of the geological history which may be well preserved and clearly understood at some locations, but which may be absent, imperfectly preserved or poorly understood elsewere. A potential site may be plagued by these problems thereby rendering a proper comprehension and assessment, of the geological setting and history at the site, impossible.

A region within which a geological investigation should be conducted may theoretically be "limitless" in size. The guidelines should therefore attempt to generically define a study area of sufficient size to permit an assessment of all conditions which may directly or indirectly impact on a site. The comcept of tectonic provinces, as used by the United States Nuclear Regulatory Commission, is presently being considered by the AECB as a possible means of achieving this objective.

GEOLOGICAL HISTORY

Knowledge of the geological history is important because, in evaluating the potential of a site to host a repository, the age(s) of the stuctures, especially faults and fractures, should be know, or, at least, circumstantially well established. If there is no way to date structures at the site an understanding of their relationship to other features, which occur elsewhere in the region will furnish a means of establishing relative or absolute ages. This is illustrated in a simplified example. If the age of an orogenic event is known and the structures at the site are geometrically kinematically and dynamically compatible with others known to have resulted from this orogenesis, the site structures can be interpreted as being as old as the orogenesis.

Another pragmatic aspect of understanding the history lies in attempting to establish the periodicity and mechanisms of faulting. the capability to do this may be very improtant in attempting to predict whether or not the site is likely to remain stable throughout the required period of time.

SEISMIC INFORMATION

In addition to knowing the locations of faults and their paleotectonic functions, it is also improtant to determine whether they are currently generating, or may potentially generate earthquakes.

Although is seems logical that the effects of seismicity would not be nearly as profound on a sealed underground repository as they would be on surficial structures such as buildings, dams and nuclear power plants they may, nonetheless, have some influence on the integrity of the repository. They may also be responsible for changing the direction of groundwater flow which, as described below, constitutes the principle means of transporting waste to the biosphere. It is, thus, recommended that a potential site be located in an area historically and presently characterized by either no, or only low-level, seismicity.

If a site is located in an area presently assumed to be either aseismic or marked by only low-level seismicity a seismic network may not exist for that area. Questions concerning, among other things, the presence of seismicity, the magnitudes, peak accelerations, location of foci, focal mechanisms and potential effects at a site will nedd to be answered and this can best be accomplished by instituting a seimic network. A network, which is both regional and site specific in scope, is recommended because regional context and implications are as important in assessing seismic conditions as they are in establishing the overall geological framework and history.

HYDROGEOLOGY

The hydrogeology of the region and the site area is one of the most important factors in the site selection process, because ground water is the principle medium by which the radionuclides can be transported to the biosphere.

Ideally an area with little or no circulating ground water should be selected as a site. However, the occurence of ground water should not necessarily exclude a site as a candidate for a radioactive waste repository. In such a case the emphasis should be placed on assuring that other hydrogeological parameters will provide an acceptably low return rate of radionuclides to the biosphere.

In order to achieve this objective the investigations of regional and site aquifers their location, size, recharge and discharge areas, flow rates, flow paths and controlling factors of ground water movement, should be carried out.

More detailed analysis of ground water movement will require assessment of the permeability porosity, and storage coefficient of the host rock, the hydraulic gradient, physical and chemical properties of groundwater and groundwater age.

Special consideration in the site selection process should be given to chemical characteristics of groundwater, because the groundwater, due to its chemical characteristics, has a potential for unfavorable chemical reactions with disposed waste, containers and surrounding rocks.

HOST ROCK

The basic requirement of any host rock to be suitable for disposal of radioactive waste is to safely isolate the emplaced redioactive waste until decay has reduced it to a nonhazardous level.

The investigations such as field mapping, geophysics, drilling, laboratory testing and analysis, should determine the size and shape of candidate host rock, the depth, mineralogical and petrological composition, structural, hydrogeological and geochemical characteristics as well as physical, thermal and geotechnical properties.

The configuration of the rock mass should be defined including the thickness, lateral extent and depth of the host rock as well as of overlaying and underlaying strata.

The size and shape of the host rock needed to accomodate a repository should be determined having in mind the geological conditions encountered at the site and amount of waste to be emplaced thereon.

To assure isolation of radioactive waste form man's environment an appropriate depth of the host rock should be selected, which should be based on the geological characteristics of the site, possible effects of the erosion or denudation on the repository and impact of the geothermal gradient.

The mineralogical composition, the presence of impurities, crystal size, homogenity isotropism and other characteristics will have bearing on the selection of the host rock.

A host rock exhibiting a high degree of homogenity and massive nature would need to be less extensive to be suitable for the disposal of radioactive waste.

Disposal of radioactive waste will limit the future use of the land surface as well as the underground area for a geological peirod of time.

Special attention should be given to the natural resources in the area.

Any minerals, oils, gas or potential geothermal resources in the host rock having obvious potential for economic use should be seriously considered as a threat to long-term geological containment. The areas of existing mineral production and significant exploration should be avoided if possible, as well the areas with abandoned mining or drilling operations.

The areas with abandoned mining operations and exploratory boreholes represent a potential pathway for radionuclides entering the biosphere.

All existing mines and boreholes should be located and evaluated. In some cases it will require re-entering the mines, cleanout, sealing and replugging.

Geothermal resource potential is also a definite threat to the long term integrity of any geological disposal site. This threat comes because of possible use of geothermal resources as a source of energy and because of undesirable conditions caused by high thermal and tectonic stresses and high temperature in the repository and therefore the areas with the geothermal flux greater than normal are undesirable for waste disposal.

Preferred condition of the host rock is that it is virtually free of faults and fractures within the area of the site and particularly inside the disposal cavity. Occurrence of a fault in the repository could be sufficient cause to abandon the site

The preferred condition of the host rock is to contain little or no ground water. However, this kind of rock will be hard to find, therefore the selected host rock should contain any free water, moisture or any fluid inclusions as low as possible.

The assessment of hydrogeological characteristics of the host rock will require determination of the following parameters, the permeability and transmissibility, the effective porosity and storage coefficient of the host rock.

The host rock capability to retain the radionuclides by its sorbtion capacity is one of the most desirable properties of the host rock.

Interaction between the host rock, ground water and radioactive waste should be investigated, and possibility of formation of products corrosive to the waste canisters, and formation of explosive and/or noxious products.

The engineering characteristics of the host rock should be a such that stresses and forces which will be encountered during the construction of the repository will not cause this structure to fail.

Therefore the major consideration should be given to the investigations of any mechanics or processes that could cause the repository to fail to the extent that ground and surface water could enter the repository and transport radionuclides into the biosphere.

These investigations should be carried out in such a manner that long term effectiveness of the repository will not be compromised during the construction or operational periods and as well after repository closing.

It would be desirable for the engineering properties of the host rock to be such that the open walls of the underground repository can be sustained with the minimum additional structural support until the waste has been emplaced and repository closed.

Therefore the competent rock with high compressive strength, massive or laminate with linear elastic properties, homogenous and normal state of stresses is preferred as a host rock for geological waste disposal.

Of the physical properties of the host rock special attention should be given to the thermal and radiation properties.

The host rock with relatively high thermal conductivity is desirable to efficiently and steadily dissipate the heat of radioactive decay.

Also, the capability of the host rock to withstand thermal stress without significant new fracturing or extension of existing factures is preferred.

PRELIMINARY SCHEDULE

The preliminary schedule (figure 3) is based on the AECL "Overall shcedule for Repository, Research, Development, and Demonstration", of June 15, 1978, and the estimate of time requirements for the quidelines preparation.

The emphasis in this schedule is given to the site selection and the design and construction phases, because it is expected that these will be crucial phases for the whole disposal program.

The site selection phase, as proposed by AECL, will consist of numerous different activities, some of them having already started such as: the concept verification drilling of boreholes in CRNL and WNRE and consulting of the communities The selection of the potential sites, evaluation of plutons, investigations and acquiring and selection of the candidate site, will follow.

The preliminary guidelines for site selection are expected to be prepared by the end of 1980, and by 1982 the final guidelines for site selection will be issued.

The site approval process will commence after the applicant has selected a candidate site and made an application for site approval.

From that time it is estimated that it will take a minimum 1.5 years to evaluate the proposed site and to issue the Site Approval.

Figure 1 – Licensing Procedures for Radioactive Waste Disposal

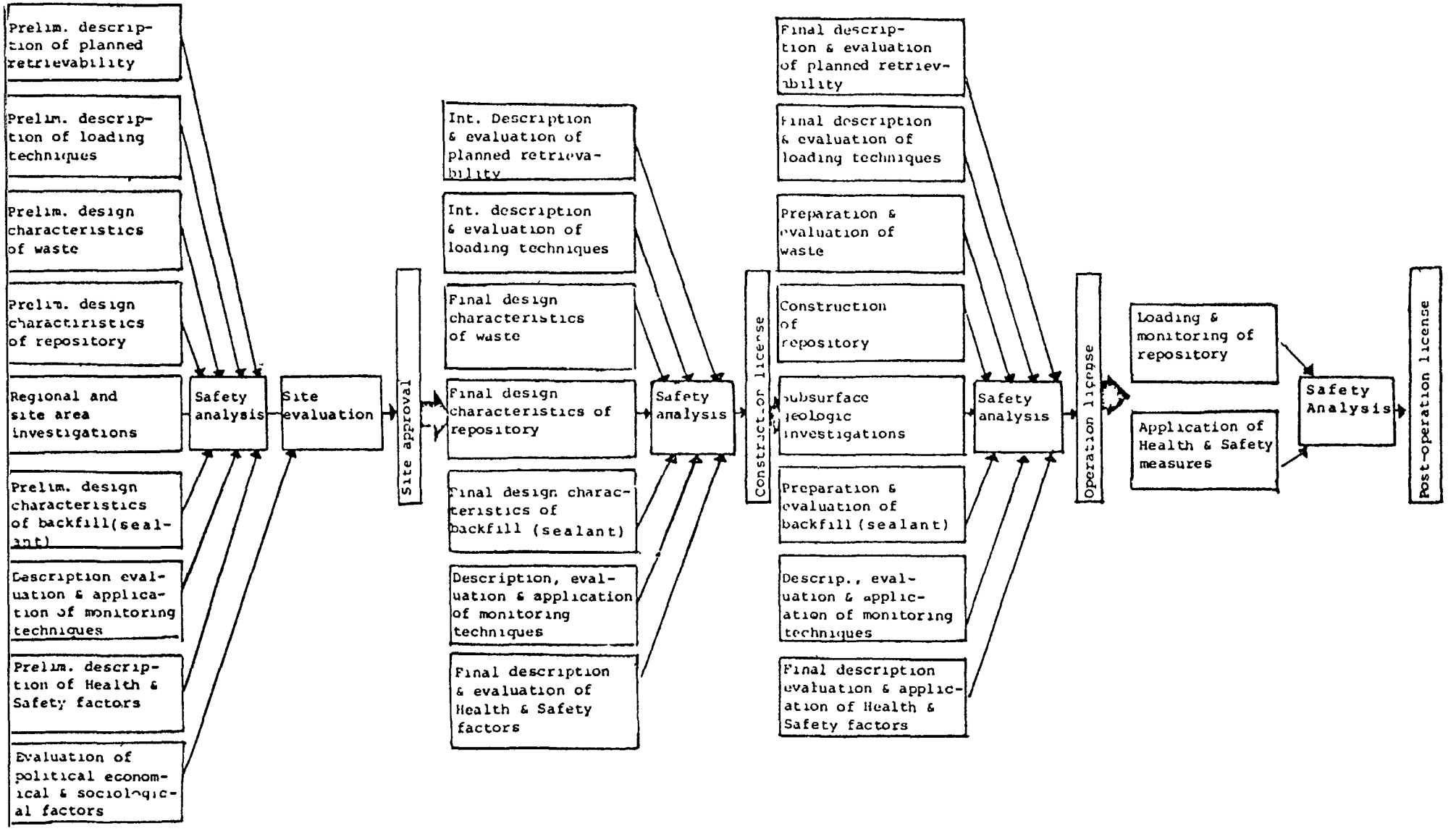


Figure 2 – Qualitative Level of Attention Required for Different Phases of the Licensing Procedure for Disposal

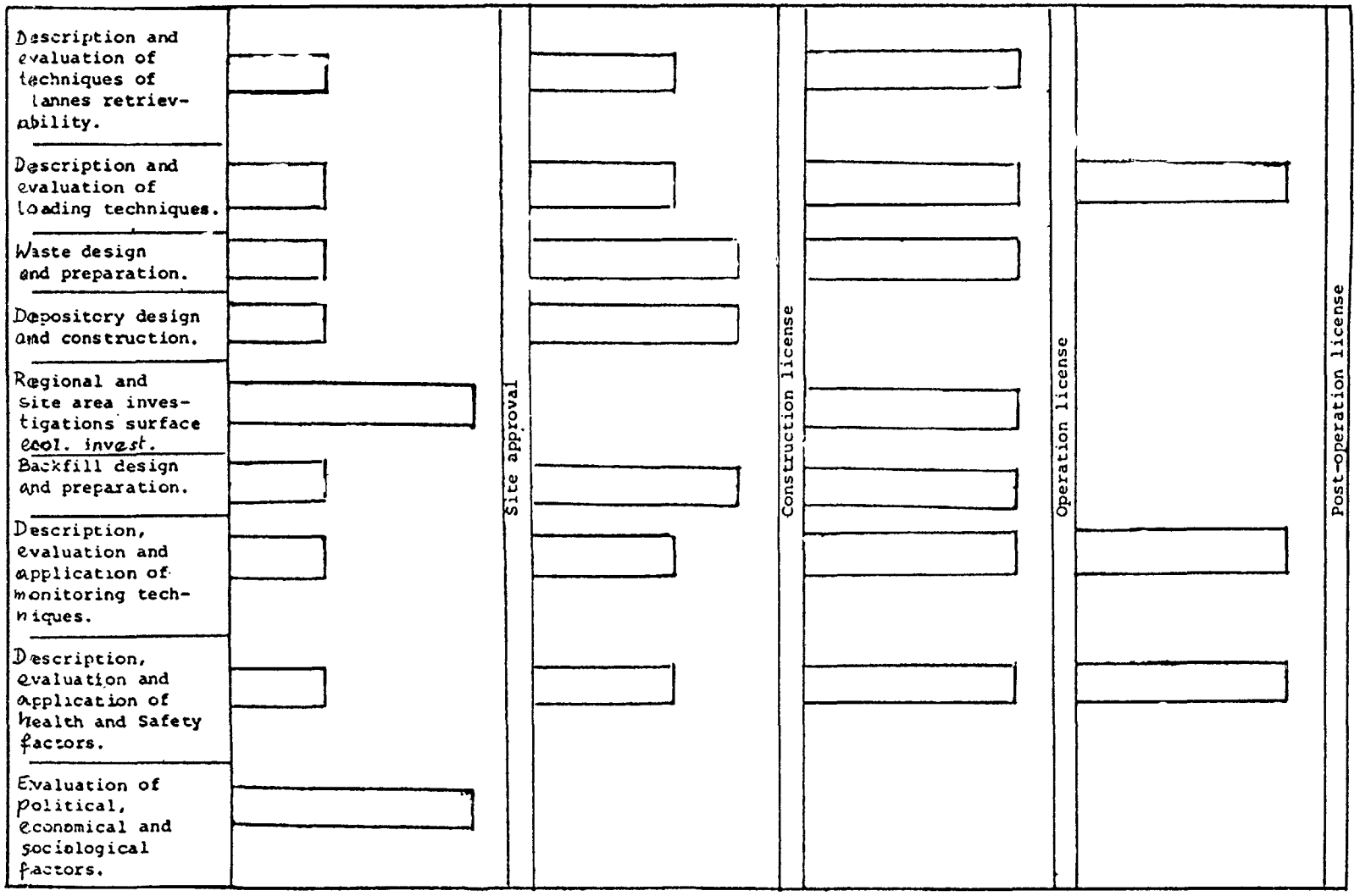
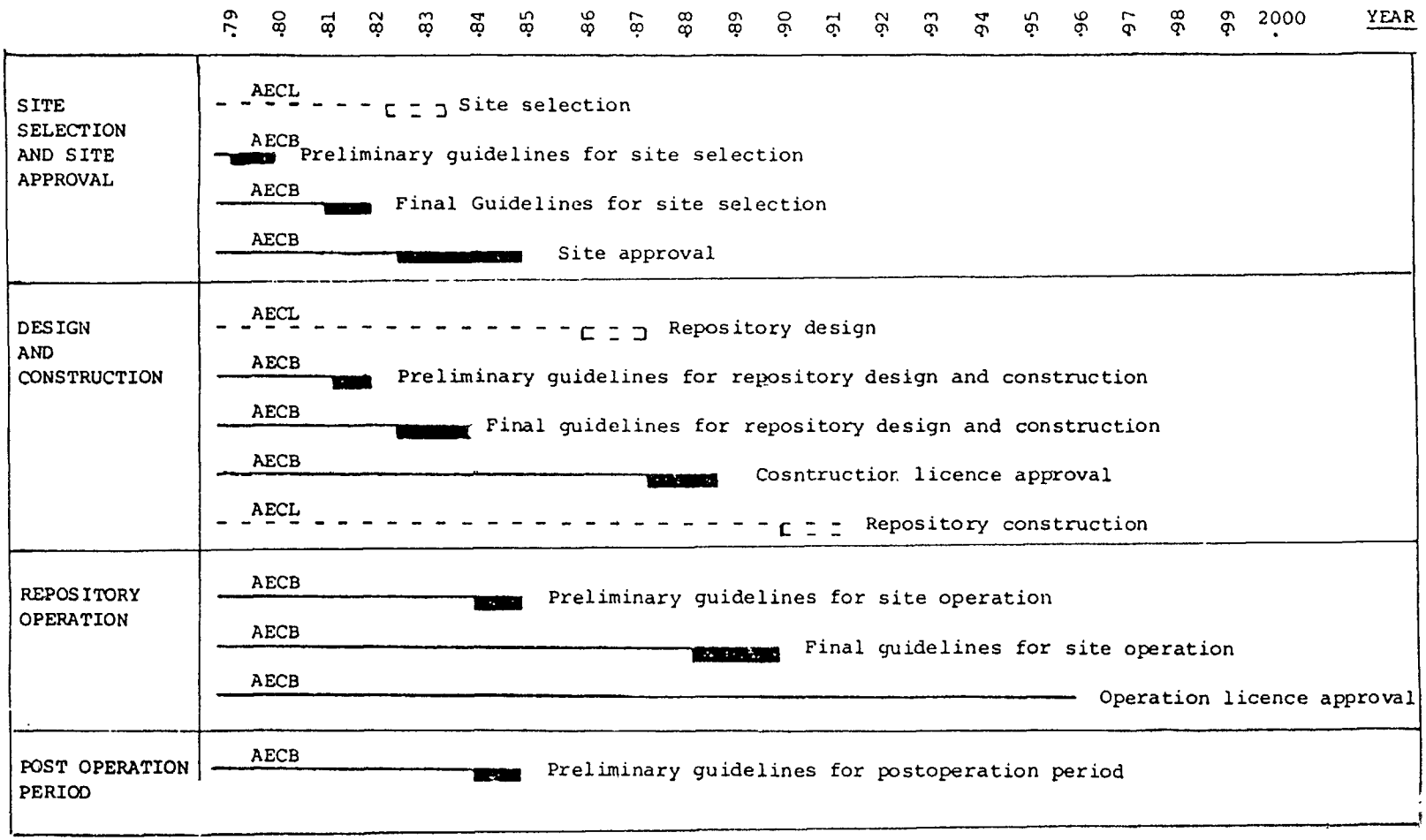
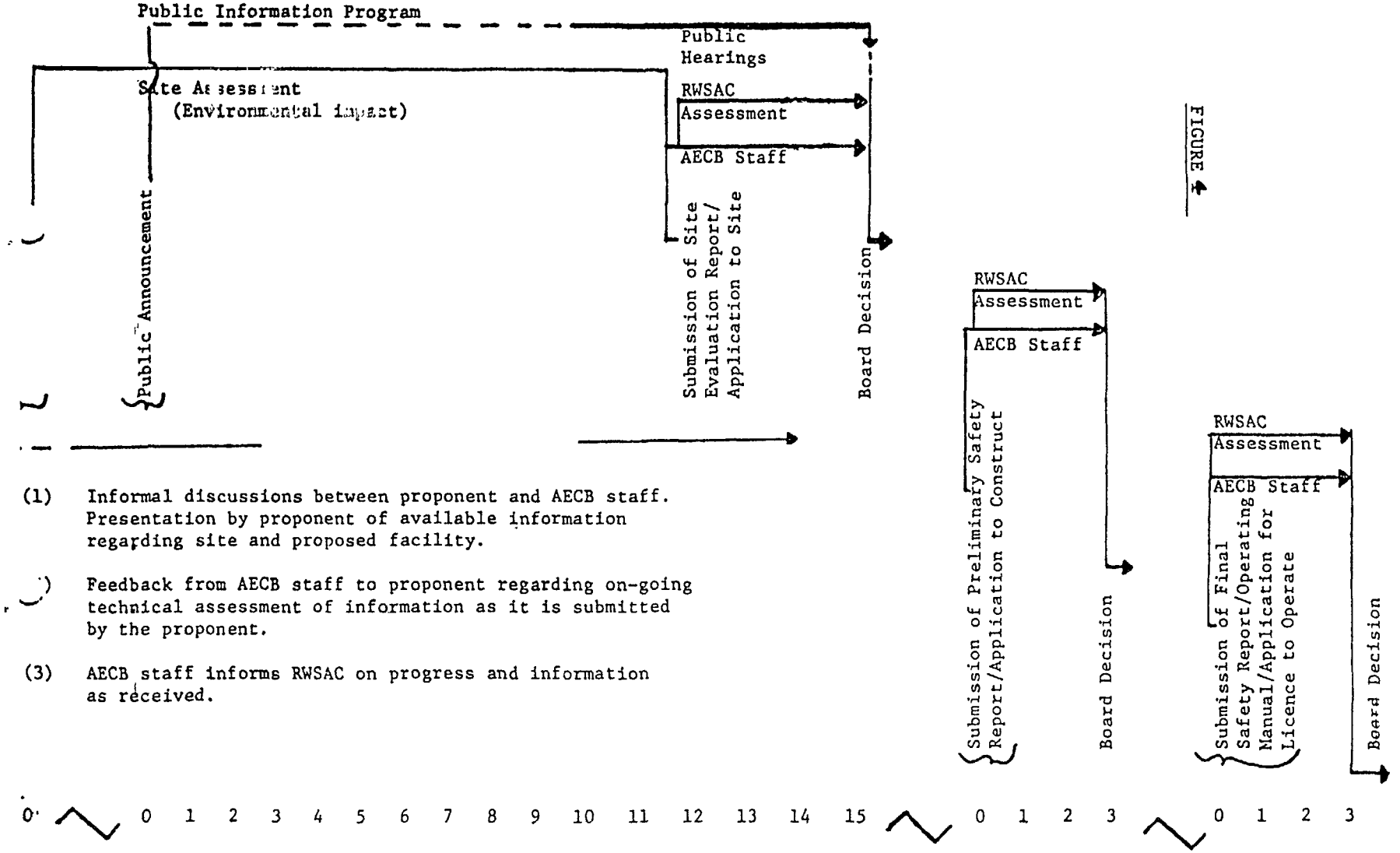


FIGURE 3- PRELIMINARY AECB AND AECL SCHEDULE

FOR RADIOACTIVE WASTE DISPOSAL IN BEDROCK





(1) Informal discussions between proponent and AECB staff. Presentation by proponent of available information regarding site and proposed facility.

(2) Feedback from AECB staff to proponent regarding on-going technical assessment of information as it is submitted by the proponent.

(3) AECB staff informs RWSAC on progress and information as received.

FIGURE 4

"SCHEDULE II

Maximum Permissible Doses and Exposures (1, 2)

TABLE I

Maximum Permissible Doses (3)

Column I	Column II		Column III		Column IV
Organ or Tissue	Atomic Radiation Workers		Female Atomic Radiation Workers of Reproductive Capacity		Any Other
	Rems per quarter of a year	Rems per year	Rems per quarter of a year	Rems per year	Rems per y
Whole body, gonads, bone marrow	3	5	1.3(4)	5(4)	0.5
Bone, skin, thyroid	15	30	15	30	3(5)
Any tissue of hands, forearms, feet and ankles	38	75	38	75	7.5
Lungs (6), and other single organs or tissue	8	15	8	15	1.5

TABLE 2

Maximum Permissible Exposures To Radon Daughters (6)

Column I		Column II
Atomic Radiation Workers		Any Other Person
WLM per quarter of a year	WLM per year	WLM per year (7)
2	4	0.4

NOTES TO SCHEDULE II

(1) The maximum permissible doses and exposures specified in this Table do not apply to ionizing radiation

(a) received by a patient in the course of medical diagnosis or treatment by a qualified medical practitioner, or

(b) received by a person carrying out emergency procedures undertaken to avert danger to human life

(2) The Board may, under extraordinary circumstances, permit single or accumulated doses or exposures up to twice the annual maximum permissible doses or exposures for atomic radiation workers. Such variance will not be granted

(a) if appropriate alternatives are available,

(b) for irradiation of the whole body or abdomen of women of reproductive capacity, or

(c) for irradiation of the whole body, gonads or bone marrow if the average dose received from age 18 years up to and including the current year exceeds 5 rems per year

(3) In determining the dose, the contribution from sources ionizing radiation both inside and outside the body sl be included

(4) The dose to the abdomen shall not exceed 0.2 rem per t weeks, and if the person is known to be pregnant, the d to the abdomen shall not exceed 1 rem during the rema ing period of pregnancy

(5) The dose to the thyroid of a person under the age of years shall not exceed 1.5 rems per year

(6) For exposures to radon daughters, the maximum permis ble exposures (in working level months) apply instead the maximum permissible doses for the lungs (in rems).

(7) The WLM unit is not appropriate for exposures in tl home or in other non-occupational situations. In sut situations, the maximum permissible annual average co centration of radon daughters attributable to the oper tion of a nuclear facility shall be 0.02 WL."

REGLEMENTATION FRANÇAISE RELATIVE A L'ELIMINATION DES DECHETS RADIOACTIFS DANS LE SOL

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Résumé

La loi du 15 juillet 1975 fixe les règles relatives à l'élimination des déchets et crée une Agence nationale pour la récupération et l'élimination des déchets.

Le décret du 4 août 1975 crée un Comité interministériel de la sécurité nucléaire chargé notamment de coordonner les actions destinées à assurer la protection des personnes et des biens contre les dangers des installations nucléaires.

Un arrêté du 2 novembre 1976 regroupe dans un Institut de protection et de sûreté nucléaire les études et recherches sur la sécurité nucléaire et les déchets radioactifs.

Les installations destinées au traitement et au stockage des déchets radioactifs sont considérées comme "installations nucléaires de base" et réglementées par un décret du 11 décembre 1963, modifié par un décret du 27 mars 1973.

La procédure d'autorisation de création des installations nucléaires de base est menée par le ministère de l'Industrie : elle inclut un examen de sûreté, une enquête publique, la consultation des autres ministères intéressés et l'accord du ministère de la Santé et de la Sécurité Sociale.

Enfin, les installations nucléaires sont soumises à une double surveillance spécifique de la part des pouvoirs publics :

- la première est exercée par des inspecteurs des installations nucléaires de base ;

- la seconde est exercée par les agents du Service central de protection contre les rayonnements ionisants (SCPRI) dépendant du ministère de la Santé et de la Sécurité Sociale .

I - DISPOSITIONS GENERALES

La loi du 15 juillet 1975 fixe les règles relatives à l'élimination des déchets et à la récupération des matériaux. Cette même loi crée une agence nationale pour la récupération et l'élimination des déchets.

Les déchets radioactifs posent cependant des problèmes spécifiques qui intéressent la "sécurité nucléaire" au sens large. L'action des ministres concernés est coordonnée par le Comité interministériel de la sécurité nucléaire institué par un décret du 4 août 1975 (cf. Annexe).

La création de ce Comité ne modifie pas les compétences des départements ministériels intéressés ni des commissions interministérielles actuellement existantes, en particulier la Commission interministérielle des installations nucléaires de base.

Dans le domaine de l'énergie nucléaire, le rôle de conseil des autorités gouvernementales appartient en premier lieu au Commissariat à l'Energie Atomique (C.E.A.) créé par une ordonnance du 18 octobre 1945, modifiée par les dispositions des décrets des 29 septembre 1970 et 14 décembre 197., lui attribuant une mission générale de recherche scientifique et technique dans ce domaine. A ce titre, il est habilité à conseiller le pouvoir exécutif dans la gestion des déchets radioactifs. Jouissant de la personnalité civile et de l'autonomie administraitve, le C.E.A. est néanmoins placé sous l'autorité et le contrôle du Ministre de l'Industrie.

Par un arrêté en date du 2 novembre 1976, les services qui au sein du C.E.A. traitent des questions de sécurité nucléaire ont été regroupés dans un Institut de protection et de sûreté nucléaire dont la mission d'étude et de recherche s'applique notamment au problème des déchets radioactifs.

Le ministère de l'Industrie étudie la création au sein du C.E.A. d'une Agence nationale pour la gestion des déchets radioactifs. Cette agence serait chargée, en se conformant à la politique générale définie par le Gouvernement, des opérations de gestion à long terme des déchets radioactifs, et notamment :

- d'assurer la gestion des centres de stockage à long terme,

- de concevoir, d'implanter et de réaliser les nouveaux centres de stockage à long terme, et d'effectuer toutes études nécessaires à cette fin,

- de promouvoir, en concertation avec les producteurs de déchets, des spécifications de conditionnement et de stockage des déchets radioactifs avant leur évacuation vers les centres de stockage,

- de contribuer aux recherches, études et travaux concernant les procédés de gestion des déchets radioactifs ainsi que leur devenir à long terme.

Elle serait consultée sur les programmes de recherche et développement, ainsi que sur les projets de réglementation, relatifs à la gestion des déchets radioactifs.

II - ROLE ET RESPONSABILITE DE L'ORGANISME REGLEMENTAIRE ET RELATIONS AVEC LES ORGANISMES EXECUTIFS

Les installations destinées au traitement et au stockage des déchets radioactifs sont considérées comme "installations nucléaires de base" et à ce titre sont réglementées par un décret du 11 décembre 1963, modifié par un décret du 27 mars 1973, lorsque la quantité ou l'activité totale des substances radioactives est supérieure à un seuil fixé selon le type d'installation et le radioélément considéré.

La procédure d'autorisation de création des installations nucléaires de base est menée par le ministère de l'Industrie : elle inclut un examen de sûreté, une enquête publique, la consultation des autres ministères intéressés et l'accord du ministère de la Santé et de la Famille.

Au sein du ministère de l'Industrie, c'est le Service central de sûreté des installations nucléaires (S.C.S.I.N.) qui est notamment chargé de mener les procédures d'autorisation relatives aux installations nucléaires de base, d'élaborer la réglementation technique générale concernant la sûreté et d'exercer la surveillance des installations.

Le Service central de protection contre les rayonnements ionisants (S.C.P.R.I.) joue un rôle important dans la surveillance radiologique de l'environnement, et notamment dans l'application de la réglementation concernant les effluents radioactifs, ainsi que, sous l'autorité du ministère du Travail, dans la surveillance de la protection des travailleurs contre les rayonnements ionisants.

III - REGLEMENTS ET GUIDES APPLICABLES AUX EFFLUENTS ET DECHETS

Les rejets d'effluents gazeux et les rejets d'effluents liquides sont respectivement soumis aux dispositions spécifiques du décret du 6 novembre 1974 et du décret du 31 décembre 1974 et de leurs arrêtés d'application du 10 août 1976 ; dès lors qu'ils émanent d'une installation nucléaire de base.

Deux arrêtés en date du 6 décembre 1966 et 25 janvier 1967 ont fixé le seuil de l'activité maximum susceptible d'être rejetée sous forme d'effluent par une installation nucléaire de base. Ces deux arrêtés sont bien entendu applicables aux installations de stockage des déchets radioactifs. D'autre part, les déchets solides, qui ne font pas l'objet d'une réglementation particulière, se trouvent, en tant que substances radioactives émanant des installations nucléaires de base, régis par les dispositions particulières qui concernent ces dernières.

IV - PROCEDURE D'AUTORISATION DE CREATION DES INSTALLATIONS

La procédure proprement dite d'autorisation de création vise à déterminer les prescriptions techniques essentielles pour la conception et la construction de ces installations ; au terme de cette procédure, le décret d'autorisation de création d'une installation énonce les obligations auxquelles devra se soumettre son exploitant.

A la mise en exploitation, le Ministre de l'Industrie complète les dispositions du décret d'autorisation de création par des prescriptions plus détaillées dont l'exécution est contrôlée par des inspecteurs.

a) Présentation de la demande

La demande d'autorisation de création d'une installation nucléaire de base est adressée par le futur exploitant au Ministre de l'Industrie. La demande indique les caractéristiques principales de l'installation. Elle comporte un plan de situation indiquant le périmètre de l'installation. Par ailleurs, un rapport préliminaire de sûreté y est annexé. L'évaluation de sûreté qui est faite par l'I.P.S.N. est soumise à l'avis d'un groupe d'experts.

b) Consultation des parties intéressées

* Consultation et intervention du public et des autorités locales

L'enquête locale est ouverte par le préfet du département dans lequel doit être implantée l'installation. Le dossier soumis à l'enquête doit notamment contenir des renseignements sur l'identité du demandeur, l'objet de l'enquête, la nature et les caractéristiques essentielles de l'installation ainsi qu'un plan de cette dernière et une carte de la région ... Les observations faites par les personnes du public sont consignées dans des registres d'enquête ; elles sont examinées par un commissaire-enquêteur désigné par l'arrêté préfectoral d'ouverture de l'enquête ; ce commissaire-enquêteur transmet le dossier d'enquête avec ses conclusions au préfet concerné dans les quinze jours qui suivent la clôture de l'enquête.

Les services locaux des ministères concernés sont consultés. De plus la législation sur la protection de la nature implique la constitution d'un dossier d'étude d'impact qui est joint au dossier de l'enquête.

* Consultation et intervention des organismes techniques

Parallèlement à la consultation du public et des autorités locales, l'analyse des rapports de sûreté des installations nucléaires est effectuée par l'Institut de protection et de sûreté nucléaire qui la rapporte devant le groupe d'experts compétent (groupe permanent). Ce groupe donne au Service central de sûreté des installations nucléaires son avis sur la sûreté de l'installation telle qu'elle est prévue par l'exploitant. Compte tenu de cet avis, informé des résultats de l'enquête locale et éventuellement des observations des ministres intéressés, le ministère de l'Industrie prépare un projet de décret autorisant la création de l'installation.

Ce projet est alors communiqué pour avis à la Commission interministérielle des installations nucléaires de base qui regroupe, sous la présidence d'un Conseiller d'Etat, les représentants des ministres compétents, à un titre ou à un autre, en matière de sécurité nucléaire.

Le projet de décret, éventuellement amendé, compte tenu des observations de la Commission, est alors soumis pour avis au Ministre de la Santé et de la Famille qui doit se prononcer dans un délai de trois mois.

Il faut noter que les décrets d'autorisation et de création autorisent la création d'une installation donnée sur un site donné et qu'il n'y a pas d'autorisation préalable relative au choix des sites.

Toutefois les différents départements ministériels concernés sont amenés à donner un avis sur la demande de déclaration d'utilité publique lorsqu'une telle demande est formulée par le futur exploitant (ce qui est pratiquement le cas pour toutes les grandes installations nucléaires). C'est alors l'enquête publique organisée dans le cadre de la procédure d'examen de cette demande qui tient lieu de l'enquête publique prévue par le décret du 11 décembre 1963. La déclaration d'utilité publique est prononcée après avis du Conseil d'Etat et exprime un accord de principe sur le choix du site.

V - INSPECTION DES INSTALLATIONS NUCLEAIRES

Les installations nucléaires sont soumises à une double surveillance spécifique de la part des pouvoirs publics :

- la première est exercée par des inspecteurs des installations nucléaires de base nommés conjointement par le Ministre de l'Industrie - Service central de sûreté des installations nucléaires et le Ministre de l'Environnement et du Cadre de Vie, et porte sur la sûreté de ces installations et la vérification du respect des prescriptions techniques imposées à l'exploitant par le décret d'autorisation de création. Ces visites sont généralement préparées en liaison avec les techniciens de l'Institut de protection et de sûreté nucléaire ;

- la seconde est exercée par les agents du Service central de protection contre les rayonnements ionisants (S.C.P.R.I.) qui veille au respect de la réglementation relative aux rejets d'effluents radioactifs gazeux et liquides et à la protection des travailleurs.

D'autres contrôles sont bien entendu prescrits par la réglementation en vigueur, notamment par le ministère du Travail, pour ce qui concerne l'inspection du travail.

VI - DIVERS

La prévention des dommages causés résultat de l'évacuation définitive des déchets radioactifs

Il est bien certain que la protection contre les risques liés à l'évacuation définitive des déchets radioactifs doit être assurée de manière différente selon leurs formes physiques : l'enfouissement plus ou moins profond sera réservé aux déchets solides de haute activité ; pour les déchets solides de faible activité, on retient le stockage en surface.

Le stockage à long terme

En ce qui concerne le stockage à long terme, la France a acquis une expérience de huit années pour le stockage en surface ou par enfouissement à faible profondeur dans une installation proche du centre de La Hague, qui est une installation nucléaire de base.

DÉCRETS, ARRÊTÉS ET CIRCULAIRES

PREMIER MINISTRE

Décret n° 75-713 du 4 août 1975
Instituant un comité interministériel de la sécurité nucléaire.

Le Président de la République,

Sur le rapport du Premier ministre,

Décrète :

Art. 1er. — Il est institué un comité interministériel de la sécurité nucléaire qui comprend, sous la présidence du Premier ministre, le ministre d'Etat, ministre de l'intérieur, le ministre des affaires étrangères, le ministre de l'économie et des finances, le ministre de la défense, le ministre de l'équipement, le ministre de l'agriculture, le ministre de la qualité de la vie, le ministre du travail, le ministre de la santé, le ministre de l'industrie et de la recherche, le secrétaire d'Etat aux transports et le secrétaire d'Etat aupres du Premier ministre, porte-parole du Gouvernement.

D'autres ministres peuvent siéger au comité pour les questions relevant de leurs competences

Les responsables des services, organismes et entreprises concernés peuvent être appeles à participer aux travaux du comité

Art. 2 — Le comité interministériel de la securité nucléaire coordonne les actions destinées à assurer la protection des personnes et des biens contre les dangers, nuisances ou gênes de toute nature resultant de la creation, du fonctionnement et de l'arrêt des installations nucléaires fixes ou mobiles, ainsi que de la conservation, du transport, de l'utilisation et de la transformation des substances radioactives naturelles ou artificielles Sont cependant exclues de la mission du comité les installations nucleaires intéressant exclusivement la defense nationale et classees secretes, ainsi que les matières nucléaires façonnées destinées à la defense nationale.

Plus particulièrement les missions du comité s'étendent :

A la protection des travailleurs et du public contre les rayonnements ionisants et aux mesures a prendre en cas d'accident impliquant un risque radiologique ;

Au rejet des effluents radioactifs et non radioactifs, liquides et gazeux, ainsi qu'aux autres nuisances, pollutions et gênes de toute nature provoquées par les installations nucléaires ;

A la sûreté des installations nucléaires, définie comme l'ensemble des dispositions à prendre pour en assurer le fonctionnement normal, prévenir les accidents ou actions de malveillance et en limiter les effets ;

Au contrôle et à la sécurité des matieres nucléaires pendant leur production, leur conservation, leur transport et leur utilisation, y compris les radioéléments artificiels et les déchets, en vue de protéger l'hygiène et la santé publique et d'en éviter les detournements à des fins non autorisees.

Il adopte ou prépare les mesures générales nécessaires à l'accomplissement de cette mission Il coordonne l'utilisation des moyens mis à cet effet à la disposition des departements ministériels intéressés et des organismes placés sous leur tutelle Il examine le programme des études et recherches à réaliser chaque année par ces ministeres ou organismes

Il prépare les positions du Gouvernement en matière de sécurité nucleaire dans les négociations internationales

Il fixe les orientations concernant l'information du public et coordonne les actions en ce domaine

Art. 3. — Le secrétaire général du comité interministériel est nommé par décret. Il est chargé de préparer les délibérations du comité, de lui proposer les mesures nécessaires à l'accomplissement de sa mission et de suivre l'application des décisions prises

Il provoque en cas d'urgence la reunion des ministres intéressés et prend les ordonnances les mesures nécessaires après concertation avec leurs representants Il en rend compte au comité.

Dans le cadre des directives adoptées par le comité, et après concertation avec les départements intéressés, il informe le public des questions de ce domaine communes à plusieurs départements.

Les services compétents des differents ministeres ainsi que les établissements ou entreprises qui en relevent lui prêtent leur concours

Le secrétariat des différents organismes interministériels consultatifs relevant de ce domaine et notamment celui de la commission interministérielle des installations nucléaires de base et de la commission interministérielle des radioelements artificiels travaillent en liaison avec lui.

Art. 4 — Le Premier ministre, le ministre d'Etat, ministre de l'intérieur, le ministre des affaires étrangères, le ministre de l'économie et des finances, le ministre de la defense, le ministre de l'équipement, le ministre de l'agriculture, le ministre de la qualité de la vie, le ministre du travail, le ministre de la santé le ministre de l'industrie et de la recherche et le secrétaire d'Etat aux transports sont chargés, chacun en ce qui le concerne, de l'exécution du present decret, qui sera publié au *Journal officiel* de la République française.

Fait à Paris, le 4 août 1975.

VALÉRY GISCARD D'ESTAING.

Par le Président de la République :

Le Premier ministre,
JACQUES CHIRAC.

Le ministre d'Etat, ministre de l'intérieur,
MICHEL PONIATOWSKI

Le ministre des affaires étrangères,
JEAN SAUVAGNARGUES.

Le ministre de l'économie et des finances,
JEAN PIERRE FOURCADE

Le ministre de la défense,
YVON BOURGES.

Le ministre de l'équipement,
ROBERT GALLEY.

Le ministre de l'agriculture,
CHRISTIAN BONNET.

Le ministre de la qualité de la vie,
ANDRÉ JARROT.

Le ministre du travail,
MICHEL DURAFOUR.

Le ministre de la santé,
SIMONE WEIL

Le ministre de l'industrie et de la recherche,
MICHEL D'ORNANO.

Le secrétaire d'Etat aux transports,
MARCEL CAVAILLÉ

REGULATORY ASPECTS OF UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE IN THE FEDERAL REPUBLIC OF GERMANY

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Abstract

In the Federal Republic of Germany, the Federal Government is responsible for safeguarding and final disposal of radioactive waste. The particular procedure of licensing, called 'plan stating', has to be performed by the respective state on behalf of the federal authority. The formal proceeding considers all technical and safety aspects as well as all affected public interests. The 'plan stating' only excludes the necessary licences according to the mining law.

The procedure of 'plan stating' mainly comprises the following stages: 1) application by the Federal Government Agency; 2) examination and valuation by the licensing authority; 3) public notification, presentation and discussion; 4) decision.

Since the last modification of the German Atomic Law in 1976 the federal government is responsible for safeguarding and final disposal of all radioactive waste. Federal plants referring to this need a special type of approval according to the atomic law, in german called "Planfeststellung meaning plan stating. This formal administration procedure legally arranges a real project considering the requirements of different technical plannings and the admissibility with regard to all affected public relevances. Additional public decisions, such as licenses, grants, permissions are not necessary. However, the plan stating does not include the admissibility by the mining laws. The mining authorities consequently for example have to approve drilling projects. Regulations by the mining code have also to be considered in addition to the atomic law for underground installations of waste isolation plants. The skeleton working plan stipulated by the mining code forms a part of the plan stating procedure. Detailed working plans for underground facilities such as warehouses and mining equipment have to be separately prepared by the management of the repository and approved by the mining department.

In the Federal Republic of Germany, the plan stating procedure according to the atomic law has to be performed by the appropriate supreme authorities of the federal lands, that are the ministries for labour, social, environmental or economic affairs of the land, in which the site is situated. The procedure mainly comprises the following stages:

a) Application

In Germany a special federal government agency, the Physikalisch - Technische Bundesanstalt, has to take over by Atomic Law the federal government responsibility. Special task can be delegated to a third, for example a private company. To begin the legal procedure, an application has to be presented to the plan stating authority. All documents of importance for the evaluation of the project have to be attached to the request, e.g. a safety report, plans and descriptions of the plant, demonstration of the reliability and qualification of the staff, analysis of the risks, data concerning nature and extent of emissions, as well as actions to minimize emissions, data concerning nature and extent of the waste. The safety report has to show all risks induced by the repository and its operation even after shut-sown. Strategies of provision have to be explained.

b) Examination and Valuation

The licensing authority investigates, whether

- the site-selection is not incompatible with public interests, such as the conservation of clean water, air and soil,
- the plants in question have effects on man,
- the construction and operation of the repository is in concordance with all semi-governmental regulations,
- the plant is scientifically and technically up to date.

c) Public Notification

The public involvement in a special requirement by the atomic law. The plan stating authority has to announce the application to the public by news papers edited in the site area.

d) Public Presentation

In order to give detailed information about the application and in order to make objections possible for everybody whose interests may be touched the application and the documents have to be presented to the public for two months.

e) Discussion

The objections have to be discussed with the parties concerned (a sort of hearing). The date of the discussion has to be published by a formal announcement.

f) Decision

The Plan stating authority gives the licence, if necessary with injunction, if the project is admissible considering all results of the procedure. The applicant and the objecting parties have to be informed by letter. The parties concerned are allowed to bring an action against the decision.

The plan stating authority asks for expert opinions with reference to all pertinent problems, e.g. questions of safety technique, ecology, meteorology and geology

The plan stating authority also requests the opinions of all other authorities concerned such as the local government authorities and their subordinate agencies, e.g. factory inspectorate, board of works, public health department. The district and community authorities as well as the concerned federal authorities have also to be involved. The federal and the state government as well as the community authorities are controlled by their parliaments. This is the second indirect way of public involvement.

The Federal Government takes additionally into consultation the German commissions on reactor safety and radiation protection. These are groups of competent specialists covering all technical aspects in the nuclear field.

The plan stating authority considers the availability of expert and concerned authority opinions as an essential condition for licensing.

A positive plan stating decision requires the following:

- life, health and property have to be protected from the dangers of nuclear power and ionizing radiation. It has to be warranted that they are not exposed to dangers produced by the construction and operation of a repository.

- the reliability and the professional qualification of the applicant and his staff has to be warranted,

- necessary provisions on the base of recent level science and technology for all conceivable damages have to be made.

- approval and supervision has to cover the construction, operation, sealing and long time post operation of the repository.

The fundamental regulations are as existing for other nuclear installations esp

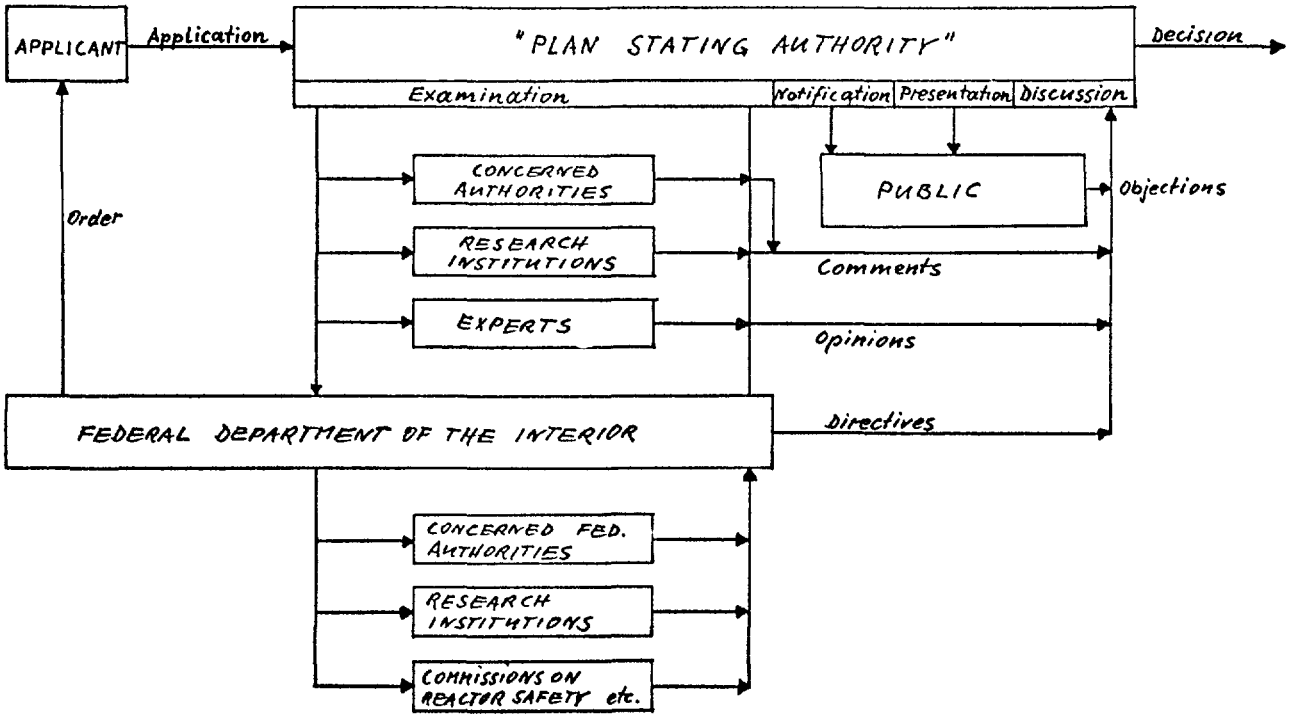
- the German Atomic Law with its decrees as radiation protection decree (for the environment and for the repository staff)

- existing water, air and ground protection regulations

- the code of works

- land use and land planning regulations and so on combined with the mining law and its special decrees.

The existing regulation in Germany by proper application can give legal force to ensure safety and security of radioactive waste repositories.



REGULATORY ASPECTS OF UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE IN JAPAN

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Abstract

Underground disposal of radioactive wastes in Japan is at a stage in which its technical feasibility is being investigated.

The regulatory aspects will be issued in the next stage. As background information, two items are briefly described:

(1) investigation on long term management system in Japan,

(2) the status quo of Japanese Atomic Laws for the radioactive wastes.

1. General

Radioactive waste management and disposal have become an actually important problem in Japan, since 15 nuclear reactors are already in operation and a fuel reprocessing plant undergoes test operation now.

Concerning waste disposal, only sea disposal of low-level waste mainly from the reactors is expected to be used in the near future.

Japan is interested in underground disposal, but is at a development stage in which its technical feasibility should be made clear and the concept itself should be developed taking into consideration the specific natural and social conditions in Japan.

The regulatory aspects of underground disposal will be important in the next stage. Therefore, we have not sufficiently discussed those aspects to get any formal and conclusive results, especially in the framework requested by the IAEA Secretariat.

The atomic energy basic law which had been issued in 1955 was revised in 1978. According to this revision, an Atomic Energy Safety Commission will be established, which will be in charge of all regulatory aspects concerning safety related to atomic energy.

The development of a radioactive waste management and disposal system at a national level will be promoted by the Atomic Energy Safety Commission.

In summary; (1) as regards waste disposal, except sea disposal of low level waste, the main issue for the time being is technical rather than regulatory, (2) public acceptance will be potentially the most important issue.

In connection with the subject, two short notes are prepared in the following.

2. Investigation on Long-Term Management System in Japan

Nuclear power is one of the most important energy sources of Japan. 15 nuclear power plants are already in operation. With regard to fuel reprocessing, the pilot plant in Tokai-Mura is also in operation. The safe and economic management of the radioactive wastes from the use of atomic energy is a very serious concern. Especially the management of the high-level waste produced from the reprocessing plant is the most important matter in the near future because the hazard of long-lived nuclides in the high level waste lasts for a long time. This is the major reason why it must be isolated from the biosphere almost permanently.

Geological disposal is thought to be the most feasible method for the isolation of the high level waste at present in Japan. However, it is recognized that there are many areas to be studied in order to realize geological disposal, such as

- geological studies
- field survey
- site selection
- design and construction of facility
- operation of facility
- sealing or decommissioning of facility
- long term surveillance etc.

According to Japanese Atomic Energy Commission's announcement of Octoer 1976, entitled "The Policy and Strategy for Radioactive Waste Management", the government must be responsible for the high level waste disposal and the long-term management of disposed waste. According to this announcement, the Science and Technology Agency (STA) in the Prime Minister's Office has just started the geological disposal study. At present this study is still in its preliminary stage.

In addition to the geological study, STA has started establishing the long-term management system of high level waste. In this case, the management system means a kind of institutional structure which has both a regulatory function and an implementing function. A regulatory function means a policy and strategy making, the establishment of criteria, standards and regulations and their enforcement. On the other hand, an implementing function means site selection, the design, construction and operation of facilities, the shut-down of facilities.

Mitsubishi Metal Corporation, a private company in Japan, is now studying what is the most efficient system for long-term waste management in Japan under the business contract with STA.

3. The Status quo of Japanese Atomic Laws for the Radioactive Waste

Up to the present moment, there has been no specific law enacted for the geological disposal of radioactive wastes in Japan. Radioactive waste itself, however, has its own legal status in the existing over-all structure of the Japanese atomic law system, as is shown below. It is still too early to decide on whether to enact a new legislation or just legally extrapolate the status quo (and in what form for either case) for covering the specific issue of geological disposal, since there is in Japan much unpredictability in the social, and possibly political, level with respect to public acceptance.

The following is an analysis of the status quo of the Japanese atomic law system which indicates essential factors for further considerations regarding radioactive waste management. (See Annex I - on the current structure of Japanese atomic laws).
There are two axes to look at in Annex I :

1. degrees of legal dominance, ie, the decision makers' status (see along the horizontal axis)

   i. a Law (the diet level, ie, the national level)

   ii. an Ordinance* (the whole Government level)

   iii. a Ministerial Ordinance (the specific Ministry level)

   iv. a notification, notice etc (more discretionary level)

2. areas of control (see along the vertical axis)

   i. basic Government policies
   eg. the Atomic Energy Basic Act (1955)

   ii. organisations

   iii. nuclear facilities
   eg. the Law for Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (1958)

   iv. utilities
   eg. the Electric Enterprise Law (1964)

   v. transportation
   eg. The Shipping Safety Law (1933)

   vi. working conditions
   eg. the Labour Safety and Sanitation Law (1972)

   vii. (strict) liability and compensation
   eg. the law on Compensation for Nuclear Damage (1961)

   viii. local benefits and public acceptance
   eg. the Power Siting Promotion Law (1952)

With this scope in mind, the Japanese current radioactive waste management is found to be regulated;
in the area of nuclear facilities by Ministerial Ordinances

- Regulations on the Atomic Reactor Establishment and the Operation (P.M.O.), whose exerpt is given,

- Regulation on the Nuclear Fuel Material Frabrication Business (P.M.O.)

- Regulation on the use of the Nuclear Fuel Material (P.M.O.)

- Regulation on the Spent Fuel Reprocessing Business (P.M.O.)

and by the Government Ordinance

- Enforcement Ordinance for the Law concerning Prevention from Radiation Hazards due to Radio-Isotopes, etc (P.M.O.)

and, in the area of utilities, by the ministerial Ordinance

- Order of Technical Criteria for Atomic Power Plants (M.I.T.I).

*To be precise, a Government Ordinance

Annex II is an excerpt of 'the Regulation on the Atomic Reactor Establishment and the Operation' which is given as an example of four Ministerial Regulations, which have very similar structures.

In conclusion, as far as the literal interpretation is concerned, even at the present situation the geological disposal of the radioactive wastes may be legally possible, ie, is not ruled out as illegal at all, provided that other pertinent provisions are all observed. But apart from the legal theory, there is now a sufficiently large room for a philosophy and a policy choice, eg. state responsibility, on the administrative side on the one hand and on the public on the other.

In Japan, the Atomic Energy Commission is responsible for the regulatory aspect and R & D. The Science and Technology Agency serves as a secretarial office to A.E.C. including budgeting.

The Status quo of Japanese

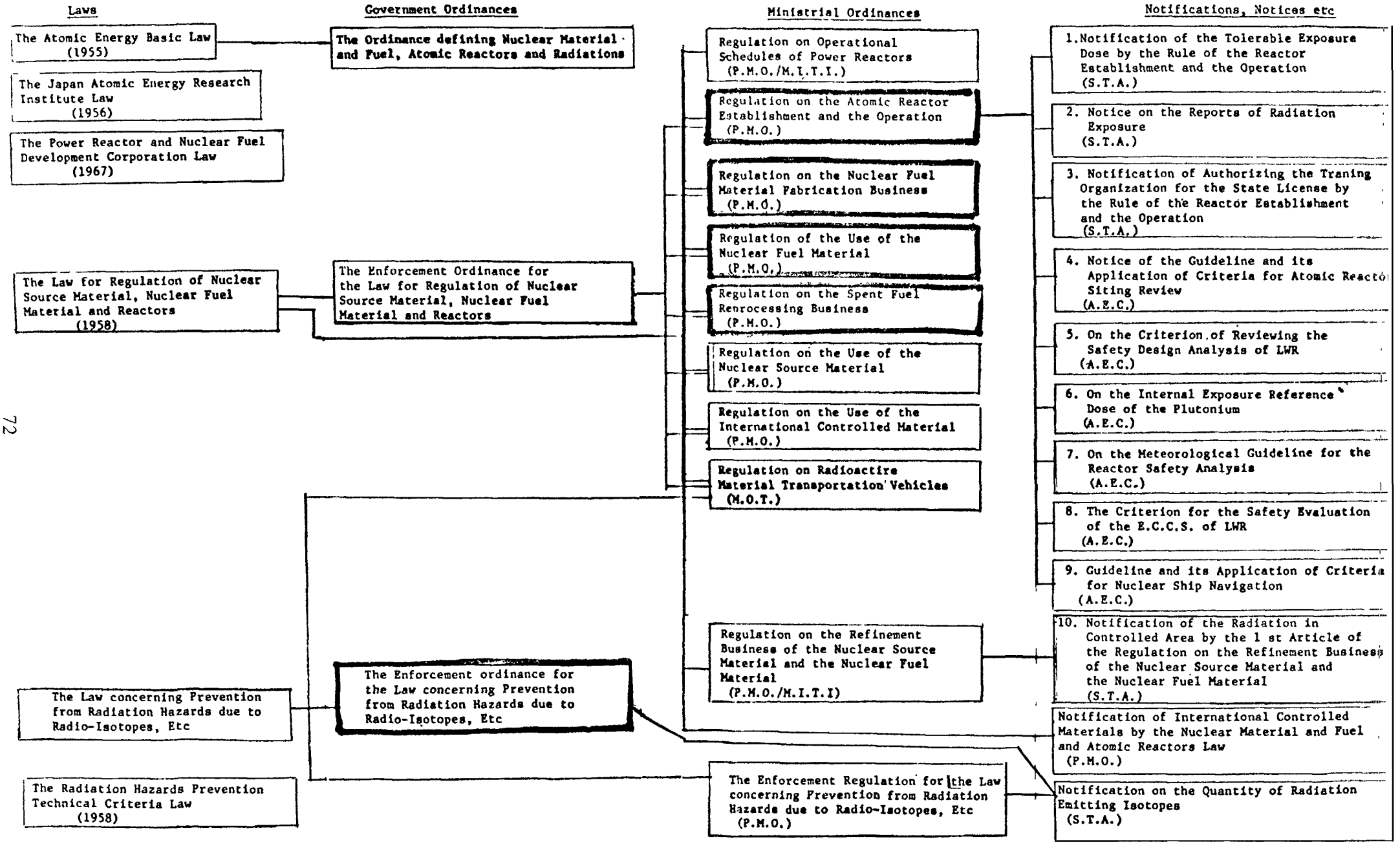
Atomic Laws for the Radioactive Waste

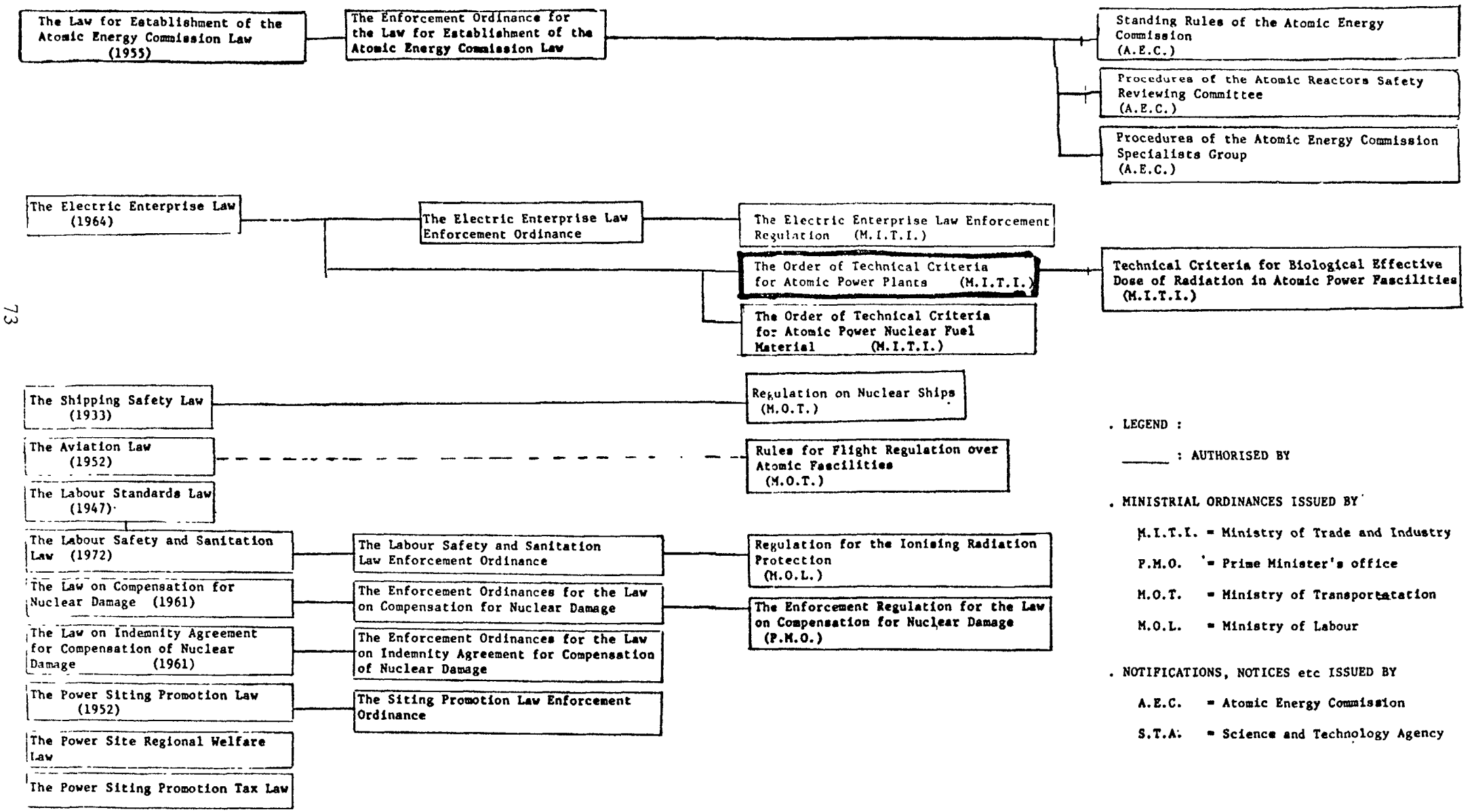
Annex I : The Current Structure
of Japanese Atomic Laws

Annex II: Excerpt from the Regulation on
Atomic Reactor Establishment
and Operation

ANNEX I.

THE CURRENT STRUCTURE OF JAPANESE ATOMIC LAWS




The Law for Establishment of the Atomic Energy Commission Law (1955)
The Enforcement Ordinance for the Law for Establishment of the Atomic Energy Commission Law
Standing Rules of the Atomic Energy Commission (A.E.C.)
Procedures of the Atomic Reactors Safety Reviewing Committee (A.E.C.)
Procedures of the Atomic Energy Commission Specialists Group (A.E.C.)
The Electric Enterprise Law (1964)
The Electric Enterprise Law Enforcement Ordinance
The Electric Enterprise Law Enforcement Regulation (M.I.T.I.)
The Order of Technical Criteria for Atomic Power Plants (M.I.T.I.)
Technical Criteria for Biological Effective Dose of Radiation in Atomic Power Fascilities (M.I.T.I.)
The Order of Technical Criteria for Atomic Power Nuclear Fuel Material (M.I.T.I.)
The Shipping Safety Law (1933)
Regulation on Nuclear Ships (M.O.T.)
The Aviation Law (1952)
Rules for Flight Regulation over Atomic Fascilities (M.O.T.)
The Labour Standards Law (1947)
The Labour Safety and Sanitation Law (1972)
The Labour Safety and Sanitation Law Enforcement Ordinance
Regulation for the Ionising Radiation Protection (M.O.L.)
The Law on Compensation for Nuclear Damage (1961)
The Enforcement Ordinances for the Law on Compensation for Nuclear Damage
The Enforcement Regulation for the Law on Compensation for Nuclear Damage (P.M.O.)
The Law on Indemnity Agreement for Compensation of Nuclear Damage (1961)
The Enforcement Ordinances for the Law on Indemnity Agreement for Compensation of Nuclear Damage
The Power Siting Promotion Law (1952)
The Siting Promotion Law Enforcement Ordinance
The Power Site Regional Welfare Law
The Power Siting Promotion Tax Law
. LEGEND :
_____ : AUTHORISED BY
. MINISTRIAL ORDINANCES ISSUED BY
M.I.T.I. = Ministry of Trade and Industry
P.M.O. = Prime Minister's office
M.O.T. = Ministry of Transportatation
M.O.L. = Ministry of Labour
. NOTIFICATIONS, NOTICES etc ISSUED BY
A.E.C. = Atomic Energy Commission
S.T.A. = Science and Technology Agency

ANNEX II.

Regulation on the Atomic Reactor Establishment and

the Operation (Excerpt)

Article 14. As prescribed by the Articles 37.1 of the Law for Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors, the establisher of atomic reactors should take the following measure for the disposal of radioactive wastes;

1.~ 3. Omitted (general rule, gaseous and liquid waste)

4. A solid radioactive waste should be disposed sealed in a corrosion-proof container without any water-permeablility. This does not apply to large-scaled machinary that is exceedingly difficult to be sealed in a container.

5. In case that a radioactive waste is disposed sealed in a container, it should be to disposal facilities with the protective capacity to radiation hazards.
A solid radioactive waste may be disposed to sea dumping, provided the disposal to these facilities is exceedingly difficult.

6. In the case prescribed in 5, the container should be equipped with sufficient strength to foreclose a possible damage in the occasion of, and after, the disposal.

7. The disposal of solid radioactive waste by a sea dumping is subject to the condition

   (a) that the container with radioactive waste sealed within should have the specific weight greater than 1.2, and

   (b) that the location of dumping should be more than 2,000 meters deep.

8. Omitted (gaseous waste)

9. Omitted (liquid waste)

ASPECTS REGLEMENTAIRES BELGES POUR L'EVACUATION DE DECHETS RADIOACTIFS DANS LE SOUS SOL

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R E S U M E

En Belgique, les procédures à suivre pour l'obtention des autorisations de construction et d'exploitation d'un site souterrain d'enfouissement de déchets radioactifs conditionnés peuvent être recherchées dans la législation existante. Les dispositions légales en matière d'installations minières sont d'application pour tous les travaux de construction et de mise en exploitation de ces installations. Dans le cas d'un cimetière pour déchets radioactifs conditionnés il est toutefois indispensable de se référer également à la législation en matière d'installations nucléaires. Suivant le type d'établissement et les substances radioactives manipulées il y a différentes procédures à suivre pour l'obtention des autorisations d'exploitation, celles-ci seront données suivant le cas par la députation permanente du conseil provincial ou par le Roi. Dans le cas prévu par l'article 37 du traité de Rome l'avis de la Commission des Communautés Européennes devra être demandé. En ce qui concerne le rôle et la responsabilité des organismes réglementaires, ici également la législation existante en matière de contrôle et de surveillance est valable tant du point de vue minier que du point de vue nucléaire.

Enfin, une loi du 5 août 1978 stipule que le Roi peut par arrêtés délibérés en Conseil des Ministres prendre toutes les dispositions en vue notamment de faire gérer le rejet de déchets radioactifs par un organisme exclusivement public.

I. INTRODUCTION

La réalisation du programme électro-nucléaire belge (5.820 MWe installé en 1983) a comme conséquence qu'à moyen terme la Belgique sera confrontée avec le problème des déchets en provenance du retraitement et du recyclage du combustible ou avec celui des assemblages fissiles usés.

En 1974, un programme de R & D concernant le rejet de divers déchets radioactifs conditionnés en formations géologiques profondes a été élaboré et mis en route par le centre de l'Energie nucléaire en accord avec les instances nationales.

C'est dans le cadre de la législation existante, celle relative aux installations minières d'une part, celle relative aux installations nucléaires, d'autre part, que les procédures à suivre pour l'obtention des autorisations de construction et d'exploitation d'un site souterrain d'enfouissement de déchets radioactifs conditionnés ont été recherchées.

2. DISPOSITIONS LEGALES GENERALES

2.1. Installations minières

Deux phases doivent être prises en considération.

A. Phase 1. Procèdures concernant les mines et carrières souterraines.

a) Demande d'autorisation pour la construction de galerie souterraines.
Cette demande doit être adressée au Gouverneur de la Province sur le territoire de laquelle les travaux seront exécutés. La demande doit être accompagnée d'un dossier circonstancié donnant notamment des informations sur le demandeur, le type et le but de la construction envisagée, le ou les propriétaires du domaine etc.

Le Gouverneur soumet la demande d'autorisation à l'avis de l'Administration des Mines (dépendant du Ministère des Affaires Economiques) qui stipule les conditions d'exploitation.
La décision finale prise par la Députation Permanente de la Province est communiquée d'une part au demandeur, d'autre part au bourgmestre de la commune concernée.

b) Demande d'autorisation pour la construction des installations de surface.
Une procédure similaire à celle prévue pour les installations souterraines est à suivre.

En cas de refus par les pouvoirs provinciaux il peut être fait appel au roi.

B. Phase 2. Procédures concernant les excavations souterraines.
La demande doit être introduite par l'employeur des travailleurs en sous-sol au bourgmestre de la commune concernée. Cette demande doit être accompagnée d'un dossier circonstancié donnant notamment des informations sur le demandeur, le type d'exploitation, le nombre présumé de travailleurs, etc.
Le collège des bourgmestre et échevins ouvre une enquête dite de "Commodo et Incommodo" par affichage public. Un procès-verbal des résultats de cette enquête est joint au dossier que le bourgmestre transmet ensuite pour avis à l'Administration des Mines (dépendant du Ministère des Affaires Economiques) qui stipule les conditions d'exploitation.
La décision finale prise par le collège des bourgmestre et échevins est communiquée :
- au demandeur
- à l'Administration des Mines
- au public par affichage.

En cas de refus des pouvoirs communaux, il peut être fait appel aux instances provinciales.

2.2. Installations nucléaires

En Belgique, l'importation, la production, la fabrication, la détention, le transport, l'emploi à des fins commerciales, industrielles, scientifiques, médicales ou autres, d'appareils, d'installations ou de substances capables d'émettre des radiations ionisantes sont régis par l'arrêté royal du 28.02.1963 portant règlement général de la protection de la population et des travailleurs contre le danger des radiations ionisantes.

Ce règlement s'applique également au traitement, à la manipulation, au stockage, à l'élimination et l'évacuation des substances et déchets radioactifs.

Les établissements où des substances radioactives sont mises en oeuvre ou détenues sont rangés dans 4 classes.

La classe I comprend les centrales nucléaires, les usines de retraitement et les établissements où sont mises en oeuvre ou détenues des quantités de substances fissibles supérieures à la moitié de la masse critique tandis que la classe II est réservée entre autres aux établissements s'occupant de la collecte, du traitement, du conditionnement et du stockage des déchets radioactifs pour autant que ces installations ne soient pas annexées à des installations de classe I.

Dans l'état actuel de la législation belge, les établissements faisant l'objet de la présente note sont donc rangés en classe II ou I, et doivent faire l'objet d'une autorisation préalable accordée respectivement par les autorités provinciales dont dépend le siège d'exploitation ou par le Roi.

Le dossier de demande d'autorisation doit contenir une série de renseignements sur l'entreprise, son fonctionnement, la compétence de son personnel ainsi qu'une étude qualitative et quantitative sur les déchets radioactifs liquides et solides rejetés ou stockés sur le site et la description détaillée de la façon dont ils seront évacués, entreposés ou transportés, les plans des installations et du matériel et les mesures de radioprotection proposées pour le personnel et l'environnement.

C'est ainsi que les déchets radioactifs solides doivent être recueillis soigneusement dans des récipients étanches assurant une protection suffisante ; ils doivent être ensuite traités et, éventuellement concentrés de manière à éviter tout risque de dispersion de la radioactivité sous quelque forme que ce soit.

Le dépôt sur le sol ou dans le sol ne peut se faire qu'à la condition que les déchets soient contenus dans des récipients étanches et résistant aux agents physiques et chimiques ou que ces déchets soient incorporés à des matières inertes insolubles, de telle manière que la dis-

persion et l'élution des substances radioactives soient impossibles ou réduites à une valeur suffisamment faible pour ne constituer aucun danger.
Enfin, dans le cas précis où les déchets sont déposés dans le sol, des renseignements doivent également être fournis sur l'hydrologie, la géologie, la séismologie du terrain, la faune et la flore susceptibles de s'y développer, les mesures de protection qui seront prises en vue d'empêcher l'accès au terrain à toute personne étrangère à l'entreprise.
Bien sûr des renseignements doivent également être fournis sur les effluents gazeux.
Pour les établissements de classe II, la demande d'autorisation est transmise successivement au gouverneur de la province, au bourgmestre de la commune du siège d'exploitation et à son collège échevinal, à un comité consultatif provincial composés de fonctionnaires des administrations concernées (Santé Publique, Travail, Administration des mines, etc...).

Pour les autorisations de classe I, la demande d'autorisation est transmise successivement au gouverneur de la province, au bourgmestre de la commune du siège d'exploitation et à son collège échevinal, à la commission spéciale composée des fonctionnaires des administrations concernées et d'experts.
Dans le cas prévu par l'article 37 du traité de Rome, le comité consultatif provincial ou la commission spéciale sollicitent l'avis de la Commission des Communautés Européennes.
La décision est finalement prise par la députation permanente du conseil provincial (classe II) ou par le Roi (classe I).
L'arrêté d'autorisation reprend les conditions d'exploitation formulées par le Comité Consultatif ou par la Commission Spéciale.

3. Rôle et responsabilité des Organismes Réglementaires

En promulguant les lois, le législateur a également mis en place des moyens de contrôle et de surveillance.

3.1. Installations minières

Un responsable d'exploitation est nominativement désigné par l'exploitant.
Il est chargé du respect des lois et règlements dont l'exécution ressort de la compétence de l'Administration des Mines. L'Administration des Mines peut à tout moment et sans notification préalable inspecter les installations et contrôler la conformité de celles-ci.

3.2. Installations nucléaires

En ce qui concerne les installations nucléaires les moyens de contrôle s'établissent à des échelons successifs.

a) Service de contrôle physique et de contrôle médical

Le service de contrôle physique doit être organisé par le chef d'entreprise et est chargé de l'organisation et de la surveillance des mesures nécessaires pour assurer l'observation des dispositions légales concernant la sécurité et l'hygiène du travail ainsi que la sécurité et la salubrité du voisinage.
Ce service doit être dirigé par un expert agréé.
Indépendamment de ce contrôle physique, un contrôle médical est exercé sur les travailleurs professionnellement exposés aux radiations ionisantes.
Ce contrôle doit être exercé par un docteur en médecine agréé.

b) Organisme agréé

Le Chef d'entreprise est tenu de confier à un organisme indépendant :

- le contrôle de la bonne exécution de la mission dévolue au service de contrôle physique

- la réception préalable à la mise en exploitation des installations et des dispositifs de protection.

Cet organisme doit être agréé par les Ministres compétents et être dirigé par un expert agréé. Il doit mettre en place une commission de surveillance indépendante et présenter tous les trimestres un rapport détaillé sur ses activités.

c) Commission de surveillance

Cette commission doit réunir tous les 3 mois des fonctionnaires de l'administration du Travail, des employeurs, des représentants des Travailleurs et de la direction de l'organisme agréé.
Elle a pour mission de surveiller les activités de l'organisme agréé et de s'assurer qu'il respecte les dispositions réglementaires.

d) Indépendamment des 3 organismes de contrôle dont question ci-dessus, les administrations concernées se réunissent périodiquement avec les exploitants, leurs contrôles physique et médical et leur organisme agréé.

Ces réunions ont pour but de créer un audit chargé de l'examen ou de l'étude de certains problèmes de sécurité soit au stade de la conception soit au cours de l'exploitation.
Elle peut émettre également des avis ou des recommandations aux Ministres responsables et à cette fin, elle peut s'adjoindre la collaboration d'experts indépendants.

e) Comité consultatif provincial ou Commission spéciale
Ainsi que nous l'avons exposé ci-dessus, ces institutions ont pour but d'étudier le dossier de demande d'autorisation et de remettre un avis aux autorités chargées de délivrer l'arrêté d'autorisation d'exploitation.
Néanmoins, afin de réévaluer la sûreté, elles peuvent, au cours de l'exploitation, demander que de nouvelles études soient réalisées en ce qui concerne la sécurité ; de même ; elles peuvent modifier les conditions d'exploitation.

3.3. Service d'inspection gouvernementale
En plus des procédures de contrôle énoncées ci-avant, le bourgemestre et les fonctionnaires des administrations * peuvent à tout moment inspecter les installations et s'assurer du respect de la législation et des conditions d'exploitation.

4. DISPOSITIONS LEGALES PARTICULIERES

La loi du 5 août 1978 portant sur les réformes économiques et budgétaires stipule entre autres dans le Chap. I relatif aux réformes dans le secteur de l'Energie que le Roi peut par arrêtés délibérés en Conseil des Ministres, prendre toutes les dispositions en vue notamment :

- de faire gérer les activités du cycle des matières fissiles en amont et en aval des centrales nucléaires ... par une société mixte au capital de laquelle les pouvoirs publics participeront pour 50 % au moins et dans laquelle ils disposeront d'une position prépondérante ... Les activités du cycle des matières fissibles portent d'une façon non limitative sur l'approvisionnement en uranium, sur son enrichissement ... sur le retraitement des matières fissibles irradiées et sur le conditionnement des déchets résultant de cette opération ; elles concernent des travaux effectués sous contrat à l'étranger et des travaux effectués en Belgique,

*les administrations sont : la députation permanente de la Province, le Ministère de la Santé Publique, le Ministère du Travail et le Ministère des Affaires Economiques (corps des mines), chacune d'entre-elles ayant sa compétence propre.

- de faire gérer, afin d'assurer une protection aussi efficace et durable que possible de la collectivité, le stockage de déchets conditionnés, le rejet des déchets, le transport des déchets radioactifs ... par un organisme exclusivement public. Cet organisme assurera également la surveillance et le contrôle permanent de toutes les opérations portant sur les déchets radioactifs.

En résumé, on peut conclure que l'intention du législateur est bien de confier la gestion du conditionnement des déchets radioactifs à une société mixte dans laquelle l'Etat occupe une position prépondérante, la gestion des stockages, du rejet et des transports étant confiée à un organisme public, organisme qui assurera également la surveillance et le contrôle permanent de toutes les opérations portant sur les déchets radioactifs.

REGULATORY ASPECTS OF UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE IN SWITZERLAND

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Abstract

According to the Swiss Legislation it is the producer of radioactive waste which is legally responsible for its safe disposal. Waste disposal is thus the task of the NAGRA (Nationale Genossenschaft zur Lagerung radioaktiver Abfälle/National Co-operative for the Storage of Radioactive Waste), a private company of the producers of radioactive wastes.

A licence for a nuclear power station will be granted only if the safe disposal of the station's wastes can be guaranteed (repository project drawn up, geological situation explored by drillings and a safety assessment drafted by the regulatory body made available). It is this condition which will dominate the waste management scene in Switzerland for the coming years because also the already commissioned nuclear power plants in Switzerland have been instructed that they will have to be shut down at the end of 1985 if by that time the safe disposal of all types of waste can not be guaranteed. The projects which have to guarantee the safety of waste disposal will be examined by the Swiss Federal Authorities and the decision will be taken by the Swiss Federal Council.

1. Introduction

Because of the continuous increase in waste quantities and in view of public concern, nuclear waste management has become a central question within the context of Swiss energy policy.

At present three nuclear power stations (with a total power output of 1 GW (e)) are being operated in Switzerland. A 1 GW (e) station is taken into operation at present. In 1996 a total nuclear power output of 6 GW (e) will be available. In 2000 we expect the waste quantity to approximate to something like 100 years' operation of a 1 GW (e) station. By 1990 the existing installations for the intermediate storage of low- and medium-level waste will be full and our electric supply companies are obliged by their contracts with the reprocessors to take back high active waste from this date.

As it is deemed essential that national solutions be found to avoid, among other things, an undesirable dependence upon other countries, the Swiss Government has decided to draw up a project for the disposal of radioactive waste in our own country. Such a project would also serve as a frame of reference for assessing disposal estimates from foreign countries. Because Switzerland has no coastline and in view of its high population density, methods permitting of deep underground disposal are being sought. We have already acquired some

experience in the management of low and medium active waste from nuclear power reactors[1]). For deep underground disposal of high active waste, however, neither technical investigations nor preparation of a regulatory framework have yet been undertaken; this work is about to commence[1]). There will probably be no essential differences between the regulatory procedures for underground disposal of radioactive waste and those for the construction and operation of nuclear power stations.

2. Legal Framework

The planning, construction and operation of waste repositories are subject to the Federal Law on the Peaceful Use of Atomic Energy (Bundesgesetz über die friedliche Verwendung der Atomenergie und den Strahlenschutz). A revised version of this Law, also governing waste disposal, will come into force during the coming months. Furthermore, in February 1979 the Swiss people will be called upon to vote on an initiative proposing a change in the Constitution which would affect the establishment of repositories.

2.1 The Federal Law

In accordance with this Law, a repository will be called a nuclear installation. A federal licence will be required for the construction and operation of a nuclear installation. The construction licence will be issued in several stages, the first stage being the licensing of the site. Installations already in operation are under federal supervision.

The responsibility for safe waste management is not explicitly attributed under this Law. However, the producers and users of radioactive materials are obliged to observe the prescriptions governing radiation protection. The Law contains no regulations concerning the preparatory work which is of great importance in the planning of repositories. It would be necessary, e.g. in the case of opposition on the part of landowners, to involve the Federal Parliament in the expropriation procedure.

2.2 Revision of the Federal Law

The Federal Law was revised because of its deficiencies and in view of public concern about nuclear energy. Although Parliament has approved this revision, it will probably not come into force before early summer 1979 because of a referendum being launched by several anti-nuclear energy groups.

Up till now two federal licences have been required for the construction and operation of a nuclear installation. According to the revised Law, a new type of licence, the so-called "skeleton licence", is required prior to the granting of construction and operation licences. This licence serves to license the site, a procedure which hitherto has been covered by the construction licence. The applicant also has to fulfil new conditions.

The licence lays down the location of an installation and the fundamentals of the project. The application for this licence has to undergo a procedure of governmental and public examination and objection at federal, cantonal and local levels. The licence will be granted by the Swiss Federal Council. The Federal Parliament has to approve any such governmental decision.

A licence for a nuclear power station will be granted only if the safe disposal of the station's wastes can be guaranteed (repository project drawn up, geological situation explored by drillings and a safety assessment drafted by the regulatory body made available). This prescription makes due arrangement for waste disposal a matter of central importance to the development of nuclear energy production.

The revised Law explicitly attributes responsibility for safe waste management to the waste producer, with the proviso, however, that - if necessary - radioactive waste can be managed by the Swiss Confederation (at the producer's expense). The Government will regulate the crucial phase of the preparatory work in a special procedure. In particular, the Swiss Federal Council can delegate the right of expropriation to the implementing organization.

2.3 The Federal Initiative

The initiative proposes that nuclear installations should be subject to a federal concession which, in turn, should be subject to several plebiscites in the site region. Experience obtained in site communities and site regions indicates that acceptance of this proposal would render establishment of new nuclear power stations or waste repositories impossible. In view of the plebiscites refusing initiatives during the last 30 years, the chances of the initiative should not be overrated, despite the interest it has aroused among the public.

3. Organs

3.1 Implementing Organization

The NAGRA (Nationale Genossenschaft zur Lagerung radioaktiver Abfälle / National Co-operative for the Storage of Radioactive Waste) has the task of planning, constructing and operating repositories. It is an organization with a private status. The nuclear electric companies are the principal shareholders in the NAGRA. The Swiss Confederation is also a shareholder, being responsible for the management of research and isotope application waste. The NAGRA acts as an employer of research institutes and industrial companies.

3.2 Regulatory Body

The licences for construction and operation of nuclear installations are issued by the Federal Department of Traffic and Energy in Switzerland. The new skeleton licence will be granted by the Swiss Federal Council with the consent of Parliament. The "Eidgenössische Kommission für die Sicherheit der Atomanlagen" (Federal Commission for the Safety of Atomic Installations) examines the nuclear safety aspects of licensing applications and controls the safety of nuclear installations in operation. The Commission co-operates with the "Abteilung für die Sicherheit der Kernanlagen" (Division for the Safety of Nuclear Installations), which is part of the Federal Office of Energy.

The aspects of non-nuclear environmental protection, mining safety, land use and construction prescriptions are dealt with by the municipal and cantonal authorities.

3.3 Federal Working Group

The Government has constituted an additional working group in which the federal offices and institutions dealing with questions of nuclear waste management are represented. This group has no legal status; its activities must be completed by a given date.

The working group has an advisory function. Its task is to render possible smooth realization of the establishment of waste repositories ("Political guidance of the implementing body"). Furthermore, it has to guarantee - if necessary - that the Confederation would be in a position to manage waste without too much delay.

4. Licensing Procedure

The municipal and cantonal authorities assess the aspects of water

protection, mining safety, land use and conventional construction prescriptions. They grant a conventional construction licence.
For the nuclear licences (skeleton, construction and operating licences) the procedure is as follows:

1. The implementing organization submits its application which is to include a safety report.
2. The nuclear safety authority gives its opinion.
3. A decision is taken at governmental level (construction and operating licences) and Parliament gives its approval (skeleton licence).

Objection can be raised in the following manner:

At the municipal and cantonal stage there is the usual procedure for objection to building projects. The federal laws allow of objection to federal licensing procedures. Moreover, the site cantons have to be asked their opinions. At the skeleton licence stage, the revised Law allows of an extensive procedure of examination and objection by the cantons, the municipalities and the public.

The safety authorities have not yet published their requirements concerning the scope of the safety reports. It is deemed necessary, however, that far-reaching safety demonstration be required at the site selection stage - which corresponds to our skeleton licence stage - as, contrary to nuclear power stations, it is wellnigh impossible to improve the safety of a final repository by constructional measures. As our country has a relatively modest nuclear power programme, the implementing organization is required to deliver a full safety analysis which is then reviewed by the safety authority. The safety authority establishes its own safety analysis for the critical parts of a project. The safety authorities are not properly geared to deliver a full set of criteria and prescriptions to the implementing body prior to the commencement of work. The establishment of a "pilot plant" also seems improbable.

These elucidations will make it clear that the prescriptions at present governing subsequent activities, e.g. the determination of natural baseline data, inspection of construction, shut-down and sealing of a repository and the shouldering of responsibility for the repository by the Confederation, do not go beyond the prescriptions transferable from the licensing of nuclear power stations.

5. Conclusions

The context within which a regulatory framework for nuclear waste disposal in Switzerland must be elaborated is the following:

1. A central problem of nuclear energy development is the timely realization of waste management.
2. No experience in the field of underground disposal of high active waste has yet been obtained. Technical investigations and preparation of a regulatory framework are commencing now.
3. It is assumed that the regulatory procedures for underground disposal of radioactive waste and for construction and operation of nuclear power stations will be essentially the same.
4. In view of Switzerland's relatively modest nuclear programme, the safety authorities cannot issue a full set of criteria in advance. There must be close co-operation between the implementing and the regulating bodies.

Literature:

[1]) Konzept für die nukleare Entsorgung in der Schweiz, VSE, GKBP, UeW, NAGRA, 9. Februar 1978.

REGULATORY ASPECTS OF UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE IN SWEDEN

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Abstract

Underground disposal of radioactive waste is in Sweden primarily governed by the Atomic Energy Act, the Radiation Protection Act and the Nuclear Liability Act. The regulative power is exercised by the Nuclear Power Inspectorate and the Radiation Protection Institute. Licences for nuclear power plants as well as nuclear waste installations are granted by the Government upon recommendation by the Nuclear Power Inspectorate.

The regulatory authorities have wide powers to stipulate conditions which have to be met in order to get an operation permit for nuclear waste installations.

Localisations of nuclear plants have to be approved by the local communities concerned.

No regulations or guides have been issued in Sweden for underground disposal of radioactive waste. The so-called Stipulation Law which came into force in 1977 stipulates that solutions to the final disposal of spent fuel and radioactive waste should be approved by the Government before a new nuclear power plant is allowed to be put into operation.

1. Underground disposal of radioactive waste is in Sweden primarily governed by the Atomic Energy Act, the Radiation Protection Act and to some extent by the Nuclear Liability Act. These three laws give the Government the authority to regulate and control different matters within the nuclear energy sector, among them also matters regarding radioactive waste.

   Other laws regulate questions applicable but not specific to nuclear facilities. The Buildings and Construction Act and the Environmental Protection Act are of particular importance.

2. The Nuclear Power Inspectorate and the Radiation Protection Institute exercise the regulatory power for radioactive waste in Sweden. According to the Atomic Energy Act installations for nuclear waste have to be licensed. The license is granted by the Government upon recommendation by the Nuclear Power Inspectorate. The procedure is similar to what is used for nuclear reactors. The law regarding licensing of nuclear waste installations came into force on July 1, 1978 as an amendment to the Atomic Energy Law. Previously, matters regarding radioactive waste was covered by the Radiation

Protection Act only. It is to be expected, as is the case for nuclear reactors, that the Government will grant licenses on the condition that the Inspectorate can issue any conditional requirement that it deems necessary. Furthermore, any provisions which the Radiation Protection Institute sets for the operation of waste installations have to be complied with.

The granting of a license for a nuclear waste installation can be regarded as an envelop whithin which the regulatory authorities have wide powers to stipulate conditions which the applicant have to meet in order to get an operation permit. The regulatory bodies also have the authority to stop the operation of an installation if this is considered necessary.

The Radiation Protection Institute sets levels for release of radioactive materials into the air and water. Moreover, the Institute has to follow the operations of nuclear installations in order to control the exposure of the personnel to radiation.

3. According to the Buildings and Construction Act siting of plants having possible environmente impacts must be approved by the local communities involved. Consequently, the local communities have an absolute veto power as regards siting of nuclear waste installations.

4. No regulations or guides for underground disposal of radioactive waste exist in Sweden besides the general principles described previously. However, the so-called Stipulation Law which came into force at the beginning of 1977 has come to serve as a focussing point for the nations interest regarding the final disposal of radioactive waste, as the law stipulates that solutions to this problem should be put forward and be approved by the Government before new nuclear reactors will be allowed to be loaded with nuclear fuel and put into operation. Because of this law, the power utilities exploiting nuclear power have made an ambitious effort to prove that solutions exist which fulfill the conditions of the law. It has to be remembered, however, that the Stipulation Law by no means overrides the general requirements of the Atomic Energy Act and the Radiation Protection Act.

An application for a permit to construct an installation for geological disposal of radioactive waste will have to be presented to the Nuclear Power Inspectorate. The final approval will be made by the Government upon recommendations by the Inspectorate and upon site approval by the local communities involved.

UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE: REGULATIONS IN THE NETHERLANDS

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Abstract

In the Netherlands, emplacement of solid radioactive waste in salt domes is the envisaged disposal option. All related questions are being studied by a standing sub-committee of the Interdepartmental Committee for Nuclear Energy, which has also a working group on legal and organizational aspects. The paper describes the role of the various central governmental bodies and local authorities involved in regulating and licensing a repository site, ranging from exploratory drilling to mine construction.

A. State of the art.

Of all possible methods for final disposal of radioactive waste into the ground, only emplacement of solid radioactive waste into deep salt-rockdomes is envisaged in the Netherlands.
For burial at shallow depth the high level of groundwater poses at present too many problems. Natural caves do not exist and of theoretically suitable deep geological formations the in comparison with other formations very large domes of rocksalt offer the best possibilities.

The study of all questions connected with final disposal in rocksalt is entrusted to a standing sub-committee of the Interdepartemental Committee for nuclear energy. The author of this paper is Chairman of this Sub-Committee. This Sub-Committee has instituted four working-groups.
The first working-group has studied the legal and organisationa_ aspects of the problem.
The second one has selected five saltdomes and prepared a project for the conducting of trial-drilling.
The third one is studying the technical problems of building a mine in rocksalt.
The fourth one is making a risk-assessment.
The membership of these working-groups is not limited to experts from ministries or State -laboratories etc., but includes also experts from universities and reseach-institutes.
Up till now the Sub-Committee has published two reports, a third report, which will deal rather exhaustively with the risk-assessment is in preparation.

Recently the Minister of Economic Affairs has announced a decision of the Cabinet to speed up the investigations and at the same time it was announced that the Government intends to institute a public discussion on (nuclear) energy. The disposal of radioactive waste will be an important subject in this discussion. What form the public discussion will have and how it will be organised will be announced by the end of 1978.
Up till now in the different studies no indications have been found that final disposal of radioactive waste in deep rocksalt-formations would not be feasible.

B. Role of Central and Local Governments.

From what was stated in point A. follows that the Central Government is very active in the field of disposal. The term 'Central Government' is used contrary to 'Local Government'. In the Netherlands two layers of Local Government must be distinguished, wenn Local Government is involved. The first body of Local Government is the Provincial Government, the second one is the Government of a municipality. Both bodies are autonomous to a certain extent.
On the level of the Central Government many Ministeries are involved. The principal Ministers are:

- the Minister of Economic Affairs, who is responsible for the production of electric power, and also for the executing of the mining regulations;
- the Minister of Health and Environmental Protection, who is responsible for the public health and environmental radiation protection aspects;
- the Minister of Social Affairs, who is responsible for the protection of labour (with the exception of miners);
- the Minister of Housing and Land-Use, who is responsible for the supervision of the administration of the regulations on land-use by local Government;
- the Minister of Culture, Recreation and Welfare, who is responsible for the protection of nature-areas.

Other Ministers who may also be involved e.g.:

- the Minister of Agriculture and Fisheries;
- the Minister of Transport and Watercontrol, and of course
- the Minister of Finance.

Liaison between the Ministeries involved is maintained by the Interdepartemental Committee and its specialized sub-Committee. The Interdepartemental Committee is the channel for making policy-recommendations to one or more Ministers, or as the case may be, to the Cabinet. Liaison with the Local Government is not institutionalised in the same way, but is maintained on an ad-hoc basis.

C. Regulations and licences.

The regulatory questions which must be solved and permissions, authorisations and licenses that must be granted to arrive at underground radioactive waste disposal are complicated and involve partly Local Government and partly the Central Government. A step by step approach will make this clear.
The following steps must be taken:

1. Site selection. From already available geological information the location of a number of salt-domes in the underground was already known.
   To investigate the most promising domes and to get data on the composition of the salt-domes and overlying strata drilling is necessary. Some of these drillings must be conducted to relatively shallow depths (± 300 metres) and are aimed at establishing the extent to which groundwater circulates (hydro-geological investigation). Other drillings will be conducted in the saltdomes to a depth of ± 800 metres, to obtain cores for analysing the salt and for subsequent tests of strength etc..
   For the geo-hydrological drilling (to be conducted by a State-owned institute) no formal authorisations etc. from Local or Central authorities are necessary. The institute has only to obtain the permission of the owner of the land and reach agreement with him on the temporary use of his land. The permission by the land-owner is nearly always given. In the case however of drilling connected with the disposal of radioactive waste it is quite possible that under pressure of local feeling land-owners may withhold their permission. If this happens, land-owners can be compelled to allow temporary use of their land by a procedure under an Act, which provides for temporary use and accessibility of private property in cases where the public interest is involved.
   This Act is applicable in cases where a work of public interest necessitates the use of a privately-owned land, e.g. this Act is used in cases when a pipeline of the Public Gas Company has to cross land, or telephonecables have to be dug in or cross over a private property.
   The Act, however, is used as an ultimate ressort, only to be used after all possibilities to reach an agreement have been exhausted.
   The deep-drilling-operations are governed by the legislation on mining. A licence from the Minister of Economic Affairs is mandatory.
   At this place of the proceedings the Local Government gets also involved as a consequence of the Act on Land Use and Planning and its implementing regulations.
   This Act requires each municipality to draw up a plan for

its territory on the use of land, e.g. an area set apart for industrial purposes, recreational areas, agricultural areas etc. The plan has to be adopted by the Council of municipality, and has subsequently to be approved by the Provincial Government that has the duty to see to it that the land-use plans of individual municipalities do not conflict and fit into a more general overall plan for the Province as a whole. If the Provincial Government has given its approval, the plan has legal standing, meaning that use of a given piece of land, contrary to the plan is illegal. The Minister of Housing and Land Use has the legal right to squash a local plan, adopted and approved in the indicated manner, and to direct the Local Government to change the plan in one or more respects. This measure, however, is rarely used and seen as a last resource, only to be used under very grave circumstances.
Now the Local Governments of the regions where the salt-domes are situated are formly opposed to drilling-operations and some of them have changed their plans for use of land in a manner that will make it very difficult to conduct drilling-operations.

2. Construction of a mine.

If the investigations are concluded and the decision is taken to go on with deep-disposal, the subsequent step must be the construction of a mine.
To construct a mine the future owner of the mine must first of all acquire the ownership of the necessary area on the surface. Here again an agreement to sell must be reached with the landowners and again there may be a conflict with the land-use-planning.
Legal rules exist to compele landowners to sell if a work of Public Importance in envisaged.
The actual construction of a mine is governed by the Mining Act and its implementing regulations.
A licence has to be obtained from the Minister of Economic Affairs.
As, however, the mine is destined for disposal of radioactive waste the Nuclear Energy Act and its implementing Decrees, in particular the Radioactive Substances Decree (1969), comes in. This means that apart from the mining licence, a licence must be obtained from the Minister of Health and Environmental Protection, acting in consultation with other Ministers involved. This licence is aimed at the storage, above ground, of necessary conditioning (handling) of radioactive waste materials and its disposal in the mine.
The applicant has to furnish detailed descriptions of what he intends to store, handle and dispose of, and what measures he proposes to take to protect workers, the public and the en-

vironment against radiation. Next to these data details must be provided on the proposed internal organisation of radiation protection, both in terms of how many people will be employed and what professional qualifications they will have.
At this stage consultation between the Ministry of Economic Affairs and the Ministry of Health and Environmental Protection is indicated to ensure that the conditions attached to the Mining Licence do not conflict with those concerned with the interests of radiation protection in the other licence.

3. Supervision and control.

Supervision of work is excersised for the mining aspects by a service of the Ministry of Economic Affairs, (the Inspectorate for Mining), and for the radiation protection aspect by the Inspectorate of Public Health, which is a Service of the Ministry of Health and the Environmental Protection.
This supervision will continue during the time the mine is in use.
No decisions have been taken up to now what should happen afterwards. This question is still being studied. It might even be that the Nuclear Energy Act will have to be amended.

4. Organisation and involvement of the public.

As to the organisation which will conduct the disposal operations, no decision has been taken either.
Probably a Public Corporation will be formed, in which the Ministry of Health and Environmental Protection has a key-position, but otherwise with participation of the electricity-companies, which are owned by the Local Government.
In several of the Acts mentioned, the licensing procedure includes the possibility for the public to lodge objections against the granting of the licence. If the licence is granted notwithstanding the objections, the objectors have the right to appeal to the Crown. The appeal is heard by a special Chamber of the State Council.
Apart from these opportunities for the public, the Government has announced that it intends to set up a public discussion in 1988 on the use of nuclear energy for power-production.
In the announcement was emphasized that the question of disposal of radioactive waste would achieve full attention in the discussion.

NORMAS LEGISLATIVAS ESPAÑOLAS QUE REGULAN LAS INSTALACIONES DE ALMADENAMIENTO DE RESIDUOS RADIACTIVOS

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Resumen

En el Plan Energético Nacional (PEN) aprobado el pasado 28 de Julio por el Parlamento, se encomienda a la Junta de Energía Nuclear el almacenamiento permanente y evacuación de los desechos radiactivos.

En estas operaciones se han seguido, hasta ahora, la normas dadas por la "Ley de Energía Nuclear" de 1.964 y, además, en cuanto a su posible carácter minero, por la "Ley de Minas" de 1.963. Su autorización está regulada por el "Reglamento de Policía Minera y Metalúrgica" de 1.934 y el "Reglamento sobre instalaciones nucleares y radiactivas", de 1.972. En ambos se especifican las concesiones, autorizaciones y licencias que deben ser otorgadas por diversos Ministerios y organizaciones administrativas inferiores, así como por las autoridades regionales y locales (Gobiernos Civiles y Ayuntamientos). Se estipulan también las inspecciones que ha de realizar el Ministerio de Industria y Energía a través de su Dirección General de la Energía y del Departamento de Seguridad de la JEN. Este último según lo aprobado en el mencionado PEN, será substituido por un Consejo de Seguridad Nuclear, que funcionará como un organo independiente dentro de la administración del Estado y cuyo equipo de personal procederá en su mayoría del actual Departamento de Seguridad de la JEN.

La responsabilidad civil en caso de accidentes nucleares está fijada por el "Reglamento sobre cobertura de riesgo de daños nucleares" de 1.967.

Existen además muchas otras disposiciones, que se remontan a 1.943, sobre diversos aspectos de la utilizacion de materiales radiactivos.

Actualmente en España, la construcción y el almacenamiento de desechos radiactivos requiere como cualquier Instalación nuclear o radiactiva y que además es minera la autorización del Ministerio de Industria y de la Energia según lo dispuesto en la "Ley de Energia Nuclear" de 1.964 y "Ley de Minas" de 1.963. La regulación de tal autorización está plasmada en el "Reglamento de Policia Minera y Metalurgica" de 1.934, y el "Reglamento sobre Instalaciones Nucleares y Radiactivas" de 1.972

A efectos de responsabilidad civil se está a lo dispuesto por el Ministerio de Hacienda en el "Reglamento sobre Cobertura del Riesgo de Daños Nucleares" de 22 de Julio de 1.967.

También ha de cumplir la Orden de 2 de Febrero de 1.960 por la que se dictan "Normas para la protección contra las radiaciones ionizantes".

No hay ninguna normativa especifica referente a los almacenamientos subterráneos de desechos radiactivos, como tampoco la ha habido hasta ahora sobre quien debe ocuparse de dichos almacenamientos hasta la redacción en este año del Plan Energetico Nacional; sin embargo ha sido principio general que dichos almacenamientos debían de estar encomendados a un Organismo Oficial, único capáz de garantizar la vigilancia continuada de los mismos; por ello el almacenamiento de los desechos radiactivos desde un principio ha estado encomendado a la Junta de Energía Nuclear (JEN), Organismo Oficial Autónomo dependiente del Ministerio de Industria y de la Energía.

El principio a que se ha aludido quedará refrendado cuando se apruebe el mencionado Plan Energetico Nacional por las Cortes Españolas, el cual ha sido remitido a las mismas en el mes de Junio del presente año. En dicho PEN se indica expresamente que la JEN tendrá a su cargo el almacenamiento permanente y definitivo de los residuos radiactivos, indicándose también respecto a los residuos de alta actividad, que la JEN proseguirá sus estudios de investigación para el almacenamiento de los mismos, cuya solución final se definirá con el adoptado criterio de la mínima

dependencia exterior y de forma acompasada con los planos de reprocesamiento, el cual no se prevé antes de 1.995.

Como es sabido en España actualmente solo existe una Instalación de almacenamiento de desechos sólidos radiactivos emplazada en Sierra Albarrana (Córdoba), almacenamiento que tiene lugar en una mina (Mina Beta) en socavón y en un almacén de superficie, Instalación que empezó a funcionar en 1.961 sin que desde esa fecha hasta ahora se haya producido incidencia alguna. Respecto al almacenamiento de desechos de alta actividad es criterio - que su almacenamiento debe hacerse en una formación geológica, - preferentemente en una formación salina, para lo cual se están - haciendo los estudios de selección; pero sin descartar las formaciones en rocas graníticas o arcillosas.

Esta Instalación de Almacenamiento como ya se ha indicado, está bajo el control directo de la JEN. Bajo el punto de vista de la seguridad nuclear, está sometida, como cualquier otra - instalación nuclear, a las inspecciones del Ministerio de Industria y de la Energía que es quien asume la decisión final a través de la Dirección General de la Energía y del Departamento de Seguridad de la JEN, independientemente de las atribuciones de otros Organos de la Administración en cuanto a instalación industrial.

Se ha de señalar que en el JEN está prevista la segregación de la JEN de las funciones de seguridad nuclear, contituyendose para este fin un Consejo de Seguridad Nuclear como organo independiente.

Por lo expuesto, el almacenamiento de la mina Beta, en cuanto a Instalación Minera, está sometida además en la materia que la - afecte a la inspección de la Sección de Minas de la Delegación del Ministerio de Industria y de la Energía y el resultado de los controles periódicos establecidos en la instalación han de ser - puestos en conocimiento de la Dirección General de Sanidad dependiente del Ministerio de Sanidad y Seguridad Social. En cuanto al aspecto laboral, éste está reglamentado de acuerdo con las disposiciones del Ministerio de Trabajo.

El Reglamento sobre Instalaciones Nucleares y Radiactivas - cuya aplicación compete al Ministerio de Industria y al que deben someterse las instalaciones de almacenamiento de desechos radiactivos, establece la normativa para la autorización de un almacenamiento sin perjuicio de las concesiones, autorizaciones y licencias que deben ser otorgadas por otros Ministerio, Organismos, Corporaciones y Ayuntamientos, en la parte que afecte a sus competencias y bienes o derechos a su cargo. También quedan sometidas a - los preceptos de la reglamentación industrial y técnica española en la parte que les afecte especialmente; a tal efecto corresponde a la Delegación Provincial del Ministerio de Industria y de la Energía cuidar de su cumplimiento sin perjuicio de otros Organismos de la Administración.

Como Instalación Nuclear, todo almacenamiento de residuos - radiactivos y para su autorización, ha de pasar por las siguientes fases: autorización de construcción, verificación prenuclear de - la instalación y autorización de puesta en marcha.

Para la autorización de construcción es necesario presentar entre otros la documentación siguiente: proyecto general y - un estudio preliminar de la seguridad que ha de comprender: descripción del emplazamiento y su zona circundante con datos precisos sobre sus características, topográficas, hidrográficas, hidrogeológicas, sísmicas, meteorológicas y demográficas, así como tipos de cultivo e industrias, descripción de la instalación, justificación de que no representa riesgo para la población, análisis de accidentes previsibles, consecuencias, concesiones y autorizaciones administrativas que han de ser otorgadas por otros departamentos ministeriales u organismos competentes.

Toda la documentación con el informe de la Delegación Provincial del Ministerio de Industria y de la Energía pasa al Ministerio aludido a través de la Dirección General de la Energía.

La JEN ha de emitir el correspondiente dictamen de seguridad y el Ministerio de Industria y de la Energía a través de la - Dirección General de la Energía y a la vista de la documentación presentada (y después de estudiar los informes de otros Ministerios y Organismos afectados como pueden ser: Ministerio de Inte--

rior, de Obras Públicas y Urbanismo, corporaciones municipales, - etc.), adoptará la oportuna autorización y condiciones especiales que puedan convenir.

Durante la fase de construcción esta previsto un Comité - de Coordinación para controlar el cumplimiento de las condiciones establecidas. Dicho Comité esta compuesto por miembros de la -- D.G.E., de la Delegación Provincial, JEN, Ayuntamientos afectados y otros departamentos ministeriales afectados, así como del explotador; pudiendose incorporar al mismo expertos en las diferentes materias.

En la fase de puesta en marcha han de presentarse estudios de seguridad adicionales con todos los datos complementarios obtenidos durante la construcción del almacenamiento. El Ministerio finalmente, una vez recibido el informe de seguridad de la JEN (función que como ya se ha indicado en el PEN, quedará segregada formando un órgano independiente), y el de la Delegación Provincial del Ministerio de Industria y de la Energía, resolverá sobre el permiso de explotación.

Por último la instalación queda sometida, durante su - funcionamiento, al régimen de inspecciones y comprobaciones - nucleares del Ministerio de Industria y de la Energía y a las que compitan a otros Departamentos, Organismos o Corporaciones.

THE PRESENT STATE IN THE FIELD OF DISPOSAL OF RADIOACTIVE WASTE IN POLAND

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Abstract

In this paper the actual situation and the future plans in the field of radioactive waste disposal have been presented. Only one central repository for radioactive wastes coming from all nuclear power stations is to be built in Poland. Two concepts of radioactive waste disposal have been considered, namely: shallow land trenches and deep geological formations. Preliminary study of the above concepts of radioactive wastes disposal, their cost estimation as well as environmental protection and natural conditions of repository localization have been shortly presented.

Introduction

The present state of the development of nuclear energy in Poland, according to which the first nuclear power station will be put into operation in the years 1984-85, results in that the problem of disposal of radioactive waste is still in the initial stage of consideration.

Nonetheless in the next years crucial decisions will be taken in this field.

When chosing the way of disposal of the radioactive waste, the following preliminary assumptions will be taken into acount:

- In the first stage there will be constructed a repository for disposal of radioactive waste from nuclear power stations
- The radioactive waste resulting from other stages of the nuclear fuel cycle will appear in Poland in significant amounts 10-15 years after putting into operation the first nuclear power station
- There will be built one central repository for radioactive waste coming from all nuclear power stations
- The disposal of radioactive waste will not take place in any nuclear power stations area
- The capacity of the repository has been estimated on the basis of the programme of the development of nuclear power industry in Poland untill the year 2000, and on the proposed waste management technology /solidification, pressing/

- Two concepts of waste disposal /shallow land burial and disposal into deep geological formations/ will be subject to more detailed considerations
- Preliminary economic comparisons will be carried out for disposal in concreted ground trenches and a rock salt mine, which will be built specially for this purpose

Licensing procedures

The programme of selection of site and method of disposal of radioactive waste will comprise the following stages.

1. Study on two conceptual designs and preliminary estimation of their costs.
2. Comparison of the conceptual designs of disposal of radioactive waste into ground trenches and into a rock salt mine with respect to:
   - environmental protection
   - costs of construction
   - natural conditions of repository localization
3. Final selection of the site and method for disposal of radioactive waste
4. Study on the localization projects for several sites selected for radioactive waste disposal
5. Selection of site localization
6. Study on the preliminary design based on technical and economical data, for the selected site
7. Approval of the preliminary design
8. Technical design of the respository
9. Approval of the technical design
10. Construction of the repository

At present, the first of the above mentioned points is being worked out. In this stage the conceptual designs and their costs are evaluated by the Ministry of Energetics and Nuclear Energy which will be the investor of the repository.

The decision as to the selection of site and method /items 2 and 3/ will be taken by a collective body which will include

the representatives of the following Ministries:

- Ministry of Energetics and Nuclear Energy
- Ministry of Health and Social Welfare
- Ministry of Administration and Environmetal Protection,

as well as specialists from desiguing offices and research institutes /Institute of Nuclear Research, Central Laboratory of Radiological Protection, Institute of Geology/.

Further steps of the licensing procedure /pp. 4-7/, will be evaluated or approved by a special body /council - comissions/ proposed by the three above mentioned Ministries.

REGULATORY ASPECTS OF UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE IN DENMARK

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Abstract

The introduction of nuclear power in Denmark is a matter to be decided by the Government and the Parliament. Disposal of radioactive waste from the nuclear fuel cycle has become a decesive part of the issue.

The licensing of future nuclear facilities, facilities for storage and disposal of radioactive waste originating from the nuclear fuel cycle, will be regulated by Act of May 12, 1976 "on the safety and environmental conditions applicable to nuclear installations". The 1976-act will not come into force until the Danish Parliament passes an implementing act, following a positive decision on a nuclear power programme for Denmark.

The Minister for the Environment will be responsible for the administration of the 1976-Act.

The Agency of Environmental Protection and the National Health Service deal with the nuclear safety and health aspects of applications and submit recommendations on these matters to the Minister.

According to the law the Minister for the Environment can issue a site approval, only if the application has been approved by a parliamentary resolution following a proposal from the Minister. Before such a proposal is made the regional and municipal authorities concerned shall submit statements and the Minister for the Environment must consult the Minister for Commerce.

Before the granting of construction and operation permits the Minister shall consult the relevant parliamentary Committee.

1. General provisions.

The introduction of nuclear power in Denmark is at matter to be decided by the Government and the Parliament. Disposal of radioactive waste from the nuclear fuel cycle has become a decesive part of the issue.

According to Act og April 23, 1976 on Energy Policy Measures the Minister for Commerce is responsible for planning and development of energy supply, production and consumption. In addition, in persuance of Act of February 25, 1976 on Electricity Supply, the Minister for Commerce is responsible for the regulation of electricity production and distribution. In matters within the energy field the Minister is assisted by the Danish Energy Agency.

A possible future nuclear power programme in Denmark including programmes for disposal of radioactive waste will be implemented by the Minister for Commerce.

The licensing of future nuclear power plants will be regulated by Act of May 12, 1976 "on the safety and environmental conditions applicable to nuclear installations". The scope of this act includes all the installations and associated activities, relating to the peaceful use of atomic energy, e.g. facilities for storage and disposal of radioactive waste originating from the nuclear fuel cycle.

However, the 1976-Act will not come into force until the Danish Parliament passes an implementing act, following a positive decision on a nuclear power programme for Denmark.

Meanwhile, regulatory matters concerning nuclear installations are subject to the provisions of Act of May 16, 1962 on Nuclear Installations, as amended by the Act of June 12, 1974 on compensation for Atomic Damage or Injury.

The Minister for the Environment is responsible for the administration of the 1962-Act on nuclear installations and in future for the administration of the 1976-Act.

So far, facilities at Risø National Laboratory provide for centralised, retrievable storage of radioactive wastes originating from the laboratory or from use of radioiso-

topes elsewhere in the country. Arrangements for final disposal have not been applied.

As any future programme for storage and disposal of radioactive waste will be subject to the provisions of the Act of 1976, the information given in the following is based on these provisions.

2. Roles and Responsibilities of the Regulatory Bodies.

The Minister for the Environment grants permits according to the licensing procedure of the nuclear installations acts.

The Agency of Environmental Protection and the National Health Service deal with the nuclear safety and health aspects of applications and submit recommendations on these matters to the Minister.

The Danish Labour Inspection Service under the Ministry of Labour deals with worker protection aspects including radiation.

In dealing with the nuclear safety aspects of an application the Agency of Environmental Protection is assisted by the Inspectorate of Nuclear Installations, which is an institution under the Agency. Recommendations to the Minister submitted by the Agency shall be accompanied by statements prepared by the Inspectorate.

Within the framework of the conditions attached to a permit the Agency of Environmental Protection - upon recommendation from the Inspectorate - and the National Health Service may specify supplementary conditions to ensure safety.

Environmental aspects, other than the nuclear safety and health aspects, are examined in the light of other legislation within the jurisdiction of the Ministry for the Environment. If necessary for the establishment and operation of a facility on an approved site the Minister can overrule decisions already taken persuant to this other legislation or decree departures from the procedural provisions. The Parliament must be informed beforehand in the proposal for site approval, c.f. item 4, on the necessity for any such departures.

The Minister for the Environment lays down rules for the content and scope of applications and general rules for the content of accompanying safety documentation.

The Minister for the Environment also lays down general requirements for nuclear safety and can authorise the Agency of Environmental Protection and the National Health Service to issue more detailed requirements. Such requirements shall be based on recommendations from the Inspectorate of Nuclear Installations.

Supervision and control in relation to nuclear safety and health matters are exercised by the Agency of Environmental Protection (the Inspectorate of Nuclear Installations) together with the National Health Service, and as far as worker protection is concerned together with the Labour Inspection Service.

3. Regulations and Guides.

Safety regulations and guidelines on disposal of radioactive waste have so far not been issued.

The Environmental Protection Agency established in January 1978 a working group to consider general safety criteria for storage and disposal of radioactive waste in relation to a possible future nuclear power programme in Denmark. The considerations are initially concentrated on underground disposal of high level waste, as an alternative to disposal in connection with fuel reprocessing facilities outside the country, and on final disposal of low and medium level wastes from possible Danish nuclear power plants.

4. Licensing Process.

The licensing procedure for nuclear installations involves three permits: site approval, construction permit and operation permit.

The details of the contemplated procedure depend to some extend on the type of facility. The following information refers to waste storage or disposal facilities.

Permits are granted by the Minister for the Environment

on conditions deemed necessary with regard to safety or other vital public interests. These conditions may, at any time, be replaced by other conditions. A permit can be withdrawn.

No decision made by the Minister can be brought before any other administrative authority for appeal.

Applications are examined by the regulatory bodies c.f. item 2.

The Minister for the Environment can issue a site approval, only if the application has been approved by a parliamentary resolution following a proposal from the Minister. Before such a proposal is made the regional and municipal authorities concerned shall submit statements and the Minister for the Environment must consult the Minister for Commerce.

Before the granting of construction and operation permits the Minister shall consult the relevant parliamentary Committee.

5. Assessment and Review during the Licensing Process.

Applications must be accompanied by documentation relevant to environmental and nuclear safety and health aspects. This documentation shall contain the applicant's assessments and conclusions concerning these aspects, a description of the site and its surroundings, and any supplementary information necessary for the handling of the application by the relevant authorities.

Requirements or guidelines on the documentation for applications for facilities for radioactive waste disposal have not been issued. Neither have assessment methods and acceptance criteria been established.

6. Inspection.

The roles and responsibilities in relation to inspection have been indicated under item 2. No further information pertinent to inspection programmes can be provided at present.

7. Enforcement Procedures.

The Agency of Environmental Protection and the National Health Service - as well as the Inspectorate of Nuclear Installations - can issue instructions necessary to ensure observance of the licensing conditions.

Further, in urgent cases, these authorities may require that operation be discontinued in order to ensure safety, pending a decision whether operation may be resumed and if so when it may be resumed.

Conditions, instructions or other decisions issuing from the Agency of Environmental Protection and the National Health Service may be sent to the Minister for the Environment for appeal, while appeal against the instructions and decisions of the Inspectorate must be lodged with the Agency of Environmental Protection.

8. Other Related Problems.

Due to the unclarified situation with respect to a Danish nuclear power programme we desist from addressing this item.

GENERAL AND REGULATORY ASPECTS OF NUCLEAR WASTE DISPOSAL IN FINLAND

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Abstract

A policy decision concerning nuclear waste management was made by the government of Finland in April 1978. The decision defines the principal functional and financial responsibilities for waste management. Preparations for specific nuclear waste management legislation were only recently initiated.

Research and development activities are under way in a limited scale, geological storage and disposal are included.

Licensing of nuclear facilities is the responsibility of the Ministry of Trade and Industry. Practical evaluation and control measures are performed by the Institute of Radiation Protection.

General legal framework for nuclear waste disposal is included in atomic energy and radiation protection legislations. So far there are no technical criteria or regulations for waste disposal.

Licensing process for waste repositories, although not yet formulated, will evidently contain elements similar to the existing procedure for nuclear power plants. Particular emphasis should be put on site selection and approval.

Disposal into deep crystalline rock formations is regarded as the realistic nuclear waste disposal alternative in Finland.

1. General provisions

1.1 Waste management policy

The government of Finland made in April 1978 on the presentation of the Ministry of Trade and Industry a policy decision concerning nuclear waste management in Finland. The decision includes the following main issues:

1. When licensing activities generating nuclear wastes, the management of the wastes shall be assured of to the extent possible taking into account the international development of nuclear waste management.

2. Waste producers are responsible for the management of spent nuclear fuel and other radioactive wastes until final disposal, as well as the decommissioning of nuclear installations.

3. Waste producers shall arrange their activities so that the resources needed for the financing of nuclear waste management are collected during the profitable operation of the plants, and the preservation of their real value is secured.

4. The long-term control of the final disposal facility for wastes originating from spent nuclear fuel or operation of nuclear installations, as well as the long-term maintenance of decommissioned nuclear facilities is the responsibility of a governmental nuclear waste management organization to be founded for these purposes. If the wastes are finally and irreversibly transferred outside Finland, the governmental nuclear waste organization and the waste producer will be released from functional and financial responsibility.

5. The expenses caused to the governmental nuclear waste management organization by the long-term control of the disposal facility and the long-term charge of decommissioned nuclear installations as well as other probable expenses of the organization are collected from the waste producers during profitable operation of the plants to a particular fund. The resources of the fund shall be invested to preserve their real value.

6. Decision on the establishment of the disposal facility will be made separately. Waste producers are responsible for the financing of the facility.

7. Waste producers shall give to the government acceptable securities for the realization of functional and financial responsibilities in case of insolvency of the waste producer. The securities shall be proportionate to the total responsibility for the waste management of corresponding nuclear facility. The Ministry of Trade and Industry will revise annually the value of the securities.

8. Taxation questions connected with previously mentioned arrangements shall be settled separately on the first occasion.

9. Research, development and planning activities in the field of nuclear waste management will be intensified. The planning and preparations of waste management will be performed and financed by the waste producers under the supervision of the Ministry of Trade and Industry.

10. The preparation of the legislation required for the realization of above mentioned arrangements will be accelerated. The conditions implied by this decision will be taken in the licenses granted prior to the enforcement of the legislation.

As a consequence of the modest dimensions of the Finnish nuclear power programme the management of spent nuclear fuel should be settled through international arrangements. The effort to minimize the total number of disposal sites is also in more general terms reasonable from technical and safety-related point of view. Since political and publicity aspects may, however, form a serious obstacle to such efforts, the government has regarded preparations for national

management of high-level nuclear waste necessary to a certain extent. Management of low- and medium-level wastes arising from the operation of nuclear power plants must in any case be organized nationally.

1.2 Legislation

Provisions for the management of radioactive wastes are given in atomic energy and radiation protection legislations. They have in common the principle, that the waste producer has functional and financial responsibility for the waste managemen This involves the idea that the licensing authority should, when issuing the operating licence for a nuclear facility, be assured of the safe management of wastes produced during the operation of the facility. The time factor associated with nuclear wastes makes, however, such assurance difficult if not impossible in practice. Therefore the legislation was recently amended so that transfer of the responsibility to a governmental organization is possible by a decision of the Ministry of Trade and Industry.

The Ministry of Trade and Industry has appointed a committee to perform a total review of legislation in the field of nuclear energy. The mandate of the committee includes formulation of a law on nuclear waste management, which should define the responsibilities of waste producers and governmental agencies as well as the duties and functions of the governmental waste management organization.

1.3 Research and development activities

The Ministry of Trade and Industry has initiated a research and development programme on nuclear waste management. The programme includes a project on geological storage and disposal of nuclear wastes, carried out by the Geological Survey of Finland. The objectives of the project are

- determination and assesment of the geological phenomena, materials and formation characteristics the knowledge of which is necessary for the safe dimensioning of the structures and technical measures needed for the nuclear waste disposal

- forecasting the extent, duration and effects of the processes induced in the Finnish soil and bedrock by the storage and disposal of nuclear waste

- search for a limited number of geological formations suitable for nuclear waste storage and disposal with relation to their location and geological characteristics, and collection of sufficient data of these formations for the final site selection.

In addition to the research and development activities initiated and financed by the Ministry of Trade and Industry, the nuclear power utilities have started a cooperation programme in this field.

2. Regulatory body

The licensing of nuclear facilities in Finland is the responsibility of the Ministry of Trade and Industry. All practical evaluation and control measures connected to licensing are performed by the Institute of Radiation Protection (IRP). The control functions of the IRP are based

on law and it is an independent governmental institute under the administration of the Ministry of Health and Social Affairs.

The general duties of the IRP involve the control of radiological safety, the supervision of safety of nuclear installations, the control of nuclear materials and the conduct of research and development work in these fields.

3. Regulations

The general legal framework for waste disposal operations is, as stated earlier, included in the atomic energy and radiation protection legislations. Atomic energy legislation is, however, rather general in nature and does not contain detailed requirements for the construction and operation of nuclear facilities. Radiation protection legislation is based on the recommendations of the IRP, and includes therefore the basic standards for radiological safety requirements.

So far there are no technical criteria or regulations for geological waste disposal. Formulation of such regulations will be performed by the IRP in cooperation with special institutes.

4. Licensing process

4.1 Existing licensing procedure

Licensing process for waste repositories, although not formulated so far, will in effect contain elements similar to the existing procedure for nuclear power plants which is briefly described.

The atomic energy legislation defines three types of licences for nuclear installations: the construction licence, the operating licence and the fuel licence. These licences are issued by the Ministry of Trade and Industry on application. The issuance of the licences and conditions attached to them are based on the statement by the IRP. The opinions of two commissions, the Atomic Energy Commission and the Consultative Commission for Radiological Protection are also taken into consideration. The IRP as well as the commissions may use outside experts for consultation.

The Atomic Energy Decree states the general prerequisites and information needed for the issuance of the licences. In addition the IRP has issued guides on the specific requirements for the documents needed in each phase of the licensing process for the safety evaluation performed by the IRP.

The construction licence is issued for a nuclear facility to be placed on a definite site. Before the issuance of the licence the siting must be approved by the local land planning authorities. The technical site evaluation is performed by the IRP on the basis of documents delivered by the applicant and information collected by the Research Department of the IRP.

The final safety evaluation for the operating licence is based on the required documents and the results of inspections.

During the operation of the installation the IRP exercises its supervision by means of various control measures like

periodic inspections and duties set up for the operator as outlined in guides prepared for this purpose. The duties include regular and special reporting and environmental monitoring.

4.2 Applicability to waste repositories

The described licensing procedure for nuclear power plants can in principle be applied to waste disposal facilities. The process must be amended especially in relation to the site selection and approval. A specific site licence or decision is not required for power plants; the acceptability of the site is evaluated at the construction licence phase. In the case of waste disposal facility more weight should be put on the site investigation and selection process.

5. Conclusive remarks

Preparations for underground disposal of radioactive wastes in Finland have only recently been started. This applies to the regulatory matters as well. The necessary institutions for licensing and control measures exist, preparations for the formulation of criteria and regulations have been initiated.

Disposal of high- and medium-level wastes into deep crystalline rock and shallow-depth burial of low-level waste are regarded as the realistic technical options for underground disposal of nuclear wastes in Finnish natural conditions.

REGULATORY ASPECTS OF UNDERGROUND DISPOSAL OF RADIOACTIVE WASTE IN AUSTRIA

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Abstract

The Austrian Law on Radiation Protection (BGBl.Nr. 227/1969) and the Decree on Radiation Protection (BGBl.Nr. 47/1972) are regulating among other subjects also the establishment and the operation of facilities for safe and permanent underground disposal of radioactive waste.

Following this legislation, both the establishment and the operation of facilities for emplacement of radioactive waste must be licenced by the competent authority named in the Law on Radiation Protection.

According to the legislation on radiation protection, the licence for the establishment of such facilities will be issued if sufficient precautions have been taken - considering also the intended location - for the protection of life and health of the human population and progeny from domage by ionizing radiation.

1. The "Osterreichisches Strahlenschutzgesetz" (Austrian Law on Radiation Protection) BG B2. Nr 227, 1969 and the Strahlensschutzverordnung (Decree on Radiation Protection) BG B2 Nr. 47, 1972, are regulating among other subjects also the establishment and operation of facilities for safe and permanent underground disposal of radioactive waste.

2. Following this legislation both the establishment and the operation of facilities for emplacement of radioactive waste must be licenced by the competent authority named in the Law on Radiation Protection. According to the legislation on radiation protection, the licence for the establishment of such facilities will be issued if sufficient precautions have been taken - considering also the intended location - for the protection of life and health of the human population and progeny from damage by ionizing radiation, and if no scruples are made regarding the reliability of the applicant as to the intended activity.

3. The licensing decree will, if necessary, include provisions and conditions on the licensee by implementation of which the protection of life and health of the human population and progeny against damages from ionizing radiation shall be secured.

4. If satisfactory protection is not even possible by adequate provisions and conditions on the applicant the licence must be refused.

5. The application must be supplemented by documentation necessary for the assessment of the project, in particular a detailed description of the facilities including building plans and a description of the intended activity stressing the intended measures of radiation protection, at least in sets of three copies each.

6. Experts or nationally authorized institutes of the pertaining special branch must be heard on the question of requirements fulfilled.

7. Follow-up regulations on additional measures must be accepted if they became necessary in the light of subsequent experience or new scientific knowledge whereby the rights already acquired by the licensee will be treated with as much consideration as possible.

8. Additional licenses, eg, in the field of construction legislation or legislation relating to water are also necessary.

9. A licence conformable to the legislation on radiation protection will be issued for the operation of facilities for safe and permanent underground disposal of radioactive waste if all legal and technical obligations, including provisions for the establishment of the facilities have been fulfilled, if a commissioner for radiation protection has been delegated and if no hazards relating to life and health of the human population and progeny must be feared due to ionizing radiation when the facilities are orderly operated.

10. Such facilities must be operated only upon receipt of a licence for operation issued after examination, and if necessary, adequate testing of the facilities.

11. If necessary, the licensing decree for operation must contain - taking into consideration licensing of the establishment of the facilities adequate provisions and conditions on the operation of the facilities, the implementation of which is necessary in the light of protection of life and health of the human population and progeny from damages by ionizing radiation.

12. In particular, if necessary it must be ordered - considering the intended activity and the thereby required measures of radiation protection - that additional persons who are qualified for sufficient knowledge of radiation protection, be made responsible for radiation protection.

13. Dependent on requirements fulfilled for the operation licence, the authority can issue also a limited licence for operation of parts of the facilities only or for a restricted operational capacity.

14. In all other instances in which the requirements have not been fulfilled, the licence for operation will be denied until the deficiencies found are cleared away.

15. The application for a licence for operation must be supplemented by adequate documentation containing in particular a detailed description of the intended activity considering especially the measures of radiation protection, in set of three copies each. The name of the Commissioner for radiation protection must be mentioned in this application. Evidence of due implementation of the prescribed provision and conditions on the applicant concerning the establishment of the facilities must be enclosed.

16. For the operation of the facilities all other licences must as well have been obtained, which are required in addition to the licence prescribed by the legislation on radiation protection. The operation of the facilities must be inspected by the authorities.

17. In conclusion, it can be stated that owing to the legal situation in Austria the establishment and the operation of facilities for underground disposal of radioactive waste in geological formations are subject to severe precautions and controls by the authorities, both regarding the operation within the facilities and potential contamination of the environment.

MAIN ISSUES EMERGING FROM THE DISCUSSION

In the course of the discussions of the Technical Committee on Regulatory Aspects of the Underground Disposal of Radioactive Waste, a number of issues arose which the Committee deemed it necessary to draw to the attention of the Agency for their further consideration.

1) It is recognised that the form of regulatory control of waste disposal will be particular to the administrative structure of the country concerned. It is important that national governments give careful consideration to the allocation of responsibilities, for example as between local and central government, or as between the arm of government promoting the use of nuclear power and those responsible for public health and safety and protection of the environment. Central government will also need to make provision for the financial support of the development and use of waste repositories. The range of national practices may extend from full central control and financing to separation of the regulatory and implementation aspects. The Committee considers it would be of great benefit to states in the formulation of their national policies if the Agency were to make arrangements to collate and distribute information on national practices and experiences, the problems arising and the solutions adopted.

2) Related to these problems is that of keeping the public informed and providing for public discussion and participation in the development of national policies: constructive discussion and participation cannot take place without the provision of adequate information. The Committee considered that the means by which public participation might be effected will be a matter for national governments to determine in relation to their national circumstances.

3) In the technical field, the Committee recognises the difficulties in making assessments of the long-term risk of radiation exposure to man or other deleterious effects on the environment due to deep geological disposal of radioactive waste. The Committee is aware of the ongoing work in promoting the development of models and the study of radiation protection requirements for the assessment of these risks, and welcomes and supports these initiatives, and considers they will make an important contribution in the development of national policies.

4) The Committee recognises that the effects of the discharges of radioactivity, both within states and across national boundaries, are not peculiar to plants designed for the handling and storage of waste. It is considered that national practices for the control of discharges will be extended to apply to waste repositories. However, it would be helpful to state if experience in such controls could be made widely available as recommended above, and if this work could be extended to the development of

a common approach to the establishment of controls and limits. Such an approach is considered especially important for long-lived wastes and in future situations where national boundaries may have less significance than they have now. The Committee also considers that development of models and radiation protection requirements, referred to above, will make an important contribution to the establishment of internationally agreed controls and limits.

5) The problem of applying an appropriate third party liability régime at an international level covering nuclear damage which might arise from the operation of a radioactive waste repository was referred to in discussions of the Technical Committee. The Committee considered it was not the right forum to consider this issue and it therefore recommends that the Agency, together with the OECD/NEA, should review through its appropriate bodies the conditions under which the existing conventions in the field of nuclear third party liability (the Paris Convention and the Vienna Convention) could be interpreted or modified to apply to the underground disposal of radioactive waste, and advise how these conventions could provide a satisfactory answer to the possible special requirements of the long-term management of radioactive waste.

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