

DECOMMISSIONING IN THE UK, A REGULATORY PERSPECTIVE

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ABSTRACT

In the UK, the legislative framework allows the nuclear site licence to be used to regulate decommissioning of nuclear facilities. HSE's experience in the regulation of nuclear decommissioning has highlighted a number of important issues which require consideration, such as: decommissioning strategies, waste disposal, the management of change, the management of contractors, openness and de-licensing. Discussion of these issues shows that a wide range of experience in regulating the decommissioning of nuclear plant in the UK has been gained. It is also clear that the lack of a disposal facility is having a major impact on the timing of final decommissioning and the need to provide passively safe storage for the future.

INTRODUCTION

Some of the early UK nuclear power stations and nuclear chemical plant are currently being decommissioned. Plans and strategies for this work are being developed against a background where the future availability of an ILW disposal site is uncertain. Recent statements concerning the reduction of discharges to the environment add to this uncertainty. A long period of waste storage is the only foreseeable option for the UK. This presents the nuclear licensees with organisational and technical challenges. The same is true of the regulator. This paper considers some of the main issues that have arisen and sets out from a regulator's perspective some requirements which stem from the regulatory system and government policies.

HISTORICAL PERSPECTIVE

Although small scale decommissioning projects have been a feature of the UK nuclear scene for many years the decommissioning of major licensed facilities is a comparatively recent phenomenon. These major facilities include six gas cooled power reactors, one heavy water reactor, two liquid metal cooled fast reactors, three materials test reactors and the fire damaged Windscale Pile 1. In addition a variety of fuel cycle and nuclear chemical facilities such as the Capenhurst Diffusion Plant are being decommissioned.

Decommissioning is inextricably linked with the management and ultimate disposal of radioactive waste. This is an area where Government policy has an immediate impact upon regulation. In the United Kingdom two recent significant developments are the 1995 Government White Paper on Waste and Decommissioning and the decision taken in 1997 not to proceed with a rock characterisation facility at Sellafield to support an eventual deep repository. These policy decisions have had an effect on our regulatory objectives and style but to date there have been no consequential changes in the formal legal framework for regulation. Further change may occur in the future and the present administration is currently considering future options.

THE LEGAL FRAMEWORK FOR NUCLEAR REGULATION IN THE UK

The main legislation governing the safety of nuclear installations is the Health and Safety at Work etc Act 1974 and those sections of the Nuclear Installations Act 1965 (as amended) which are relevant statutory provisions. Under the Nuclear Installations Act (NI Act) no site may be used for the purpose of installing or operating any nuclear installation unless the operator holds a valid licence from the Health and Safety Executive (HSE). Once a licence has been issued there is a continuing period of responsibility of licensees under the NI Act throughout operation and decommissioning until there is no longer any danger from ionising radiations from the site. HM Chief Inspector of Nuclear Installations on behalf of HSE grants such licences but safety remains the responsibility of the licensed operator. It is for the licensee to satisfy HM Nuclear Installations Inspectorate (NII), which regulates nuclear sites on behalf of HSE, that this responsibility has been fully met.

Although NII is responsible for the regulation of waste management on nuclear licensed sites, discharges to the environment and the disposal of radioactive waste are regulated under the Radioactive Substances Act 1993 by the Environment Agency and the Scottish Environment Protection Agency. Close liaison is maintained between the NII and the two Environment Agencies in addition to specific statutory consultation arrangements.

THE PROCESS OF REGULATION ON LICENSED NUCLEAR SITES

The HSE may attach to nuclear site licences conditions which appear to it to be necessary or desirable in the interests of safety or with respect to the handling, treatment and disposal of nuclear matter. The standard licence conditions are essentially non-prescriptive and many of them require the licensee to make and implement adequate arrangements to address safety issues (1). The regime is flexible in that it can be used for all stages of the life of the plant and each licensee can develop arrangements which best suits its business. Consequently these conditions apply equally to decommissioning and operating sites and form a continuous process of regulation "from cradle to grave". The arrangements which a licensee develops to meet the requirements of the licence conditions constitute elements of a safety management system. NII reviews the licensee's arrangements to see they are clear and unambiguous and address the main safety issues adequately. NII looks for consistency between the assumptions and commitments made in the safety case and the safety management system.

In regulating a site NII makes use of a number of controls derived from the licence conditions. These include giving Consents, Approvals or Directions on behalf of the HSE. The Conditions also provide for the use of Agreements, Notifications and Specifications which are all legally binding communications between NII and the licensee to allow the licensee to carry out an activity or to require some form of action to be taken.

One of the central requirements is for the licensee to produce adequate safety cases for all operations which may affect safety. In effect these address the safety of the plant throughout each stage in its life cycle including post-operational clean-up, modifications to enable decommissioning, site remediation, care and maintenance and de-licensing. From these safety cases are derived operating limits and conditions, maintenance and other safety requirements. The licence conditions also require that the safety case should be regularly reviewed to verify that

plant and its safety management still conforms to the limits, conditions and requirements described in its safety case, and, in the longer term, to validate the case using modern safety standards. Reviews are also used to take a strategic look at the lifetime and decommissioning strategy for a plant. .

Another requirement under conditions attached to the site licence is that the operator is required to produce and implement decommissioning programmes. Outline decommissioning programmes should be available for plants at the design stage and more detailed programmes would normally be produced some time before cessation of use of the plant. NII has the option of approving these programmes which then cannot be changed without the approval of NII. In addition, the arrangements for decommissioning should, where appropriate, divide decommissioning into stages and NII has the power to specify that the operator shall not proceed to the next stage without its consent. These powers under the licence can be used by the NII to give a high degree of regulatory control over decommissioning.

GOVERNMENT POLICY

The UK Government 1995 policy document on Radioactive Waste Management includes substantial reference to decommissioning (2). This White Paper confirms that the principles set out in the IAEA safety fundamentals document (3) on radioactive waste management and the safety standard on establishment of a National System (4) are reflected in UK national policy. On nuclear sites, this policy is enforced by NII on behalf of HSE.

This policy has a number of key elements, the main points of which are listed below.

- The process of decommissioning nuclear plants should be undertaken as soon as it is reasonably practicable to do so, taking account of all relevant factors.
- Operators should draw up strategies for decommissioning their redundant plant which need to include justification of the proposed timetables and a demonstration of adequate financial provision.
- The proposals should also ensure that the hazards presented by the plant or site are reduced in a systematic and progressive way.
- Use should be made of existing disposal routes (Only industrial waste and LLW can be disposed of at present).
- Radioactive waste should also be segregated and characterised to facilitate the overall safe management of conditioning, storage, retrieval and subsequent disposal.
- Use should be made of existing disposal routes. (Only LLW is disposed at the national facility at Drigg, operated by BNFL).

- When it is necessary to store radioactive waste, NII requires that it is stored in a passively safe form and in a manner which facilitates retrieval for final disposal.

DECOMMISSIONING STRATEGIES AND RISK MANAGEMENT

The licensees are expected to keep their decommissioning strategies under review to take account of such matters as: Government policies, environmental requirements, safety requirements, the availability of disposal routes for radioactive wastes, the development of new technologies, the experience gained in decommissioning and the financial implications of proceeding on different timescales.

For nuclear chemical plant, there is, generally, little benefit in allowing radioactivity to decay. In some cases, because of the in-growth of daughter products, the radiological conditions can deteriorate and this warrants early action. On the other hand, for power reactors, some of the steel activation products have relatively short half lives and there can be radiological benefits in allowing these to decay. Additionally, there is inevitably a balance to be struck during decommissioning between doses to workers, individually and collectively and to the public.

The decommissioning strategy should describe the plant to be decommissioned and the options considered for the task. The licensee should give the reasons for choosing a preferred option and timescale and explain how it meets the requirement of Government Policy and relevant regulations. The licensee should also identify alternative options in case the preferred option becomes untenable and the time needed to develop them. The provision of adequate arrangements for continued monitoring, maintenance and staffing of the sites should be considered. The decommissioning strategies will need to be costed to a degree sufficient for judgements to be made on the adequacy of financial provision arrangements.

It is HSE's responsibility to review the strategies quinquennially in consultation with the Environment Agencies. HSE will also keep the appropriate Secretaries of State informed about its consideration of the decommissioning strategies. Some decommissioning, however, requires pragmatic judgements to be made by the licensee and regulator. For example, where there is an increased risk (for example, radiation dose) in taking action but which will allow remediation to start and so reduce risks in the longer term. In such circumstances a special case procedure applies and robust arguments are needed.

DISPOSAL AND STORAGE OF WASTES

The White Paper (2) states the intention that intermediate level wastes (ILW) should be disposed of in a deep repository. At present there is no ILW disposal facility in the UK and it is now unlikely that one will be available before well into the next century. The position is under review following the Government's refusal of planning consent to a Rock Characterisation Facility at Sellafield. Whatever decisions are made it is apparent that ILW will need to be stored on sites for a number of decades.

It is Government Policy that where it is practical and cost effective to do so, licensees should characterise and segregate waste on the basis of physical and chemical properties and store in accordance with the principles of passive safety in order to facilitate safe management and

disposal. A passively safe form is one in which the waste is chemically and physically stable and stored in containment which minimises the need for active safety mechanisms, maintenance, monitoring and human intervention.

Waste specifications must therefore satisfy the NII regarding segregation, characterisation, passive safety for long term storage and suitability of the waste for eventual disposal.

NII have recently considered the effect on nuclear sites of the likely delay to the provision of an ILW disposal site (5). It concludes that the delay does not cause any immediate safety problems for ILW storage, however, those waste management strategies that still defer conditioning of raw wastes, waiting for a repository, need to be reconsidered. It also concludes that a number of additional waste stores will be needed. This will be additional to any stores required for waste arisings from decommissioning. This storage capacity will be included in the licensee's decommissioning strategies noted above. The design, construction, operation and eventual decommissioning of stores for radioactive wastes on a licensed site are subject to the full regulatory control system.

LONG TERM MANAGEMENT OF DECOMMISSIONING

In the UK many decommissioning projects are expected to last for a very long time with significant intermediate care and maintenance periods. Also as explained above, because of the delays in developing a waste disposal facility for Intermediate Level Waste, waste stores will be needed for considerable periods of time. Therefore both the licensees and the regulators need to give careful thought about long term management aspects of decommissioning; some of which are discussed below. The continuation of the licensee's financial and managerial capacity to control the site is one of the factors to be taken into account in HSE's Quinquennial Review of decommissioning strategies.

The licensing regime is based on the premise that the licensee is the user of the site, is in control and is an intelligent customer for services provided by contractors (1). This will still be necessary during periods of care and maintenance and waste storage. Therefore the licensee will need to be able to demonstrate that an adequate organisation is and will be in place to discharge those responsibilities until the site is finally delicensed. The size and skills required by the licensee's organisation will vary depending on the state of the plant. The licensee should provide or have access to high quality health and safety expertise to provide advice, audit and peer review of safety cases. During care and maintenance the licensee must be able to interpret monitoring and surveillance results and be prepared to take remedial action if required.

The organisation will also need some system to retain corporate memory of the facility if the period of care and maintenance is likely to be prolonged. This will include not only those records required to be kept by legislation but also the local plant knowledge needed for the purposes of later decommissioning. The object to be achieved here is the capture and recording of such matters as actual methods of operation, location of leaks and contamination, actual pipe and cable runs, deviations from original drawings and specifications and also local repairs and modifications. This will reduce the need for a period of research when care and maintenance ceases and final decommissioning begins.

When operational facilities move into the care and maintenance phase they become stores for nuclear matter if they contain contamination or radioactive sludges, dusts or debris. However, the structures have rarely been designed and constructed for such use and may not meet modern standards for nuclear stores. Where reasonably practicable NII will expect the licensees to make such waste passively safe before any lengthy storage period.

Where storage does occur the licensee will need to develop and justify the regime of monitoring and surveillance proposed. This regime will depend on the facility but it will need to be designed to ensure that early warning is given for example of structural problems or water ingress. The licensee will need to develop criteria on the acceptability of the results. Regular reviews of the safety case for the facility will be required.

MANAGEMENT OF CHANGE

The move towards decommissioning can be regarded as a process of major organisational change. In the UK, nuclear licensees have embarked on extensive change programmes in recent years including privatisation. NII has required the changes to be carried out in accordance with rigorous and comprehensive management of change arrangements and we have extensively audited the licensees against these arrangements. As discussed above, the licensee should be able to show that the organisation remains able to meet projected resource and competence needs and that staff morale, commitment and safety culture are maintained.

CONTRACTORISATION

Decommissioning is often a stage of the plant's life cycle where large numbers of external contractors are employed. However, UK licensing is based on the licensee being the user of the site. The licensee must retain responsibility for the safety management system and be in control of the day-to-day activities on the site until the site is delicensed. Therefore, it is vital that the licensee retains sufficient competent personnel to understand, own, understand and use the plant safety case, and to act as intelligent customers for work by contractors.

Contractors are used for a wide variety of tasks. A common use is for a self contained specific project. In such cases the licensee should have the capability to be able to define, monitor and supervise the work. However, contractors may also be employed to provide services such as health physics expertise or nuclear maintenance. These contractors need very careful management by the licensee to ensure that the licensee retains control of intellectual property and that assets remain available to the licensee if necessary. If the contractor is replaced then a proper handover must be arranged so that the new contractor's staff are trained to be suitably qualified and experienced when they take over.

Where the NII has not been satisfied that effective steps have been taken to ensure safety on licensed sites undergoing decommissioning using contractors then regulatory and enforcement actions have been taken.

OPENNESS

It is Government policy to encourage openness in aspects of all health and safety and this certainly extends to nuclear decommissioning where many stakeholders can be identified. The licensees' decommissioning strategies required by the Government White Paper are anticipated to be in the public domain as will be the corresponding HSE report on them.

More direct local contact with the public is obtained via the local community liaison committees (LCLCs) established for licensed sites. These committees usually meet twice a year in open session with media present. Members of LCLCs receive written reports from the NII on a quarterly basis and the NII site inspectors attend each meeting. The licensees have indicated that these information channels will be maintained during the period of decommissioning and NII is keen to encourage these endeavours.

DE-LICENSING AND SITE CLEARANCE

The requirement to demonstrate that there is no longer any danger from ionising radiations from anything on the site ("no danger" criteria) at the end of decommissioning is absolute in UK legal terms (1). NII have interpreted this to mean no measurable increase in radioactivity above natural levels and applied it to the delicensing of some sites. It has not been applied to a large scale nuclear facility which has experienced significant ground contamination.

De-licensing has successfully been undertaken for research reactors and other small scale facilities. As current facilities age and enter the decommissioning phase of their operations it is likely that there will be an increase in the number of requests NII receive to de-licence sites or parts of sites. NII makes decisions on the proof of "no danger" on a case by case basis looking at the evidence that is available not only in terms of surveys, but also the history of the site including any incidents. The licensee will provide a safety submission, however there is a fundamental difference to the normal permissioning regulatory system, where the licensee is responsible for safety, insofar as it is NII that must form an opinion on whether there is no longer any danger from ionising radiations from the site.

In addition to assessing the licensee's safety submission, NII will carry out (or will have carried out on its behalf) an independent radiological survey of the site which should not reproduce the licensee's measurements but will allow NII to form a judgement on the acceptability of the licensee's safety submission. NII will also consult with relevant Government Departments and the Environment Agencies.

Details of the criteria for judging that "no danger" has been met have been given by NII elsewhere (5), but in simple terms it means that there is no measurable increase in radioactivity above natural levels.

FUTURE DEVELOPMENTS

This paper has considered some of the main issues that have arisen from decommissioning experience in the UK and it sets out from a regulator's perspective some requirements which stem from the regulatory system and government policies. To promote wider awareness and discussion of key strategic issues affecting decommissioning and waste disposal, the NII are currently preparing guidance for publication later this year. The guidance will cover topics such as:

Decommissioning as soon as reasonably practicable;

Passive safety for decommissioning and for storage of radioactive materials and waste;

Discounting costs for decommissioning;

Manning a decommissioning site;

Record keeping for long term nuclear liabilities;

Quinquennial Review of decommissioning strategies;

Inspection, care and maintenance; and

Consideration of risk and best practice.

CONCLUSIONS

A wide range of experience in decommissioning nuclear power and chemical plant has been gained in the UK. The goal-setting regulatory regime has enabled NII to maintain control over this work without making fundamental changes to the system.

The lack of a disposal facility for ILW has an impact on the timing of the final decommissioning activities as well as on the engineering of waste storage that must now ensure passively safe conditions for many decades.

Decommissioning can be regarded as a process of major organisational change for which NII will require licensees to have rigorous and comprehensive management of change arrangements.

A policy of openness will be essential to ensure public support for safe and timely decommissioning.

Whilst some sites have been cleared to so-called "greenfield" status and delicensed as representing "no danger", no experience has been gained in dealing with a major site that has experienced significant levels of radioactive contamination.

Guidance on key strategic issues affecting decommissioning and waste disposal is currently being produced by NII with the aim of publication later in 1999.

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