The Delicensing of Nuclear Licensed Sites in the United Kingdom

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ABSTRACT

In the UK, sites rather than specific facilities are licensed for the purpose of carrying out certain operations. The framework for licensing is the Nuclear Installations Act 1965 (as amended) (NIA65). The licensing aspects of the NIA 65 are administered by the Health and Safety Executive (HSE) and delegated to their agency, the Office for Nuclear Regulation (ONR). Over the last few years, applications for sites or parts of sites to be delicensed and released from their duties under the NIA65 have been increasing as sites are no longer needed for licensable activities. We present the legal framework for licensing with particular reference to delicensing of Nuclear Licensed Sites in the UK, the development of a definition of 'no danger' which is the test for delicensing in the NIA65, and the regulatory approach that is taken by the ONR in arriving at a decision. In addition we will highlight some of the challenges that have been met during the delicensing of some sites or parts of sites in the UK. These sites have been used for a variety of operations under the NIA65 and present different challenges in the demonstration of 'no danger'. Despite the challenges encountered licensees for the sites and parts of sites have demonstrated compliance with the HSE's criterion and these sites have been delicensed successfully.

INTRODUCTION

The ONR, an agency of HSE, regulates safety at nuclear installations in the UK. This is achieved largely through assessment and inspection in relation to a nuclear site licence. There is a joint responsibility between HSE, other Government Departments, and Agencies so far as radiological protection of the public is concerned. The aim of this paper is to describe the authors' views on practical aspects of ending the period of responsibility of a nuclear licensee for injury or damage arising from ionising radiations from anything on the site (or part of the site), which is referred to as delicensing.

HEALTH AND SAFETY LAW

In the UK, the main legislation governing health and safety at work is the Health and Safety at Work etc. Act 1974; in addition the NIA65 provides the framework for the regulation of the safety of nuclear installations. Under the NIA65 no site may be used for the purpose of installing or operating any civil nuclear reactor or any other installation prescribed under the Nuclear Installations Regulations 1971 unless an extant nuclear site licence has been granted by the HSE. From the time of granting a site licence to the ending of the licensee's period of responsibility, regulatory control of all activities relevant to safety is achieved through the conditions attached to that licence. Unless a new licence covering the site is issued to another body, the licensee's period of responsibility continues, until in the opinion of ONR there has ceased to be any danger from ionising radiations from anything on the site, the 'no danger' criterion.

SITE LICENCE

Licence conditions require the production of adequate safety cases for all phases in the life of an installation, which encompasses decommissioning. The final stage of decommissioning can be considered to be the removal of nuclear licensing requirements from the site, or part of it. However, it may be that following decommissioning the site could not be demonstrated to meet the delicensing criterion and so the licensing regime would remain in place. In seeking to end the licensee's period of responsibility similar procedures to those undertaken for an operational plant are expected, in that a safety submission would need to be made for ONR agreement.

Of particular importance is information concerning natural background radiation and radioactivity levels in the vicinity of the site which should be presented together with justification of the level chosen for comparison to site survey data, both for radiation levels and soil analyses. The licensee's safety case will need to give a summary of radiological survey information to support its request for delicensing. This should utilise maps showing the area to be delicensed and areas that have previously been designated as controlled or supervised areas. Where buildings remain in the area to be delicensed it is helpful to include the floor, wall and ceiling plans to summarise the monitoring information. In addition the licensee should have documentation available for inspection which includes:-

- the suitability of staff carrying out the monitoring work;
- types and serial numbers of instruments used each day;
- records of functional checks of instruments;
- a description of how monitoring was carried out;
- action levels used, e.g. to investigate further or to decontaminate;
- survey sheets showing the location monitored and the readings obtained;
- calibration certificates for all instruments used.

In addition to the technical aspects of delicensing, licensees will also have to cover the administrative aspects which will include:

- Consultation with the appropriate environment agency;
- Maps / plans – for attachment to a Variation;
  - need to show the area delicensed and the residual licensed area
  - Marking of the new licensed site boundary
  - Further information The Licensing of Nuclear Installations[1]
- Retention of records.

SAFETY ASSESSMENT AND CRITERIA

The HSE published the criterion for delicensing nuclear licensed sites[1] following public consultation. The criterion interprets the meaning of 'no danger' in NIA65 for the purpose of releasing a licensee from his period of responsibility. The criterion states:

'On the basis of existing, published guidance, HSE considers that an additional risk of death to an individual of one in a million per year, is 'broadly acceptable' to society. Applying this to nuclear licensed sites, any residual radioactivity, above the average natural background, which can be satisfactorily demonstrated to pose a risk less than one in a million per year, would be 'broadly acceptable'. For practical purposes, therefore, we will use this criterion as the basis of what we regard as 'no danger' for the purposes of sections 3(6)(b) and 5(3)(a) of

NIA65. Compliance with this criterion would normally mean that HSE can remove the site from regulatory control under NIA65 – i.e. allow the site to be delicensed.

This represents a dose of the order of $10\mu Svy^{-1}$. This is a stringent criterion to meet.

In order to make the demonstration that this criterion has been met licensees will have to use measureable quantities such as activity concentration and to link these with the risk criterion. HSE has published Guidance to ONR inspectors[2] on the interpretation and implementation of the HSE policy criterion of no danger for the delicensing of nuclear sites. This references documents from the International Atomic Energy Agency[4] and the European commission[5] that relate activity concentrations to a dose of $10\mu Svy^{-1}$ for a variety of uses of the land. The licensees are free to use these or to develop their own criteria. In all cases the licensees' choice of criteria would need to be rigorously justified.

The objective for ONR's assessment in relation to delicensing is to seek to ensure the licensee properly identifies (and if necessary has removed) any artificial radioactivity (or enhanced levels of naturally occurring radioisotopes resulting from work activities) that, when considering reasonably foreseeable future use of the site, either contributes significantly to external background radiation dose or could contribute significantly to internal dose. It should be noted that there is no provision for conditional release of a nuclear site, i.e. relaxed criteria cannot be invoked because of an intended use of the site, such as for industrial purposes or a car park. Thus the aim is to finish up with a site for which there is 'no danger' from ionising radiation for any reasonably foreseeable use.

Guidance on the mechanisms by which a licensed nuclear site, or part thereof, may be removed from the licensing requirements of the NIA65 is given in the HSE document 'Licensing procedure – The delicensing process for existing licensed nuclear sites'[6].

PRACTICALITIES OF JUDGING NO DANGER

In addition to assessing the licensee's safety submission, ONR is also required to carry out - on its behalf - independent radiological monitoring of the site. This will assist ONR in forming a judgement on the acceptability of the licensee's safety submission. The Health Protection Agency, HPA, under contract to ONR has been used on many occasions to undertake radiological monitoring, including surface contamination surveys, radiation surveys, sampling, analysis and assessment of radioactivity on a number of licensed sites.

ONR will also consult the relevant environment agency and Government Departments as necessary.

An important part of ONR's decision making regarding judgement of whether there is 'no danger' is to determine the extent of differences, if any, between levels of radiation measured on parts of the site to be delicensed and the levels that are considered to be typical of natural background radiation in the area. Typically, measurements are taken by the licensee and HSE's independent contractor, at a number of locations on the nuclear site and at a distance of a few kilometres - using for example an environmental gamma monitor with energy compensated GM tube.

Depending on the size and history of the area to be delicensed, a Licensee's delicensing safety case may well quote results for several hundreds of soil samples taken at various depths and positions. ONR would also have soil sample measurements taken by their independent contractor, at a number of locations and depths. This independent sampling provides information and contributes to ONR's confidence in the adequacy of the Licensee's sampling

and analysis procedures to detect levels of radioactivity on the site to demonstrate compliance with the 'no danger' criterion. It is not intended to reproduce the licensees work in full.

As part of the review of the adequacy of a licensee's safety case, ONR would give particular attention to drains and other underground features such as structures and soakaways. ONR would expect plans of underground features to be available in the safety case, e.g. active drains, non-active storm drains, surface water drains, and sewers. There should also be an analysis to show that the licensee has a good understanding of the underground drainage system, and whether there is a theoretical possibility that activity could flow back from active drains under abnormal conditions into the non-active drains. In addition to this, knowledge of contaminated land & groundwater and the hydrogeology is also important as activity from elsewhere on site or neighbouring site might migrate into the site or part of the site that is to be delicensed. Where active (or formerly active) drains are present details of the jointing of the pipes together with information on any detected leaks should be provided. Even where there is some confidence that drains were non-active ONR would usually ask the licensee to justify this by suitable and sufficient inspection and monitoring as appropriate.

LIAISON ARRANGEMENTS WITH ENVIRONMENT AGENCIES

The powers for regulation of the disposal of radioactive wastes generated by any facility, including those for which a nuclear site licence is in force, derive from the Environmental Permitting Regulations 2010 in England and Wales and the Radioactive Substances Act 1993 (RSA93) in Scotland. The regulatory responsibility rests with the Environment Agency in England and Wales and the Scottish Environment Protection Agency in Scotland. Regulation of other aspects of radioactive waste management on licensed nuclear sites, in particular relating to its creation, accumulation, storage and treatment is covered by licence conditions and enforced by ONR. There are working arrangements including a Memorandum of Understanding between the environment agencies and ONR to ensure that the waste management aspects are properly considered, including those associated with delicensing.

CHALLENGES AND SUCESSES

A number of challenges were encountered during delicensing at a number of the sites. These were overcome and allowed ONR to make the declaration of no danger, delicense the site (or part thereof) and end the licensee's period of responsibility.

Sources

For some sites, sources that were on the site were going to be used on the site following delicensing. ONR was asked if the sites could be delicensed with the sources in situ, preventing double handling and representing ALARP. The legal advice to HSE was very clear:

- The NIA is clear about danger from "anything" on the site.
- There is no provision to ignore some things that are on the site.
- To do so would be outside vires, an improper exercise of power and the delicensing decision would be unlawful.

This clearly meant that the sources had to be removed from the site at the time of delicensing. In one case the sources could be moved to an adjacent site and then returned following delicensing. In a second case there was no adjacent place to move the sources to. In this case the delicensing was done in two parts. The first area was delicensed and the sources moved to the delicensed area when all suitable arrangements were in place. The second part of the site was then delicensed. In these ways the letter of the law could be met and allow delicensing.

Monitoring and drains

The principles associated with delicensing are, generally, different from those used in day to day radiation protection. The surveys of large areas of land; nuclides need to be measured, by surveying or analysis, to lower levels. This means that the techniques and instruments used will need to be demonstrated as fit for the purpose of demonstrating that the 'no danger' criterion has been met. This is an area where the regulator and licenses have early engagement and forms part of the information looked at in ONR's independent survey. In general the licensees are aware of these requirements and make suitable arrangements to get the correct instrumentation, surveying regimes and analysis techniques. This included the development of large area surveying tools linked to GPS, either hand held or vehicle mounted, that can be used for large area surveys. The awareness of the licensees and their utilisation of the appropriate techniques has allowed the demonstration of the delicensing criterion to the satisfaction of the regulator and allowed sites to be delicensed.

In doing large area surveys it was noted that variations in doserates were noted in traversing identical looking surfaces particularly tarmac. This led one licensee to do a report on the expected variation in naturally occurring radionuclides in tarmac. As a result they were able to demonstrate that the variations were entirely due to naturally occurring radionuclides and so formed part of the natural background and so could be discounted for the purposes of delicensing. As discussed above, another area of concern for the regulator is that of active drains on the site. If a decision is made to leave the drains in place then a robust demonstration will be needed that they will meet the no danger criterion for any reasonably foreseeable use of the site that may involve removing them. Equipment and techniques have been developed that allow drains to be videoed, surveyed and samples taken as necessary to enable the licensee to decide if the drains need to be removed or meet the HSE criterion.

One licensee removed the majority of their drains apart from in those areas where it would be technically difficult to remove them, for example under buildings and where areas of protected plant life would have to have been removed. In these cases, the drains were monitored, characterised and grouted with an assessment made showing the most exposed person in the worst case scenario would not receive a dose greater than 10μSv per annum. Similarly this kind of assessment has been made in cases where buildings were to remain on the land for reuse. In such cases the requirement for independent verification of these analyses becomes key and licensees usually find it is advantageous to engage with their regulator at an early stage.

An example of successful working between the Licensee/ONR/HPA in a spirit of 'no surprises'

The intention of the Licensee is to reduce the footprint of the existing Nuclear Licensed site to around 10% of its existing size. During the delicensing project, regular quarterly meetings have been held between the Licensee, ONR, EA and the HPA (the ONR independent contractor) giving confidence to all in the progress of the project in a spirit of no surprises.

The Licensee documentation has been written with a view to demonstrating compliance with the HSE criterion, though the Licensee has also set their own target criteria, which are below the values required to meet the HSE criterion where this was shown to be the ALARP option. The Licensee has generated dose assessments demonstrating the one in a million, 10 μ/yr has been met if RS-G-1.7 values are exceeded.

During the project the licensee has submitted a number of 'Clearance in Principle, CIP,' reports to ONR for a number of buildings where remediation has been completed. On behalf of ONR, HPA have undertaking independent monitoring, sampling, analysis and assessment

of these buildings. The HPA independent monitoring has confirmed that the Licensee conclusions are appropriate and ONR have issued 'Agreement in Principle, AGIP,' assessments for a number of the cleared buildings as appropriate. The Licensee has instigated a number of measures – 'frozen arrangements' - to prevent re-contamination of cleared areas. The Licensee will submit a safety case at the end of the project requesting a variation of the nuclear site licence. A final 'sample programme' of monitoring and surveys of the site will be undertaken to confirm adequacy of the 'frozen arrangements' at this time.

The project has progressed well to date with 4 CIP and AGIP documents issued and agreed. A live 'Agreements and Assumptions' document has been generated during the project, recording the key principles and agreements made, activity limits for delicensing, Licensee targets, progress of remediation actions and a record of the dose assessments made.

The EA have recently revised the Licensee's disposal authorisation under the Environmental Permitting Regulations 2011 (amendment) which now allow disposal of small amounts of C14 at up to 10 Bq/g (C14 is 'out of scope' at this activity concentration). This has caused the Licensee a number of conceptual problems as this was a factor of 10 higher than the RS-G-1.7 values for residual activity for delicensing purposes as recommended by HSE. At the current time, the ONR position remains that land should be cleared to demonstrate achievement of the 'no danger' criterion of the residual risk of death of one in a million per year. Where it is not suitable to use the values in RS-G-1.7, the Licensee has agreed to present other values and arguments to demonstrate that the risks are reduced to meet the 'HSE Criterion for delicensing nuclear sites' and that any assessment of dose will be based on conservative assumptions regarding reasonably foreseeable future use of the site and exposure pathways to demonstrate that any future use of the site represents 'no danger' for cleared buildings.

The Licensee has accepted the ONR position indicating that their intention remains to achieve the RS-G-1.7 levels as agreed in the 'Agreements and Assumptions' document for delicensing purposes - where this can not be achieved the Licensee will undertake rigorous dose assessment to demonstrate achievement of 'No Danger' for any reasonably foreseeable future use of the site or land.

ONR policy and Guidance on delicensing

ONR are leading a project to review the potential for delicensing with a proviso of the subsequent use of the site.

CONCLUSIONS

The legal framework in the UK for regulating the safety of the nuclear industry uses a licensing regime together with regulations. This places the responsibility for safety on the licensee, but provides the regulatory authority with a powerful and flexible method of regulatory control.

HSE developed and published a criterion[1] and guidance[2] to allow ONR inspectors to make judgments of the 'no danger' requirement in the NIA65. Delicensing can be considered as the final step of decommissioning, and ONR has experience of delicensing both entire sites and parts of sites.

Some particular challenges, technical and administrative, in relation to site decommissioning and the demonstration of 'no danger' at the point of delicensing, together with their resolution are discussed. Particular areas of success are also discussed.

It is shown that despite the stringent criterion to demonstrate 'no danger' and challenges in making the demonstration, licensees have successfully, decommissioned sites and presented safety documentation to the regulator that has allowed the regulator, following suitable assessment and inspection, to delicence sites and parts of sites.

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[1] The Licensing of Nuclear Installations, HSE (http://www.hse.gov.uk/nuclear/notesforapplicants.pdf)

[2]. HSE Criterion for delicensing Nuclear Sites, HSE May 2005 (http://www.hse.gov.uk/nuclear/delicensing.pdf),

[3]. Delicensing guidance: Guidance to inspectors on the interpretation and implementation of the HSE policy criterion of no danger for the delicensing of nuclear sites, HSE August 2008 (http://www.hse.gov.uk/nuclear/delicenceguide.pdf)

[4] Application of the Concepts of Exclusion, Exemption and Clearance, Safety Guide No RS-G-1.7, IAEA 2004 (http://www-pub.iaea.org/MTCD/publications/PDF/Pub1202_web.pdf)

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[6] Licensing procedure – The delicensing process for existing licensed nuclear sites HSE March 2011 (http://www.hse.gov.uk/nuclear/operational/inspection/ins038.htm)