

Final Surrender of Radioactive Substances (Environmental) Permits on UK Nuclear Licensed Sites – 16646

Jim Cochrane *, Juliet Long **

* Scottish Environment Protection Agency

** Environment Agency

INTRODUCTION

This paper is split into three, linked, parts; each part explains work being taken forward by the United Kingdom (UK) Government and/or the nuclear site regulators to apply proportionate regulatory controls before, during and after nuclear site decommissioning and clean-up.

Part I of the paper describes work led by UK Government to examine credible options for a step-wise removal of those safety, security and environmental protection regulations that apply to nuclear site decommissioning and clean-up. Any removal of regulations will have to take due account of and be proportionate to the residual risk following cessation of all clean-up works.

Part II of the paper describes the approach used by the UK Environment Agencies¹ to regulate final site clean-up of UK nuclear licensed sites. Ultimately, clean-up will result in nuclear sites being released from radioactive substances regulation.

Part III of the paper links Parts I and II of the paper together by describing how the UK Environment Agencies will apply proportionate regulation to the clean-up of the 140-acre Dounreay site in Caithness which is the largest nuclear clean-up project in Scotland and the second largest in the UK, after Sellafield.

Regulation of UK Nuclear Sites

On UK nuclear licensed sites, three main “sets” of regulations apply. In no order, the first set includes worker health and safety, security, safeguards and transport of nuclear matter; all regulated by the Office for Nuclear Regulation, (ONR). The second set includes environmental protection and improvement and sustainability issues; regulated by the UK Environment Agencies. The third set are those regulations applied by UK Waste Planning Authorities who have the regulatory remit for the land use planning regime which operates through a system of plan preparation and control over the development and use of land.

¹ The UK Environment Agencies include, the Environment Agency, Natural Resources Wales, the Scottish Environment Protection Agency and the Department of the Environment, Northern Ireland

RS Regulation by the UK Environment Agencies

The Environment Agency, Natural Resources Wales, and the Scottish Environment Protection Agency (the environment agencies') are the environmental regulators for England, Wales and Scotland, respectively. As non-departmental public bodies, the role of the environment agencies' is to make sure that the environment and human health are protected, to ensure that natural resources and services are used as sustainably as possible and to contribute to the Government's policy aim of sustainable economic growth. Our responsibilities include regulating the disposal of radioactive waste on or from nuclear sites. We also carry out environmental monitoring around nuclear sites. The Department of the Environment (Northern Ireland) is responsible for regulating the control of radioactive substances in Northern Ireland. However, there are no nuclear sites in Northern Ireland.

UK Regulations to Control Radioactive Substances on Nuclear Sites

The level at which a substance becomes 'radioactive' and the level at which regulation is required for the keeping, use or disposal of radioactive substances in the UK is governed by the Radioactive Substances Act 1993 (RSA 93) and the Environmental Permitting Regime 2010 (EPR 10). RSA 93 applies in Scotland and Northern Ireland, EPR 10 applies in England and Wales. In addition, administrative arrangements apply to exempt radioactive substances from regulatory controls and are set out in Exemption Orders which apply, separately, to RSA 93 and EPR 10. SEPA grants Authorisations under RSA 93 and NRW/EA grant environmental permits to nuclear sites under EPR 10. The term "permit" is used in the remainder of this paper as a short-hand term to mean either an Authorisation granted by SEPA under RSA 93 or a Permit granted by EA or NRW under EPR 10 to control radioactive substances on nuclear sites.

In regulating radioactive waste disposal, the environment agencies' are obliged, by international and domestic standards and law, to ensure that exposures of people to ionising radiation are kept below certain limits and constraints. In addition, below these limits and constraints, exposures must be kept as low as reasonably achievable (ALARA), taking account of economic and societal factors.

Safety & Security Regulation of UK Nuclear Licensed Sites

The Office for Nuclear Regulation (ONR) is the independent regulator for safety and security at the 37 licensed nuclear sites in the UK. These sites include the existing fleet of operating reactors, fuel cycle facilities, waste management and decommissioning sites and the defence nuclear sector. In addition, ONR regulates the design and construction of new nuclear facilities and the transport and safeguarding of nuclear and radioactive materials.

The Nuclear Installations Act 1965 (NIA 65) is the main legislation in the UK governing safety and security of nuclear matter on nuclear sites. ONR is the regulator of NIA 65 and attaches 36 standard conditions to each licence it grants. The licence sets goals requiring the site operator to develop and implement “adequate arrangements” to comply with each licence condition. In addition, the UK has implemented the Nuclear Energy Agency requirements to have liability insurance for nuclear accidents (the Paris Convention) under NIA 65. Therefore, for NIA 65 regulation to end ONR would have to agree that (i) the 36 licence conditions and (ii) nuclear liability insurance were, both, no longer needed.

The safety of a nuclear facility depends on controlling the risk of exposure to radiation from both routine operational activities and from potential accidents. On nuclear sites, ONR regulates both of these aspects, but the environment agencies’ regulate discharges and disposals of radioactive substances into the environment. To ensure that regulatory activities on nuclear sites are coordinated, the environment agencies’ and ONR have entered into Memoranda of Understanding setting out each of our regulatory aims and responsibilities.

PART I - APPLYING PROPORTIONATE REGULATORY CONTROLS TO CLEAN-UP NUCLEAR SITES

The UK nuclear industry, its sites and operations is regulated independently to ensure that the workforce and general public remain safe, that sites and nuclear materials remain secure, and that the environment remains protected. Nuclear regulatory regimes have been built up incrementally over a period of 60 years as the complexity and diversity of operations has increased.

Many of the UK’s nuclear sites are now undergoing decommissioning and clean-up including the fleet of 10 Magnox sites (CO₂-cooled, graphite-moderated reactors using natural uranium as the fuel and magnox alloy as fuel cladding). But, the nuclear regulatory regimes in the UK were not developed with decommissioning in mind. This manifests in two main problems:

1. There is no clear Guidance from the environment agencies’ as to the expectations, principles, requirements and criteria site operators should use as the basis to clean-up their nuclear sites and, ultimately, surrender² their environmental permits; Part II of this paper describes Guidance being produced by the environment agencies’ to surrender permits granted to nuclear site operators

² The term “surrender” is used here to mean the process the environment agencies’ use to remove the controls required by the environmental permit such that the permit is no longer required

2. The UK Government policy on decommissioning endorses that the level of safety, security and environmental regulation is proportionate to the level of the risk posed by the site. Work to support this policy is collated under a project titled the Proportionate Regulatory Controls (PRC) Project and is described here in Part I of this paper.

Part I - Introduction to the PRC Project

Under its "Better Regulation" business agenda, the UK Department for Energy & Climate Change (DECC) set up the PRC Project in 2014. The main aim of the PRC Project is to consider whether (i) the current approach to regulating decommissioning sites is proportionate and (ii) whether nuclear site restoration could be managed with a seamless transition across three main "layers" of regulatory control as outlined in Figure 1 on Page 8. Nuclear site regulation is based on applying overlapping layers of safety and security (ONR), environmental protection (environment agencies') and land use planning controls (Planning Authorities) to protect man and the environment.

Figure 1 shows the current regulations that apply on nuclear sites. NIA 65 governs the safety and security regime and is the first layer of regulations in Figure 1. The environmental protection regime (either RSA 93 or EPR 10) is the second layer of regulations and continues to the point where all clean-up work has been completed and the environment agencies' accept an application from the site operator to surrender their permit. At that point both the first and second layers transition to regulations governing the UK land use planning regime. This is the third layer of regulation in Figure 1.

Context of Nuclear Site Decommissioning

The current framework for nuclear site regulation is mature. But, UK regulations to control high radiological hazards (NIA 65) continue to apply even where the site hazards have been reduced to a safe level and the focus is on site clean-up. And, the current regulations aren't flexible enough to incorporate those controls provided by restrictions on the planned/future uses of nuclear sites. Both these points are illustrated in Figure 1 below which shows that NIA 65 and EPR/RSA 93 applies throughout clean-up to the point where licences and permits are revoked/surrendered, often at the same time.

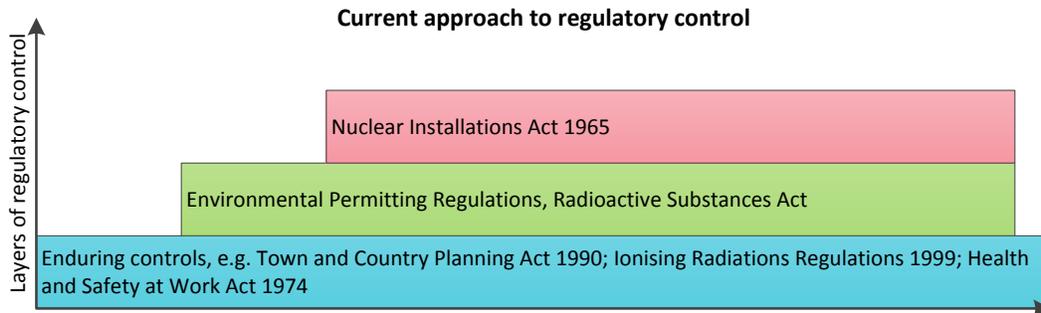


Figure 1: An illustration of the 'layers' of regulatory control that currently apply to nuclear site clean-up.

Continuing to apply the current regulations in the way we do now could:

- (i) result in nuclear site clean-up costs becoming an unjustifiable burden to the UK taxpayer
- (ii) limit or delay opportunities to re-use former nuclear sites
- (iii) limit the opportunity to apply more proportionate and risk-based regulation on nuclear sites in cases where restricted future uses for the site are being considered

So, put simply, current arrangements to regulate final site clean-up on nuclear sites may be disproportionate to the residual risks.

Consideration of the Possible Opportunities for Better Regulation

Since October 2014, UK Government and nuclear regulators have been working together on the PRC Project to evaluate the benefits and drawbacks of options that would realise (i) an earlier release of safety and security (NIA 65) regulatory controls, and also (ii) an earlier release from the environmental protection regime (RSA 93/EPR 10) to regulations governing the UK land use planning regime. This is illustrated in Figure 2 below.

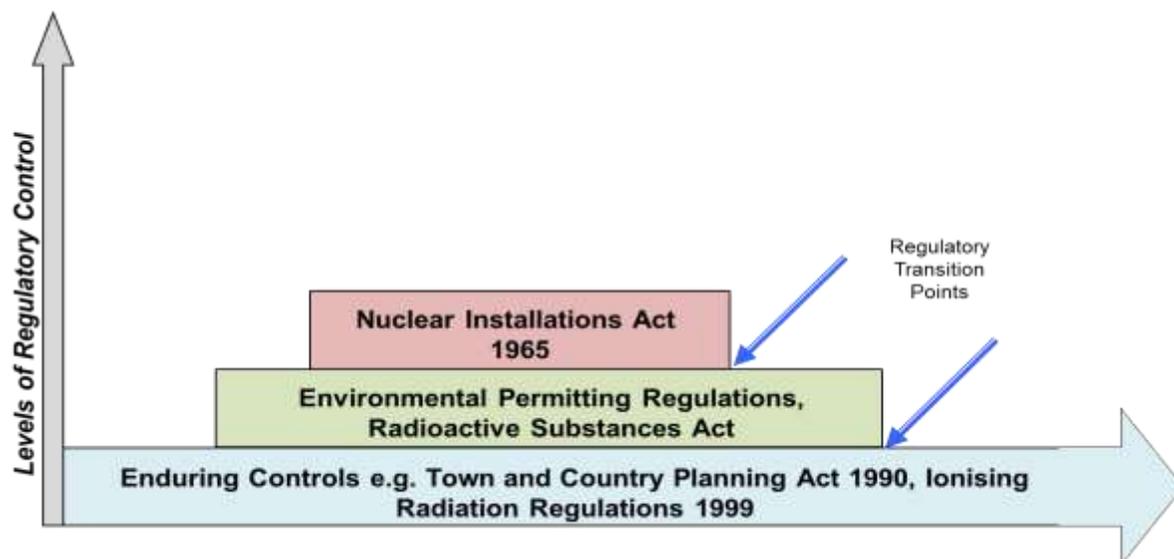


Figure 2: An illustration how regulatory controls could transition during the clean-up of nuclear sites

Note, in particular, the Regulatory Transition Points in Figure 2. The first transition is from NIA 65 controls to environmental protection controls. If NIA 65 ends earlier than is currently allowed, the intention is that the environment agencies' take on the regulatory responsibility for final site clean-up to the point where the site can be handed on to the land use planning regime.

The environment agencies, are also exploring whether a site can be cleaned-up to a condition that would allow its release from RSA93/EPR 10 regulations earlier on the basis of a restricted future use for the site rather than having to be cleaned-up to a greenfield condition (unrestricted use). This would allow the second Regulatory Transition Point in Figure 2 to take place earlier than is currently allowed. Regulation under this proposal is set out in more detail in Part II of this paper.

Any earlier "transitions" in nuclear site regulation would only be taken forward if the outcome delivers the same level of protection for safety, hazards & environment, but in a more proportionate manner. The successful and earlier transition of NIA 65 and EPR 10/RSA 93 regulatory controls should allow:-

- Delivery of optimised site end states;
- Proportionate controls being applied to manage the risks of nuclear site clean-up such that:-
 - future site uses are not unnecessarily restricted, and potential users are not deterred by an unjustified regulatory burden and / or the perception that the residual risk is greater than it is;
 - future site uses are not restricted by the unnecessary 'layering' of regulatory requirements.

For NIA 65 regulation to end ONR would have to agree that (i) the 36 licence conditions and (ii) the (Paris Convention) nuclear liability insurance were, both, no longer needed. Therefore, the PRC Project is exploring whether NIA 65 regulation can end earlier and in line with the risk levels agreed by NEA to exclude nuclear sites undergoing decommissioning from nuclear insurance liabilities. The NEA exclusion is a two-step process: the first step is a comparison of the installation's inventory with a set of radioactivity thresholds; the second step is a site-specific assessment for comparison with an off-site dose criterion of 1 mSv/y. For UK nuclear sites, it should be possible to meet the exclusion criteria before the NIA 65 licence is revoked. This would allow sites to be relieved of their NIA 65 insurance liabilities much earlier than at present. ONR would then determine whether the NIA 65 licence can be revoked on the basis that it is no longer needed. Decisions on the circumstances in which particular licence conditions were no longer required would be taken on a site-by site basis based on detailed regulatory guidance.

PRC Project - Overview

The PRC Project is looking to get answers to the following four main questions:

1. "How to" and the implications of earlier "exit" of NIA 65 controls as applied to nuclear site clean-up
2. Once the environment agencies' surrender the site permit, can the nuclear site be used for other (restricted) purposes; if so, what institutional controls need to be in place and who regulates these controls?
3. What changes are needed to the current nuclear site regulatory framework to enable a seamless transition between nuclear safety and security regulations, environmental protection regulations and land use planning controls?
4. What options and benefits could accrue from any regulatory changes?

Summary of PRC Project to Date

The PRC Project has developed a "preferred" option for nuclear site clean-up which adopts a proportionate use of NIA 65 licence conditions, other safety regulation and environmental permit conditions. As the hazard reduces, ONR would regulate with a reduced number of licence conditions up to a point where ONR decides that NIA 65 licence conditions are no longer needed and revokes the licence. Either earlier, or congruently, ONR would consider whether the site clean-up meets the NEA exclusion criteria for nuclear installations undergoing decommissioning and the requirement to have liability insurance under NIA 65 has ended. If licence conditions are no longer needed and the site meets the NEA decommissioning exclusion, ONR could decide that NIA 65 regulation ends earlier than is currently allowed.

At that point site regulation does not end; it is only regulation under NIA 65 that ends. The site will continue to be regulated by the UK Health and Safety Executive, environment agencies, and local planning authorities. For the environment agencies', regulation would continue to the point where the site can demonstrate that the site condition has been returned to a satisfactory state and complies with our nuclear site surrender test –details are in Part II of this paper which also considers EPR 10/RSA 93 regulations ending earlier than is currently allowed.

PART II - ROLES/RESPONSIBILITIES OF THE ENVIRONMENT AGENCIES FOR FINAL SITE CLEAN-UP

Following completion of site clean-up works, a nuclear site operator may apply to the relevant environment agency for all, or part, of a site to be released from radioactive substances regulation³ (RS regulation). The environment agencies' will only agree to release a nuclear site from RS regulation if we are satisfied that radioactive waste disposal has ended and that the site is in a state that will ensure a satisfactory standard of protection for people and the environment in the future.

The scope, extent and aims of clean-up differ for each nuclear site. However, the principles and detailed requirements for protection of people and the environment from radioactivity remaining on or adjacent to nuclear sites are common to all sites. For that reason, the environment agencies' are currently drafting guidance which sets out our detailed "permit surrender" requirements which, if met in full by the site operator, will satisfy our principles. We refer to this Guidance as the environment agencies' Requirements for Revocation, which we shorten to our "GRR Guidance". GRR Requirements are grouped under management requirements (including evidence and documentation), radiological requirements (including risk/dose guidance levels) and technical requirements (including site characterisation, monitoring and record-keeping).

Permit Revocation Criteria in the GRR Guidance

As explained in Part I of this paper, in cases where the licence granted by ONR under NIA 65 can be revoked (possibly, earlier than now), the environment agencies' would be responsible for regulating the final clean-up of the site. EPR 10/RSA 93 regulations would continue to the point where the permit is surrendered and the site is released from RS regulation. At the point the permit is surrendered, the GRR Guidance requires operators to ensure that radiation exposures are optimised and that the assessed residual risk of death or serious injury to the public should be consistent with a risk guidance level of 10^{-6} per year (i.e. 1 in a million per year) – we refer to this as a "risk guidance level".

³ "Release from regulation" being either surrender of the permit under EPR10 in England and Wales, or revocation of an RSA93 authorisation in Scotland.

It will be for site operators to demonstrate that their plans for clean-up meet our risk guidance level, but we acknowledge that meeting our risk guidance level need not entail removal of all radioactive waste or residual contamination. Therefore, subsequent proposals for changes in land use will need to consider whether any residual contamination or waste that remains on the site may be impacted by changes in site use, especially where restricted future uses for the site are proposed (discussed later in this paper).

We use the term “risk guidance level” to describe the assessment standard for natural evolution of the system after site has been released from RSR, because it indicates the standard of environmental safety we are seeking, but does not suggest that there is an absolute requirement for the stated level to be met. The site would also be required to achieve a “Site Reference State⁴” no more than 300 years after the cessation of work with radioactive substances at which point the site would be suitable for unrestricted use. The permit could also be revoked before the Site Reference State was achieved and the site released for restricted use⁵.

If the site operator applies to surrender the permit on the basis of a restricted future use for the site, the environment agencies’ would require the site operator to demonstrate that adequate controls will be put in place to ensure that all our GRR requirements are met, and will continue to be met. Once a site operator surrenders their RS permit, the environment agencies’ have no regulatory controls over any radioactive waste or residual radioactive contamination remaining on the site.

Partial Surrender

An operator may wish to vary the permit to release some land from RS regulation before the whole site has reached a state at which the permit can be surrendered completely. Applications to vary the site boundary so as to release land from RS regulation will need to satisfy the relevant environment agency that the proposed condition of the land is consistent with our GRR requirements for release from RS regulation, and that any contribution this land makes to risks for the site as a whole will not prevent the Site Reference State being achieved at an appropriate time.

Unrestricted & Restricted Future Uses for Nuclear Sites

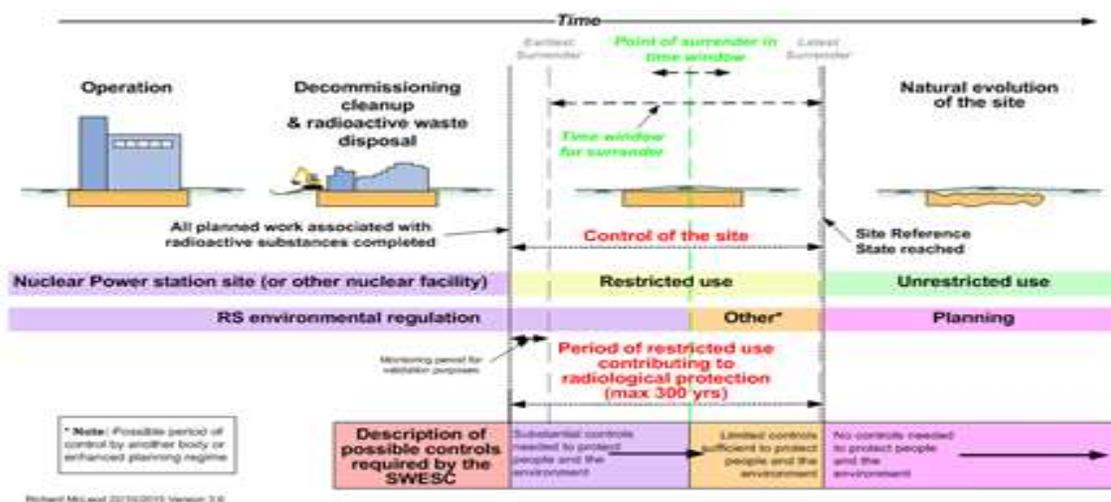
Our GRR Guidance takes account of two main uses for the site following clean-up. The first we refer to as unrestricted use and refers to the site being in a condition at the end of clean-up works that it can be reused immediately for any future use

⁴ Site Reference State marks the boundary between the period of restricted use of a site and a subsequent period of unrestricted use

⁵ Restricted use is a period of time during which controls on a site provide a contribution to radiological protection of people and the environment

including, for example, housing and as a children's' play park. In contrast, on completion of clean-up, a site may require a period of restricted use to provide a contribution to radiological protection of people and the environment until radioactive decay, dilution and dispersion allows unrestricted use of the site. This is illustrated in Figure 3 below.

• Control of nuclear site during and after decommissioning



Regulatory Controls During the Period of Restricted Use

Once an operator has completed all planned work involving radioactive substances, the risks to people and the environment presented by any remaining radioactive substances (in the form of residual contamination, or permitted on-site disposals), may be sufficiently low to allow for immediate unrestricted use of the site. At that point, the site has reached the Site Reference State and can be released from RS regulation as that is, by definition, when our GRR requirements are met without the need for any restrictions or controls.

But, where the risks presented by the radioactive substances remaining on or adjacent to the site do not allow immediate unrestricted use, an operator may propose a period of restricted use. The period of restricted use starts when clean-up works have been completed and ends when the Site Reference State has been met. During this restricted use period, the site may rely on a combination of RS regulatory controls and other land use planning controls. However, at some point before the end of the period of restricted use, the site operator may apply to

surrender the permit. In such cases, restricted use could continue but the site would not rely on RS regulatory controls to protect either human health or the environment. Land use planning controls and other legal instruments could ensure the restricted use continues to be met.

Proposals by the site operator for a period of restricted use would have to demonstrate that the controls provided for this period will be sufficient and can be implemented as planned and maintained.

The extent of any controls during the period of restricted use and their duration will depend on a number of issues, such as the amount of residual activity and its availability in the accessible environment. Our general view is that the more activity left on site at the end of decommissioning and clean-up, the later the release from RS regulatory control and the longer the period of restricted use is likely to be to ensure that the permit surrender requirements set out in our GRR Guidance are met. Because of the major social changes that may take place over long periods of time, it is unlikely that the environment agencies' will accept a claim for a period of restricted use of longer than 300 years from the end of site clean-up works.

To date, the environment agencies' have not regulated any sites under a period of restricted use. This is a new concept for us and has arisen from discussions with the PRC Project and whether restricted use is a new, more proportionate proportionate regulatory approach that can be applied before, during and after nuclear site clean-up. We think it is.

What's included in our GRR Guidance

Our GRR Guidance document describes what the operator of a nuclear site needs to do before the site can be released from RS regulation, in terms of the condition of the site to be achieved and the process by which the site is brought to that condition. It adopts a principles-based approach, involving a fundamental protection objective, a set of principles and more detailed requirements describing how the objective and principles should be met. Our GRR Guidance also (i) outlines the regulatory process through which an operator can, if required, apply for the relevant environment agency's permission for on-site disposals of radioactive waste, (ii) demonstrate that the site will be left in a state that will meet our requirements and, (iii) ultimately, satisfy the relevant environment agency that a site can be released from radioactive substances regulation.

Our fundamental protection objective requires that nuclear sites are brought to a condition where the radiological risks to individual members of the public and the population as a whole are kept as low as reasonably achievable (ALARA) throughout the period of regulation and afterwards. This fully aligns with the International Commission on Radiological Protection principle to ensure optimisation of

radiological protection. Therefore, when deciding if a nuclear site has been brought to the Site Reference State, the environment agencies' have to take into account economic and societal factors, the need to manage radiological risks to other living organisms and any associated non-radiological hazards.

Complying with the GRR Guidance Principles, requirements and Permit Surrender Criteria

To demonstrate conformity with our fundamental protection objective in a manner consistent with our principles and requirements, the nuclear site operator will need to establish and maintain:

- a site-wide environmental safety case (SWESC) demonstrating that people and the environment are, and at all future times will continue to be, adequately protected from the radiological hazard and any non-radiological hazards associated with all the anthropogenic radioactivity remaining on or adjacent to the site; and
- a waste management plan (WMP) setting out the current intent for dealing with this anthropogenic radioactivity. The WMP may be regarded as part of the wider decommissioning and clean-up plan for the site.

The site operator should prepare these documents at the earliest practicable opportunity, and review and, where appropriate, revise them to maintain up to date documentation.

Introduction to the SWESC

In our GRR Guidance, we say that the SWESC should be produced by the site operator and is a "live," evidence-based, document setting out how decommissioning and clean-up work has been undertaken and is planned. The SWESC should explain how human health and the environment is being and will remain to be protected, both, during the period the permit is in place and following its revocation. If satisfied by the site operator claims, the environment agencies' would revoke the RS permit and the site would no longer be subject to RS regulation.

Aims/Outcomes of the SWESC

The SWESC should also describe the state of the site at the time when all planned work on site involving radioactive substances has ceased. That state may, or may not, be the same as the Site Reference State. If not the same, the SWESC should demonstrate how Site Reference State will be reached through natural processes including radioactive decay, dilution and dispersion, within a claimed period of time. During this claimed period of time (the 'period of restricted use'), controls on the use of the site will be needed, but may not be regulated by the environment

agencies'. The SWESC should identify these controls, the organisation responsible for administering these controls and substantiate that they are sufficient.

The environment agencies' will consider the SWESC against the principles and requirements of our GRR Guidance document. Quantitative assessments are likely to be important, but regulatory acceptance will ultimately be based on judgement by the environment agencies' site inspectors. The quantitative and qualitative assessments provided in the SWESC will aid the judgements we make.

Introduction to the WMP

Another requirement is for the site operator to develop and maintain a Waste Management Plan (WMP) as part of its wider decommissioning plans. The WMP should explain how the programme of disposals of radioactive waste will be managed to the point where no further work involving radioactive substances is required to achieve the Site Reference State. The WMP should demonstrate that any proposed on-site disposals of radioactive waste are optimised, and that the plan itself is consistent with the SWESC.

As a minimum the WMP needs to:

- identify all current and prospective disposals of waste on site;
- demonstrate that any proposed on-site disposals of radioactive waste are optimised;
- demonstrate that the disposals are consistent with the evidence and arguments presented in the SWESC; and
- demonstrate an integrated approach to the management of all waste, both radioactive and non-radioactive, over the lifetime of the facility.

Disposal Options for Radioactive Waste

In the decommissioning and clean-up of nuclear sites, UK Government policy recognises that it may not be practicable to remove all radioactive waste and radioactive contamination from a site. Furthermore, Government policy requires operators to consider what options exist for radioactive waste disposal; options include disposal off-site, 'in-situ disposal' (ie leaving contaminated structures where they are in the ground), and disposal on-site (eg actively disposing of radioactive waste by filling voids on a site). All such disposals will require a permit from the relevant environment agency.

In cleaning-up nuclear sites, there is a "trade-off" between the extent of clean-up required and the future use of a nuclear site. When assessing that trade-off, the environment agencies' are obliged to ensure that a reasonable balance is struck between the costs and benefits (health, environmental, societal as well as financial) of any on-site disposal of radioactive waste as compared to its removal and disposal at another off-site location. The environment agencies' are adopting a flexible

approach how we regulate in-situ disposal of radioactive waste and this also contributes to more proportionate regulation of nuclear sites envisaged by DECC in its PRC Project

Past operations at nuclear sites have produced large amounts of radioactive waste. Decommissioning will result in greater amounts, as facilities contaminated by radioactivity are dismantled and demolished. Buried structures, such as foundations, drains and pipes, if they are sufficiently contaminated, will become radioactive waste once they are no longer in use. Although areas of undisturbed ground or groundwater contaminated by radioactivity are not themselves regarded as radioactive waste, their clean-up may produce radioactive waste.

Radioactive contamination not causing a problem could remain where it is and waste could be managed by its disposal on-site where it may serve a useful purpose (eg void filling). Therefore, site operators may wish to make a case that disposal of some decommissioning waste on site represents an optimised solution; that is, one that strikes an appropriate balance between human health, environmental, economic and societal impacts.

PART III – CLEAN-UP OF THE DOUNREAY NUCLEAR SITE

Nuclear site operators are proposing a wide range of future uses for their sites based, primarily, on the redevelopment potential of their sites and the level of clean-up needed to allow redevelopment to take place. For some sites where development land has a high "value", site clean-up seeks to ensure as many foreseeable future uses of the site as possible, ie unrestricted use. However, for some sites, clean-up may only be appropriate for their next planned use or for a restricted use. It will be for development control under the UK land use planning regime to consider the suitability of the site for any subsequent development.

Dounreay

Part III of this paper describes the clean-up work currently taking place at the 140-acre site in Caithness which is the largest nuclear decommissioning project in Scotland and the second largest in the UK, after Sellafield.

Dounreay was once Britain's centre for fast reactor research and development. In 2012, the site owner, the Nuclear Decommissioning Authority (NDA), signed a contract with a consortium of Cavendish Nuclear, CH2MHILL and URS (now called Dounreay Site Restoration limited, DSRL) to complete the closure of the site.

Site Closure

DSRL have said that their objective in decommissioning Dounreay is to close down the site and leave it in a safe condition for future generations.

The completion of clean-up works is known as the Dounreay "interim end state"; the point when all the redundant buildings have been cleaned out and demolished and the radioactive waste made safe for either long-term storage or disposal. Over the last decade, the forecast date for completion of this work has accelerated. In March 2013, DSRL published the new [Site Closure Programme](#) which gave indicative dates that site closure would be during the period 2022-2025. The "final end state", the condition of the site at a date when the site need only be regulated under the land use planning regime, has not yet been decided , but could be many generations hence.

The "interim end state" for the site is the condition it will be left in for future generations. This was the subject of public consultation in March 2007 on a wide range of options for the interim end state. Following this public consultation, the Dounreay Stakeholder Group recommended the site was cleaned-up to be *"a restored site, with early release of land once decommissioning was complete"*.

Clear preference has been expressed for early shrinking of the site boundary to release land for alternative uses - e to support renewable energy development - as well as to show early tangible land restoration. Once clean-up work is completed, parts of the site will be available for appropriate further use. Therefore, the interim end state is geared towards cleaning-up and removing ONR/SEPA regulatory controls from some areas within the existing site boundary on an early timescale. However, some areas of the site (stores containing conditioned radioactive waste and packaged nuclear material) are likely to require on-going safety, security and environmental protection controls beyond the year 2025 "interim end state". These areas will continue to require a NIA 65 licence from ONR and a RS permit from SEPA after the interim end state. However, this does not prevent these areas of the site from being re-used; but, such re-use will need to comply with all ONR/SEPA licence/permit conditions.

Although radioactive contamination remaining in these "regulated" areas may have higher levels of residual radioactive contamination, it is anticipated that they can being managed in-situ through natural attenuation and radioactive decay. At the interim end state, SEPA expects DSRL to apply to surrender those areas of the site that have been clean-up suitable for unrestricted use; in effect a partial surrender of the current permit. Also, at some time in the future, SEPA expects DSRL (or any new operator at that time) to apply to SEPA to surrender the permit that applies to those areas of the site subject to on-going RS regulation. The application is likely to be on the basis of a restricted future use for the Dounreay site. Discussions between SEPA and the land use planning regulator (in this case, Highland Council) are already taking place as to the transition of regulatory controls

and what land use planning controls Highland Council could use to ensure restricted uses of the site continue in the future.

The neighboring Royal Navy facility at Vulcan is excluded from the Dounreay interim end state but Vulcan's end state is expected to be consistent with the Dounreay end state. There is also an engineered disposal facility located near to the Dounreay site that takes solid, low level⁶ radioactive waste. The radiation exposure from both these sites has to be taken into account by DSRL in their SWESC when deciding if all exposures are below the 10^{-6} risk guidance level in the GRR Guidance document.

Dounreay Site Chosen as a "Pilot" to Test the GRR

The environment agencies' have decided to apply the "thinking" set out in Parts I and II of this paper to the on-going clean-up of UK nuclear sites. Dounreay is one of the sites chosen to "road-test" our GRR Guidance document and the opportunities for more proportionate regulatory controls envisaged by the PRC Project.

Conclusions

On-going work led by UK Government and supported by UK nuclear regulators is examining whether proportionate regulatory controls could be applied to UK nuclear sites such that they can be cleaned-up to a condition that would allow their release from NIA 65 and RSA93/EPR 10 regulations earlier than present.

Currently, ONR regulates nuclear site clean-up works through conditions included in licenses granted under NIA 65 and other relevant safety legislation. As the hazard and risk on the site reduces, ONR could regulate under a reduced number of licence conditions leading, eventually, to the licence being revoked. Other work led by UK Government hopes to conclude that nuclear sites could be released earlier from the requirement in NIA 65 for to have (Paris Convention) liability insurance if the site meets the NEA exclusion criteria for decommissioning sites, endorsed in 2014. Ultimately, this could result in all NIA 65 controls being removed much earlier than at present.

If NIA 65 controls were removed earlier, the environment agencies' would be responsible for regulating final clean-up of the site under EPR 10/RSA 93. The site would be cleaned up according to criteria for the surrender of RS permits outlined in the environment agencies' Guidance document currently being drafted. At the point the permit was surrendered, a "risk guidance level" of 10^{-6} per year would apply to any residual exposures of ionising radiation from the site or from other

⁶ Solid low level radioactive waste with activity concentration no greater than radioactive waste having a radioactive content not exceeding 4GBq/te of alpha or 12 GBq/te of beta/gamma activity.

WM2016 Conference, March 6 – 10, 2016, Phoenix, Arizona, USA

facilities near the site. The site would also be required to achieve a "Site Reference State" no more than 300 years after the cessation of work with radioactive substances at which point the site would be suitable for unrestricted use.

The permit could also be surrendered before the Site Reference State was achieved and the site released for restricted use. That would require continued controls; which could include RS regulatory controls and other land use planning controls. At some point before the end of the period of restricted use, the site operator may apply to surrender the permit. In such cases, restricted use could continue but the site would not rely on RS regulatory controls to protect either human health or the environment. To date, the environment agencies' have not regulated any sites under a period of restricted use. This is a new concept for us and has arisen from discussions with the PRC Project and whether restricted use offers, more proportionate proportionate regulatory control before, during and after nuclear site clean-up. We think it does.

All the proportionate regulatory controls outlined in this paper can be used to apply to the clean-up of the Dounreay site and those other sites in the UK being decommissioned or about to be decommissioned.