

## **Regulatory Expectations for Successful Land Quality Management at Nuclear Licensed Sites**

### **Introduction**

This paper has been prepared jointly by the Office for Nuclear Regulation (ONR), the Environment Agency, Natural Resources Wales and the Scottish Environment Protection Agency (SEPA) ('the regulators'). It sets out our overall objective for land quality management (LQM) on nuclear licensed sites in Great Britain. In addition, this paper provides an overview of the regulators' expectations of nuclear site licensees and operators with respect to achieving our LQM objective. These high-level expectations have been produced to promote relevant good practice; importantly, they do not specify regulatory requirements, and are not legally binding on operators.

Note: this paper does not attempt to describe the expectations of other organisations such as local authorities that may also have a statutory interest in this area.

LQM refers to the prevention of land and groundwater contamination, and the remediation (including control and monitoring) of radioactive and non-radioactive contamination on the surface of the ground, in the ground and in groundwater. Therefore, LQM includes management activities that should occur irrespective of whether or not any contamination exists. If there is contamination then LQM activities should include the implementation of proportionate remediation options intended to meet standards that will ultimately not require further specific regulatory controls on the site and will not preclude other beneficial re-use of the land.

Although there is a considerable body of literature and experience associated with the remediation of land contamination, it should be recognised that the waste management and decommissioning policies and regulatory frameworks in the UK and overseas are different and therefore international standards for remediation work may not be the same as those in the UK.

The regulators have developed, or are developing, more detailed requirements and guidance relevant to LQM for the different regulatory regimes. We encourage nuclear site operators to engage early with the regulators to achieve a more detailed understanding of our requirements, and guidance applicable to their sites.

We are always looking for ways to improve our documents and the information contained so that we can make them as useful as possible. If you have any enquiries or suggestions relating to this document please contact us on [ONRenquiries@onr.gsi.gov.uk](mailto:ONRenquiries@onr.gsi.gov.uk).

### **Overall objective of Land Quality Management**

The overall objective of LQM is to take all reasonably practicable measures to prevent contamination and to ensure existing contamination is managed to mitigate safety and environmental risks. This includes ensuring that where contamination exists, proportionate remediation is undertaken to avoid, so far as is reasonably practicable, risks to human health, safety and to the environment for present and future generations.

## **Our expectations for good Land Quality Management**

We expect licensees and operators to manage the land quality at nuclear licensed sites in ways that:

- a) prevent unacceptable activities in terms of land and groundwater protection taking place; and
- b) ensure that any risks to people and the environment associated with land quality are promptly and properly managed.

To do this, we expect licensees and operators to have a robust strategy for the management of land quality at their sites, implemented through a single LQM plan that addresses issues holistically and takes due account of radioactive and non-radioactive substances.

The development of both the strategy and plan should be systematic and the approach to their development and management should be fully integrated and iterative. They should address our expectations that operators should:

- prevent new land contamination, so far as is reasonably practicable;
- understand the land quality and contamination characteristics of the site, so as to inform decisions on land quality management;
- assess the options for LQM taking due account of sustainable development;
- identify and prioritise LQM activities;
- apply the waste management hierarchy;
- avoid the creation of radioactive wastes in forms which may foreclose options for safe and effective long-term waste management
- ensure sufficient and competent resources are allocated to implement LQM activities
- engage with stakeholders (including the regulators) from an early stage;
- develop the safety case / radioactive and non-radioactive waste management arrangements for land quality management;
- ensure that risks are as low as reasonably practicable/achievable (or otherwise minimised as appropriate for non-radioactive contamination); and
- maintain fit-for-purpose land management records and manage relevant knowledge appropriately.

## **Land Quality Management strategy and plan**

Operators should establish a clear vision and strategy for LQM activities, recognising wider activities across the site and ensuring that the objective of LQM at each site is clear, proportionate and agreed with local regulators. As a minimum, the strategy should recognise relevant stakeholder expectations or requirements (including those of the local community) for site management and subsequent re-use of the land, including any agreed interim or final site end states and dates.

The strategy should set out what is to be achieved through LQM, and be supported by a plan that sets out 'how' LQM is delivered. The strategy and plan should work together cohesively such that any change in one is considered in terms of whether it needs to be reflected by a change in the other. The relationship between the two elements (strategy and plan) is vital to ensuring that the various LQM activities work to a common sense of direction or purpose.

There should be a single coherent plan for LQM activities at a site, to be developed and implemented by the licensee and/or operator. The plan should set out key objectives, milestones, timescales and responsibilities, and make clear reference to LQM enabling procedures and arrangements such as record keeping, quality assurance, decision-making and stakeholder engagement. Both the plan and strategy should be subject to appropriate stakeholder engagement and reviewed and updated as necessary at regular intervals.

### **Prevent and limit new contamination**

In the first instance arrangements should be in place to prevent the contamination of land and groundwater. Where contamination has already occurred arrangements should be in place to remediate the contamination, whether on or arising from the nuclear licensed site.

All potential sources of contamination should be designed and maintained to prevent leaks. This means considering both fixed and mobile sources, including those above and below the ground. Priority should be given to those sources that present the highest hazard and risk to land and groundwater. Options for leak prevention could include adoption of non-liquid processes, conversion of waste to a passive solid form, multi-barrier containment, external bunding, pressure detection, and leak detection (at source and receptor).

All potential sources of leaks should, as far as reasonably practicable, have proportionate and effective monitoring systems, including leak detection, which are proportionate to the risks and hazards. Contingency plans should exist, ready for implementation in the event of any leak occurring.

Arrangements should exist to ensure that leakage control and detection systems (including those that form part of any contingency plans) are appropriately tested and maintained.

If new contamination occurs, its effects should be assessed quickly, and appropriate and proportionate remediation undertaken to minimise the impacts on groundwater and land quality. Any leak that is detected should be stopped or otherwise controlled to prevent continuation or recurrence of contamination. Such incidents should be notified / reported to the regulators promptly, recorded, characterised and the risks assessed.

All reasonably practicable measures should be used to minimise the spread of contamination (whether new or existing) and to monitor the extent and consequences of its impacts.

Site-wide arrangements should recognise the possibility of accidents occurring, and should include activities to mitigate and manage leaks and escapes of any contaminants (radioactive or non-radioactive).

## **Understand the land quality characteristics of the site**

The LQM plan should be based on thorough knowledge and understanding of the characteristics of the site and surrounding area, now and in the past, and any contamination that may exist.

The extent of site characterisation (including characterisation of any contaminants) should be sufficient to understand the potential and existing sources of contamination, pathways and receptors. Site characterisation activities should also allow any changes to be managed (including any changes in the influence of external factors on the site e.g. landscape change as a result of coastal erosion or increases in risk of flooding owing to climate change). In the event of any contamination occurring or being suspected, site characterisation activities should allow the behaviour and migration of contamination to be predicted, and an appropriate level of control to be exerted.

Site characterisation should be used to establish a conceptual site model which describes the pathways by which contamination from a source could reach local receptors, and the risks posed to those receptors. This conceptual model should also set out baseline conditions against which any subsequent changes can be reviewed and their potential impacts assessed. Where land quality issues are potentially significant, more detailed characterisation of the source term, pathways and receptors may be necessary. Where appropriate and proportionate this may also include the use of models to aid understanding of the geology, hydro-geology, geochemistry and contaminant transport.

It is essential that immediate characterisation and risk assessment takes place on finding any new contamination, whether due to previously undetected sources or worsening impacts from known sources. Where appropriate, ongoing monitoring of contamination should be carried out.

## **Assess the options for Land Quality Management**

LQM decisions should be informed by an assessment of options for remediation that exist for each land and groundwater contamination source term taking account of the overall remediation strategy for the site. An appropriate level of stakeholder dialogue should occur early in the process of identifying, screening and selecting remediation options.

Option assessment includes consideration of:

- the physico-chemical nature and current state of contaminants;
- the actual or potential risks to people and the environment under current conditions;
- the benefits and detriments that implementation of each option would bring;
- the impact that any delay in implementing the option might have upon the spread of contamination;
- the actual or potential risks, and the costs of any option;
- the nature and volume of wastes that would be generated, and availability of disposal routes;
- the lifecycle impacts<sup>1</sup> on people and the environment;
- the practical issues of implementation associated with each option;
- the intended site end states (interim and/or final); and
- the extent to which each option addresses any concerns raised by stakeholders.

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<sup>1</sup> This should consider both immediate impacts (detriments, including cost, and benefits) of action and broader impacts such as longer term effects and impacts of transferring risk elsewhere, the long-term effectiveness and permanence of the options, and the ability of each option to reduce the toxicity, mobility or volume of contamination through treatment.

## **Prioritise Land Quality Management activities**

The outcome of the assessment of remediation options should be a strategy which should form the basis of a prioritised programme of work to implement the selected option.

LQM activities should integrate fully with other site restoration and waste management activities, both current and future. Unless otherwise justified, contaminated areas of land should be remediated to appropriate standards before any new construction. Where appropriate, opportunities should be taken for remediation when civil works are being undertaken. Plans for other site activities should take account of the potential impact that any new development might have upon any land and groundwater contamination (for example, impacting on local groundwater flows and so changing contaminant migration rates or pathways).

The order in which remediation work is undertaken will generally reflect the risk posed to people and the environment from the area of concern. The highest priority for action should be given to those areas posing the greatest hazard and risk. LQM activities should continue throughout the period that the site remains under regulatory control, including any periods of monitoring.

Any change to planned management activities should be justified and the reasons for the changes clearly recorded.

## **Apply the waste management hierarchy**

LQM plans should avoid the unnecessary generation of waste.

Opportunities to minimise the volume of waste arising from LQM should be explored. For example, this might include consideration of:

- early containment or removal of the source term to minimise spread of contamination and protect groundwater;
- in situ alternatives to excavating material for management as waste (e.g. monitored natural attenuation);
- re-use of excavated material, for example via in-fill or landscaping on site or elsewhere, ensuring that any necessary permit or authorisation is obtained;
- sorting, segregation and treatment of excavated material, where practicable; and
- implementing sentencing arrangements and protocols to exclude or exempt material or waste from regulatory control.

It is also important to consider the potential types and volumes of secondary wastes which may arise from a particular remediation option, in order to minimise these arisings.

Any wastes generated should be managed, stored and disposed of in a safe and environmentally responsible manner.

## **Work with stakeholders**

To ensure achievable, cost effective and acceptable solutions for remediation it is important to identify at an early stage stakeholders with an interest in LQM. Once identified, stakeholders should be engaged in a proportionate way during the development and implementation of LQM plans.

To achieve this, the process of developing LQM plans should be supported by an engagement plan that reflects the range of needs of stakeholders. Early, open, continued and transparent involvement of, and communication with, those with an interest in LQM plans should help develop trust.

Any stakeholder engagement plan needs to include regulators in the assessment, planning and decision-making for LQM. Engagement should occur from the outset, focused on an agreed set of objectives and any hold points that may be appropriate.

## **Develop the safety and waste management arrangements for Land Quality Management**

All land and groundwater contamination should be managed in accordance with an appropriate safety case and waste management arrangements, to demonstrate that risks to operating staff, to other persons and to the environment are avoided, so far as is reasonably practicable.

## **Maintain fit-for-purpose land management records**

Arrangements should be in place to ensure records are made of any leaks and incidents resulting in land and/or groundwater contamination. These should include records of the:

- nature and extent of contamination;
- processes used for deciding management options and the setting of strategies;
- remediation that is being or has been carried out; and
- method for and results of validation of the remediation work.

All records should be kept and updated as necessary.

Care should be taken to ensure that transfer of LQM information between operators, including any contractors, is carried out in a responsible manner, following any transfer in responsibilities at a site.