

A Guide to Closure



Artist's rendition of the IES

This document provides an overview of the Dounreay site closure process, which is facilitated by the Environmental Restoration Programme Plan (ERPP).

It provides the roadmap from decommissioning of facilities to the closure of the site and details the various steps and processes that DSRL will follow in order to take the Dounreay site to its Interim End State (IES) condition.

The condition which the site must meet at IES is summarised in the companion booklet, "A Guide to the Interim End State". The key requirements at IES are:

- Any residual radioactive contamination must meet the 'IES' criteria by Final End State (FES). The criteria is defined as '...any residual radioactivity, above the natural background, which can be satisfactorily demonstrated to pose a risk (of death) less than one in a million per year...'
- Demonstration that all residual contamination (radioactive and non-radioactive) poses an acceptable risk to safety, health or the environment (for the time between Interim and Final End Points and by implication beyond).
- The demonstration of meeting IES criteria is via an Environmental Safety Case, referred to as the Site Closure Environmental Case (SCEC). The ERPP gathers the evidence to underpin the SCEC.

The ERPP begins during the decommissioning of facilities and encompasses a series of activities that must be undertaken:

- Characterisation of land, floor slabs, sub-structures, services and groundwater
- Demolition of structures above floor slab level
- Remediation of land, floor slab, sub-structures, services and groundwater that do not satisfy the IES requirements
- Restoration and landscaping of the site.

Dounreay site closure will be achieved on a zone by zone basis. Zones are grouped and will be cleared in three phases (Figure 1). This allows for an incremental approach to achieving IES, and addresses less contaminated zones first, enabling the process to be proved, lessons learned and confidence built. The more challenging zones can then be undertaken with the benefit of experience and stakeholder confidence.

The processes associated with these activities are defined in a series of checklists, protocols and procedures. Process improvement will be achieved in a variety of ways, including lesson learned reviews, maintenance of an issues database, internal audit and also external audit (by the NDA and other regulators) following completion of each work phase.

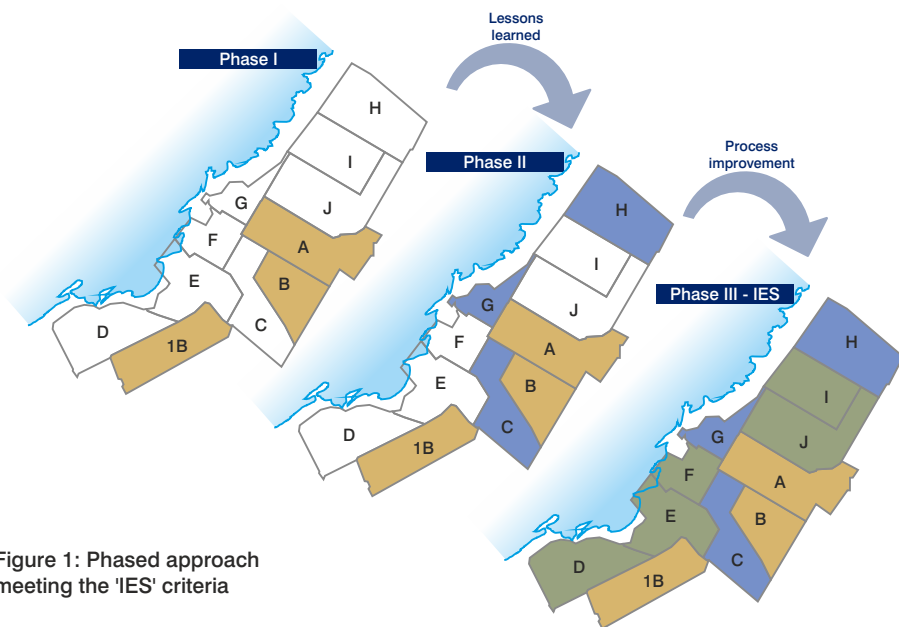


Figure 1: Phased approach meeting the 'IES' criteria



2013



Interim End State

A key requirement for achieving the IES is demonstration that the IES criteria will be met at FES. Decommissioning and demolition will remove the majority of hazards from the Dounreay site, with the subsequent remediation and restoration activities managing the remaining contaminants in the ground, along with sub-surface structures and infrastructure. Restoration will also ensure that the site is left in a physically safe condition, for example holes will be backfilled and the surface landscaped where appropriate.

In order to target remediation activities, a series of clean-up levels for the various contaminants of concern have been developed on the basis that the site will be available for unrestricted use at Final End Point (FEP).

The clean-up levels are the background concentration of each contaminant, plus the acceptable residual contaminant concentration that represents a 10^{-6} per year increased risk of death during unrestricted land use at, or before, FEP. Where more than one contaminant is present then modified Derived Concentration Guideline Levels (DCGLs) are readily calculable to take into account their relative risks.

The DCGLs are calculated for contamination in surface soils. Impacts to groundwater need to be considered now, not at IES or FES, and could drive remedial effort for the site.

Life cycle of closure

There are four distinct stages in the life cycle of the closure:

- **Decommissioning**
- **Demolition**
- **Remediation**
- **Restoration**

Not every building, facility or area of Dounreay will require all four stages, but each stage will require supporting documentation to demonstrate successful completion. Part of that documentation is characterisation information and the ERPP provides the roadmap to optimise data gathering and report generation at each stage in the life cycle.

Characterisation – the key to decision making

Characterisation is the term that describes gathering information about the condition of an area and is performed for different purposes at different stages of the closure project – from decommissioning, through demolition and remediation to restoration (Figure 2). Although data from each stage helps to inform the next step in the life cycle, it may not be suitable to meet the specific drivers of the next stage. The ERPP defines the evidence items from each stage that is required to carry forward to the next stage (Figure 3).

Life cycle characterisation - Drivers				
	Decommissioning	Demolition	Remediation	Restoration
Primary drivers for characterisation	<ul style="list-style-type: none"> • H&S protection • Waste routing 	<ul style="list-style-type: none"> • Waste routing • H&S protection • End State scoping 	<ul style="list-style-type: none"> • End State attainment • Waste routing • H&S protection 	End State demonstration
Primary objectives of characterisation	Safe removal & disposal of high active components and process equipment	Compliant routing of low activity building demolition waste	Removal of land and treatment of groundwater above the clean up levels	Assurance that no contamination is re-introduced through imported material
Primary media being characterised	<ul style="list-style-type: none"> • Components • Process residues • Process areas 	<ul style="list-style-type: none"> • Building debris • Concrete slabs 	<ul style="list-style-type: none"> • Concrete slabs • Land • Groundwater 	Land contouring material
Primary characterisation techniques	<ul style="list-style-type: none"> • Hand held rad surveys <ul style="list-style-type: none"> • NDA • (High LoD) 	<ul style="list-style-type: none"> • Hand held rad surveys • Chemical PID • NDA of cores • (Low LoD) 	<ul style="list-style-type: none"> • Hand held rad surveys • Drive over rad surveys • Chemical lab analysis • (Low LoD) 	Verification of supplier QC processes
Primary waste types	ILW / LLW / OOS	LLW / OOS	LLW / OOS	None

Figure 2: Life cycle characterisation – Drivers

Life cycle characterisation - Process

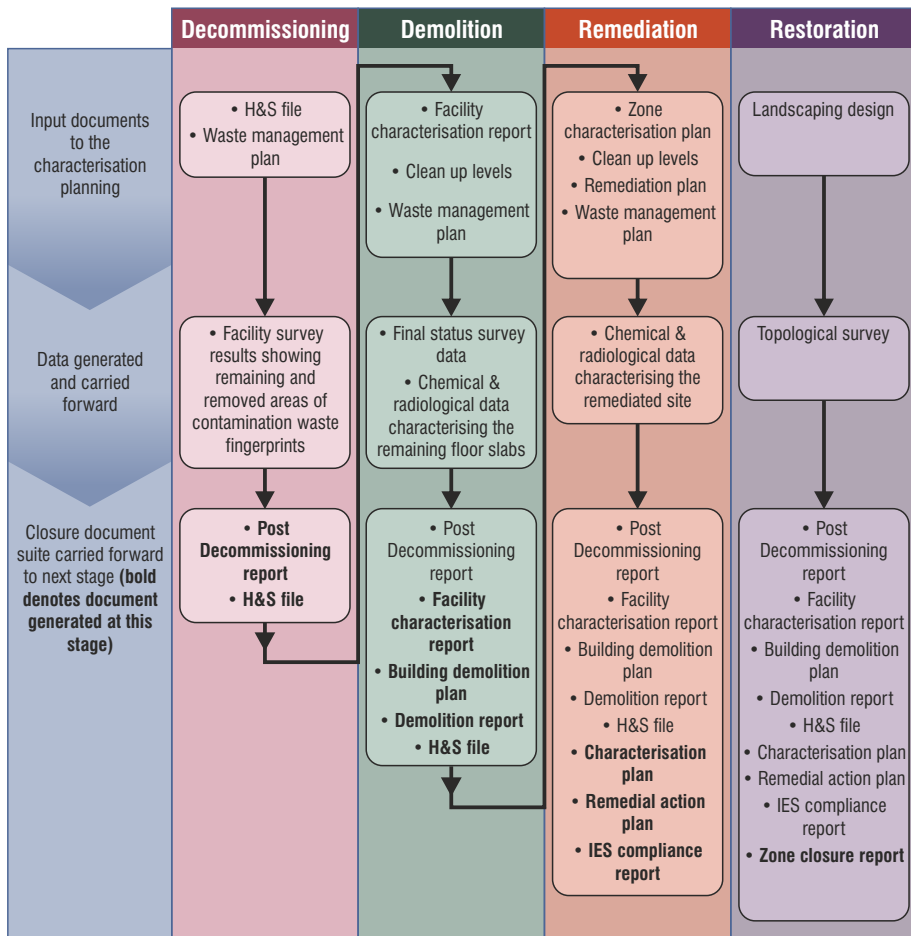


Figure 3: Life cycle characterisation

Study Areas

Some zones may be too complex to be addressed as a single area for the purposes of characterisation and closure, either due to contaminants present or to the scheduling aspects of the work. These will be sub-divided into study areas as defined by the configuration and layout of different facilities, infrastructure and areas of contaminated ground – some zones will have a single study area and others may have several. Once the zone has been split into these study areas, each study area will be characterised in order to demonstrate it meets, or complies with, the site end state requirements.

The build-up of evidentiary documentation for each study area in the zone will substantiate the completion of the whole zone.

Determining the appropriate level of activity for each study area requires a systematic evaluation of relevant information emerging from the demolition, remediation and restoration phases. A structured set of questions must be answered at different stages of the closure life-cycle. These questions help to determine the appropriate next steps – whether extensive characterisation is required, what type of sampling is suitable, whether an Interim End State Compliance report can be prepared. The characterisation process is shown in Figure 4.

Characterisation - Process

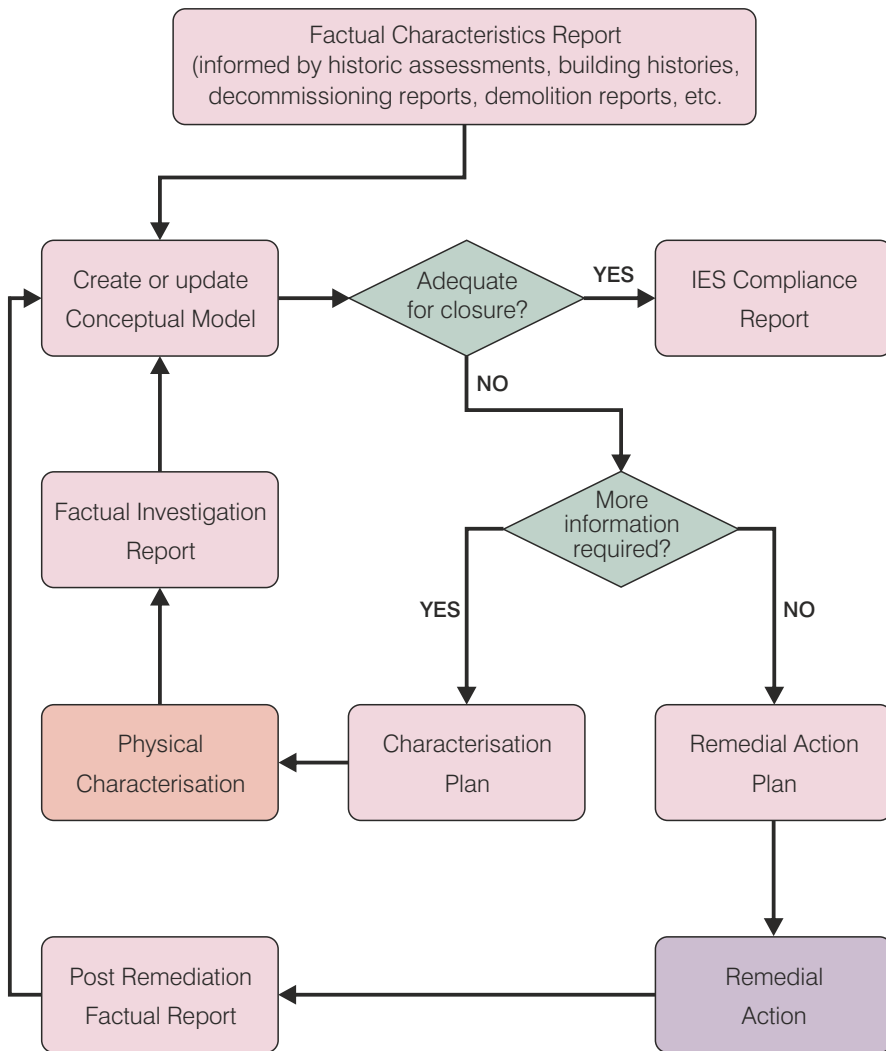


Figure 4: Structured questioning during the characterisation life-cycle

Work scope through the stages

Decommissioning

Decommissioning removes the majority of the hazards associated with the plants and facilities on the Dounreay site, and is undertaken by the decommissioning projects. The ERPP provides the process to reach IES, following completion of decommissioning.

The decommissioning projects ensure that any residual contamination left in-situ, e.g. associated with floor slabs and sub-surface infrastructure, meets the no danger criteria. The ERPP provides processes to support decommissioning with appropriate characterisation. Initial characterisation of a facility is undertaken as soon as is reasonably practicable in order to confirm if there is any contamination that exceeds the IES requirements, and also the mixture of radiological contamination present. The latter information confirms the clean-up criteria for the facility. While the responsibility for remediation of floor slabs and sub-surface infrastructure rests with the decommissioning projects, it may be deferred until remediation of the surrounding land is undertaken.

Demolition

The process of demolition is defined as the removal of structures to their foundation plinth. Residual hazards associated with building structures will be removed at this time, e.g. asbestos cladding. It is the decision of the decommissioning project teams whether they will carry out the demolition of the facility, or if it will be handed over to a demolition project team.

Remediation

The primary purpose of remediation is to remove remaining contaminants from the ground, sub-surface structures and infrastructure, such that the average levels of any residual contamination meet the IES criteria.

Characterisation will have determined the extent and form of the contamination that exceeds the IES criteria. Where this characterisation process has identified the need for remediation, a Remedial Action Plan will be developed. If no remediation is required in a study area, an Interim End State Compliance Report will be prepared after the remedial options have been assessed.

During remediation, characterisation will be on-going to assess whether the operation is progressing as planned or adjustments are warranted, for example to increase or decrease the extents of excavation. The final step of remediation is to backfill the excavation. A backfill specification will be developed to ensure that backfill materials satisfy the no danger criteria.

Restoration

The restoration phase defines what the site will look like during IES. Restoration will involve contouring the surface and soft landscaping. In practice, backfilling will be designed and implemented as part of the remediation of individual study areas. Landscaping will be phased as appropriate.

The surface of disturbed land (which excludes land left at the level of foundation plinths or roads) is to be coated with top soil and reseeded with native vegetation, in order to blend with the local environment. This surface will be contoured to be consistent with the drainage system on site. The restoration must comply with the Local Planning Authority requirements for any reasonable future use of the site.

Interim End State compliance

Once characterisation has confirmed that the residual contamination satisfies the no danger criteria, an Interim End State (IES) compliance report will be prepared. This report might be prepared following initial characterisation of an area, or following remediation and associated verification. It is noted that in some instances, residual contamination within a study area may exceed the clean-up criteria, but across the entire zone the IES criteria may be achieved. The IES Compliance Reports will underpin the determination that residual contamination is considered suitable to meet the IES.

Zone closure

After remediation and restoration have been carried out satisfactorily in each study area within a zone, the requirement for Zone Closure will be met. Zone Closure reports will be produced once a zone is ready for closure and provide the evidence that no further remedial action is required to meet the IES. These reports are the primary reference for the Site Closure Environmental Case, and will be underpinned by the Interim End State Compliance reports for each of the study areas within the Zone.

The suite of documents that underpins the Interim End State compliance reports and Zone Closure reports is pre-defined for consistency, efficiency, and ease of review. Templates ensure that expectations are clear and document preparation is as streamlined as feasible (Figure 5).

On a complex site like Dounrey many organisations are involved in the closure process and different work teams perform different tasks at different stages in the closure process. To ensure a one-time-through work and documentation process, the ERPP defines handover packs as work activities change from team to team (Figure 6).

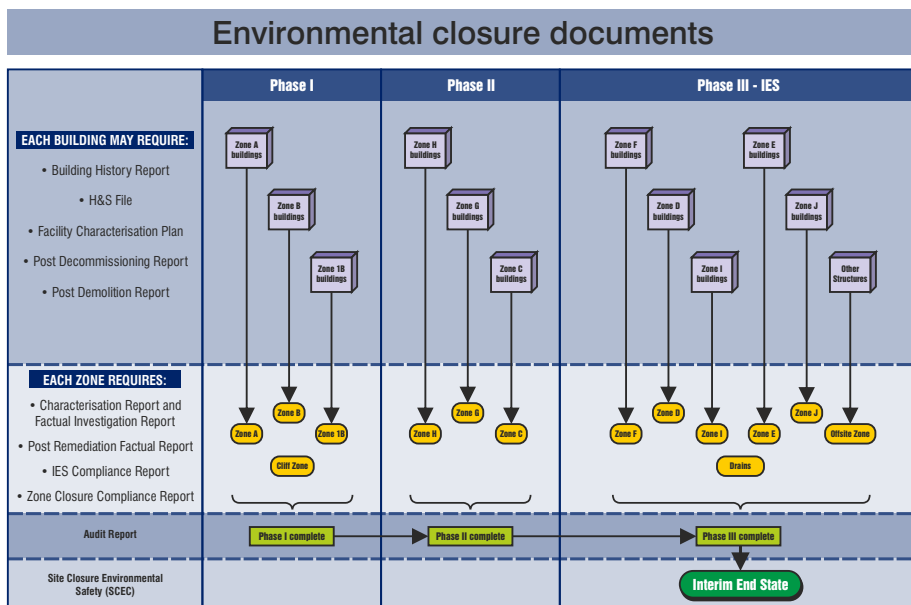


Figure 5: Pre-defined suite of documents to demonstrate closure

Demonstrating Closure

Readiness for closure is demonstrated by the completion of the relevant body of technical reports defined by the ERPP. On completion of the various activities outlined above, demonstrating to the NDA, the Regulators and the public that the IES requirements have been satisfied will be critical. The ERPP therefore pre-defines evidence documents that must be completed for each of the key processes described above.

Templates for these evidence documents are provided within the ERPP. All of the phases to IES involve handover documentation which will build together to provide the evidence the site has met the IES conditions. This evidence matrix will be provided to the NDA for review and their final agreement that IES has been achieved.

These evidence documents will continue to be of importance beyond IES. In combination with land condition reports produced post-IES they will support future revocation of Radioactive Substances Act 1993 authorisations and ultimately de-licensing of the nuclear site. Management of these records post-IES currently rests with the NDA.

The key closure documents are Interim End State Compliance reports, Zone Closure Compliance Reports and their supporting information

Relationship between closure stage, handover packs and evidentiary documents

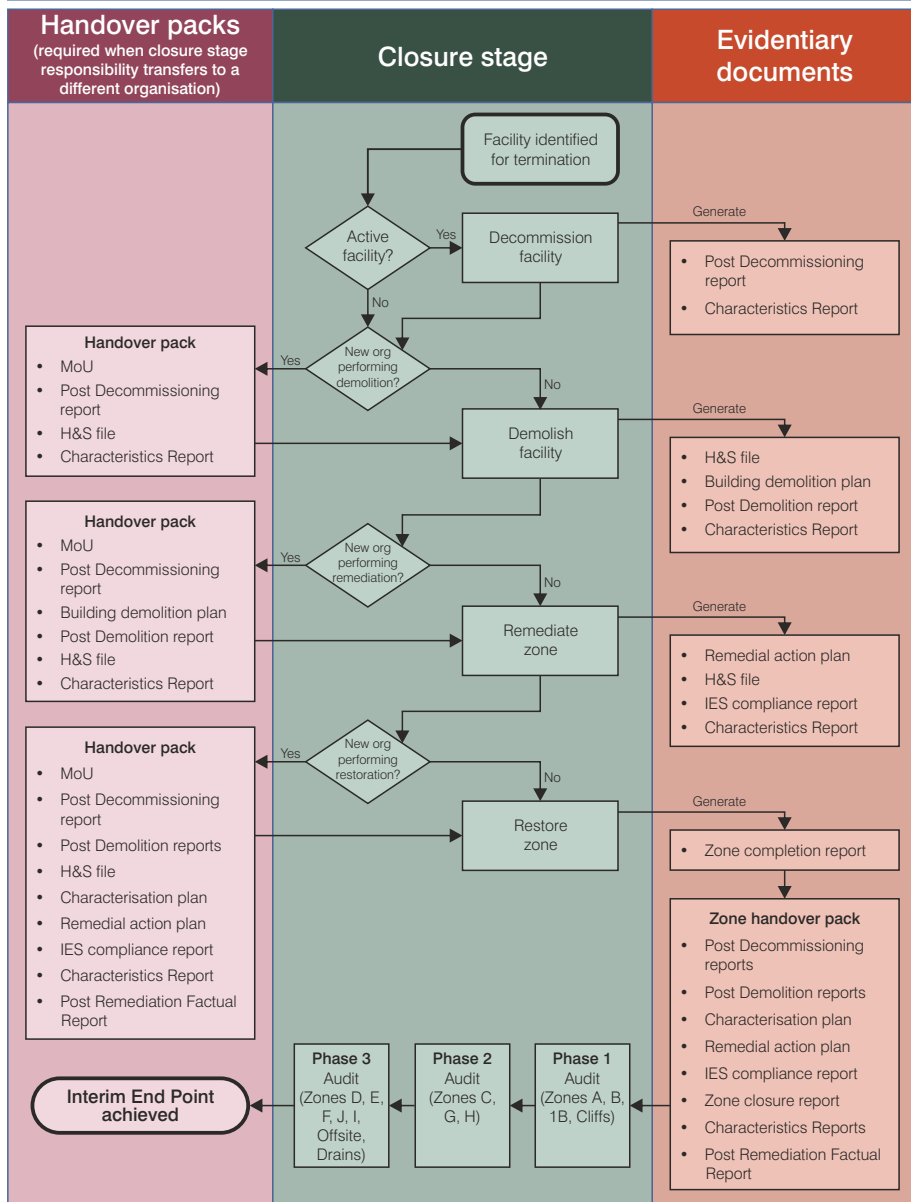


Figure 6: Handover packs between work teams ensures one-time-through documentation

Waste

Waste management is an important aspect of the site closure process, and it is important to note that there is a legal requirement to comply with the Waste Hierarchy, and this will be applied across all projects on site, whether they are dealing with decommissioning, demolition or remediation.

If materials are being reused, suitable characterisation is required to demonstrate Interim End State (IES) compliance and documented evidence of this must be retained for use in Interim End State Compliance reports and Zone Closure report. These materials must be fit for purpose. The ERPP provides a mechanism for recording the reuse of materials left on site.

Health and Safety

DSRL's primary health, safety and environmental objectives are to:

- Achieve the highest standards of health and safety performance through the minimisation of risk
- Minimise the environmental impact of our activities in terms of resource consumption pollution and the generation of waste
- Exceed the expectations of our customers and stakeholders

To achieve these goals, DSRL are committed to:

- Ensure that all personnel are Suitably Qualified and Experienced (SQEP) to carry out work and are fully aware of their duties and responsibilities
- Ensure that all necessary controls are identified and implemented for the safety of employees, the public and the protection of the local environment
- Ensure that all relevant stakeholders are involved in consultation, planning, organisation and management.

As part of the Health and Safety process, the Construction (Design & Management) Regulations (CDM) affects all projects on site. CDM is a frame work to ensure communication and collaboration between the relevant parties, as well as being a legal requirement. It aims to prevent accidents, promote health and safety and also provide a framework for forward planning within the project.

Interim End State to Final Closure

The environmental closure process will take the site to its IES condition. After the Interim End Point (IEP), the site will continue to be managed, maintained and monitored, until FEP. Environmental monitoring will document the site conditions relative to the Final End State and quality criteria. Other Final End State criteria include the removal of remaining radiological waste and stores. The site reaches final closure when the Final End State conditions are achieved, completing the site closure process.



A Guide to Closure