



Policy, Strategy and Risk Assessment Methods for Sustainable Waste Management during Nuclear Site Regeneration

Dr Andrew Fairhurst

01 December 2022

Nuclear Decommissioning Authority



About us

- We're charged, on behalf of government, with the mission to clean-up the UK's earliest nuclear sites safely, securely and cost effectively
- We're committed to overcoming the challenges of nuclear clean-up and decommissioning, leaving the 17 nuclear sites ready for their next use
- We do this work with care for our people, communities and the environment, with safety, as always, our number one priority



Outline

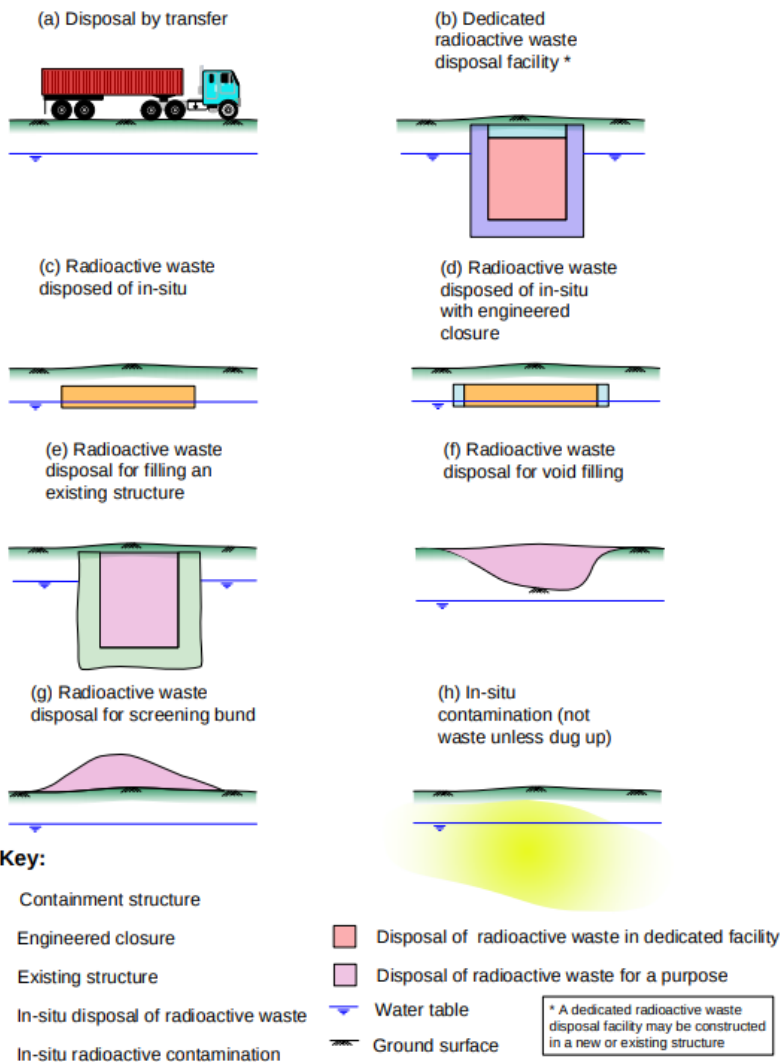
- Site end states
- Waste management options available in the UK
- Decision making
- Policy, strategy and regulation
- Work in progress
- Case studies

Site End State

The condition to which the site (land, structures and infrastructure) will be taken at the end of the decommissioning process

- It must be:
 - Safe
 - Sustainable
 - Publicly acceptable
- Enable beneficial reuse as early as possible
- Controls may be used to protect people and the environment from residual hazards where necessary
- Assumptions at this stage due to future uncertainty. Enough to set direction and focus future work

Waste Management Options in the UK



Sustainable waste management

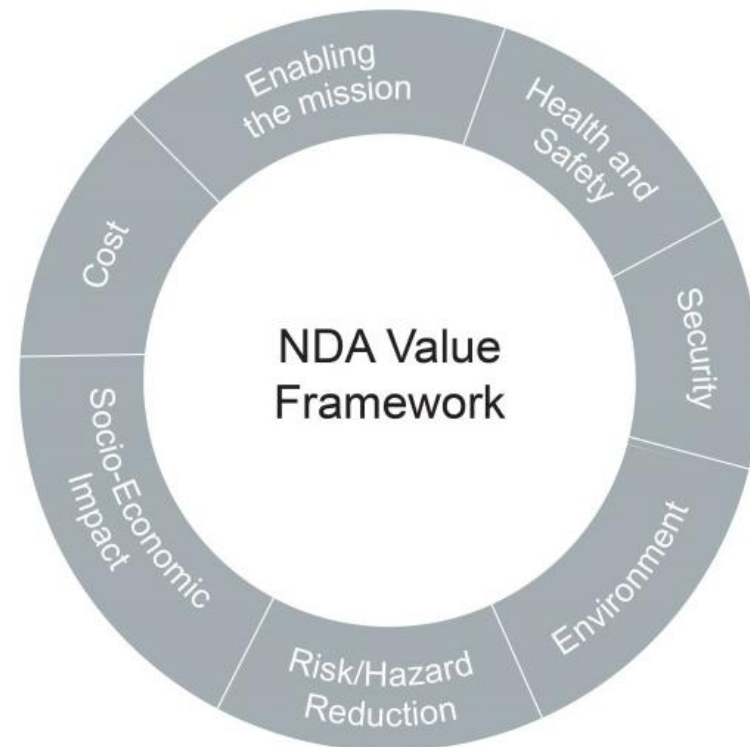
- Environment Agency guidance ("GRR") introduces the relatively new concepts of disposal in situ (not the same as entombment) and disposal for a purpose
- Disposal in situ describes the approach for managing structures that remain once decommissioning and clean-up has finished - UK law requires that residual structures are classed as waste if they are radioactively contaminated
- Disposal for a purpose may be used to backfill features or voids or potentially for landscaping purposes
- On site disposal will be a planned, demonstrably optimal solution supported by a safety case
- Disposal may require a period of control before site is suitable for unrestricted use

Potential waste management options - Management of radioactive waste from decommissioning of nuclear sites: Guidance on Requirements for Release from Radioactive Substances Regulation Version 1.0: July 2018

Decision Making

Case by case decision making

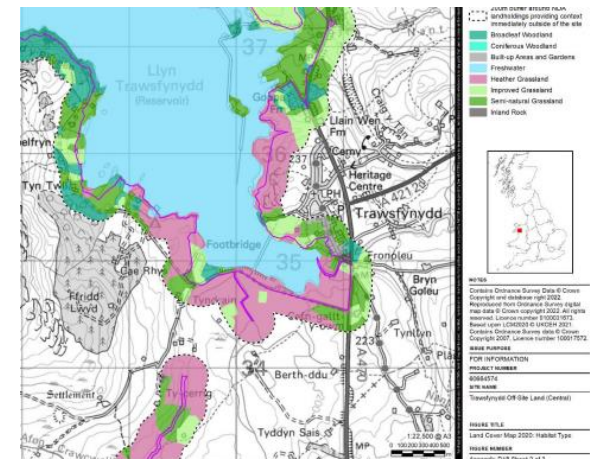
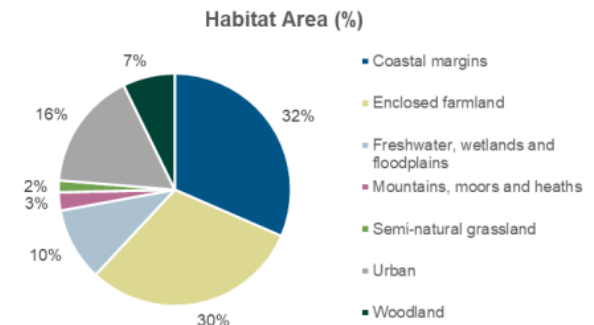
- Is the selected waste management solution safe?
- What is the balance between controls, physical state and next use?
- Is the solution optimal in the broadest sense? (taking account of all sources of risk and of lifecycle impacts on environment, society and economy)
 - Less well understood
 - Social value
 - Circular economy
 - Commitment to biodiversity net gain / natural capital
 - The importance of non-radiological and conventional risks
- NDA uses the Value Framework



Decision Making

Site-specific and case-specific

- Land value varies (commercial and social)
- Differing community requirements
- Different political and legislative regimes
- Different environmental sensitivities (aquifers, coastal erosion, etc.)
- Local resources and opportunities



Policy, Strategy and Regulation

What is changing

Policy

- Broad adoption of sustainability into nuclear decommissioning and local government

Strategy

- Building the interfaces between decommissioning, site end states, land use and community / national requirements

Regulation

- Changes to the Nuclear Installations Act
- Environment Agencies development of “Guidance on Requirements for Release from Radioactive Substance Regulation” published 2018
- Developing guidance on planning aspects of waste management

Work in Progress

An iterative and developing approach

Managing uncertainties

- Working to manage uncertainty better, adopting proportionality into uncertainty modelling parameters (e.g. climate change)

Site stewardship

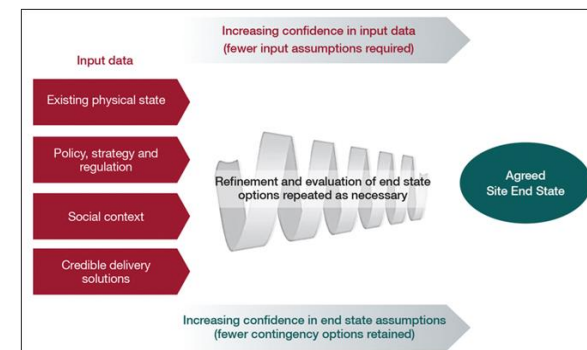
- Understanding our commitments to long term site stewardship and appetite for risk in relation to re-work

Managing unknown unknowns

- Establishing strategy and management approaches to robustly address future unknowns, e.g. contaminants of emerging concern

Societal change

- How we manage societal change and its consequences
- This must all feed an iterative approach.....



Work in Progress

Case studies

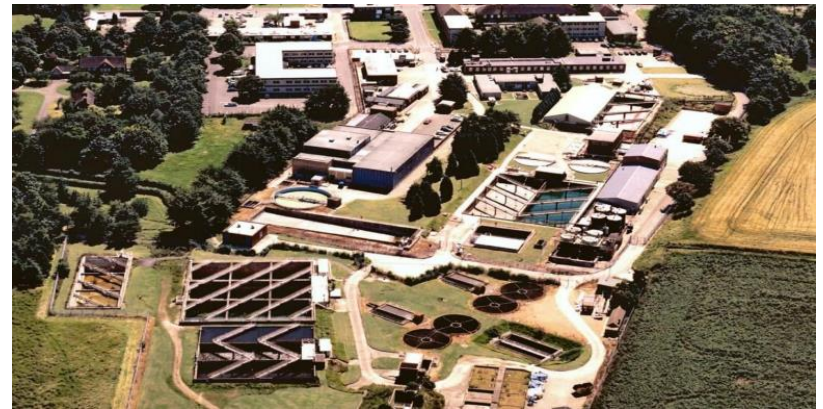
Work is progressing at Winfrith, Dounreay and Trawsfynydd amongst other sites:

1. End state definition:
 - Embedding 'how to do it'
2. 'So what':
 - Working on interfaces with land use, decommissioning and establishing a programmatic approach with change control
3. 'What if':
 - Looking at the resilience of assumptions and confidence in approaches to build into the 'so what' stage

Harwell Case Study

Liquid effluent treatment plant land remediation project

- 2018 - 2022
- Strong commercial drivers on valuable land
- Environment Agency “Guidance on Requirements for Release from Radioactive Substance Regulation” not yet published
- Expectation to fully clear the site to ‘no danger’



Harwell Case Study

Waste management overview

- 26 zones with unique fingerprints
- 96,926 tonnes of waste
- 79,480 1m³ bags
- Wastes classified following assay:
 - 69.9% in scope of regulations – 5,733 lorry movements
 - 30.1% out of scope of regulations – 1,240 skip transfers
- Balancing costs, environmental impact and land demand, was this the right decision?



Winfrith Case Study

Context

- Reactor research site
- Limited commercial reuse
- Environment Agency “Guidance on Requirements for Release from Radioactive Substance Regulation” now published
- Deep subsurface structures means there is a deficit of material
- Sites of Special Scientific Interest
- Shallow groundwater

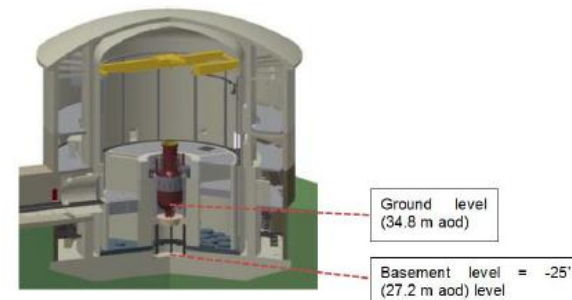


Winfrith Case Study

Direction of travel

A Value Framework assessment suggests leaving below ground structures and Disposal for a Purpose is preferable because:

- “Safe” leave it where it is (radiological protection)
- Risk to workers of removing contamination (e.g. scabbling in confined spaces)
- Volume of waste arising and risks associated with transportation
- Enables restoration to a preferred next use of “open access heathland”
- Limited commercial re-use drivers
- Challenges remain, e.g. groundwater, disposal for purpose case, stockpiling, long term controls





Conclusions



What is safe vs. What is optimal

Waste management is framed by what is safe. An environmental safety case must be made

Optimisation is more than radiological protection:

- Environmental cost
- Worker and public safety from operations
- Social value
- Reuse of materials and assets (circular economy)
- Intergenerational equity



Work is progressing on making these optimal decisions and being used to refine policy and strategy. There is more to do.