Examples and lessons learnt in sustainability-based decision making for decommissioning and radioactive waste

Ellanor Joyce – NRS End State Manager

Nov 2023

NDA | NRS Nuclear Restoration Services

Winfrith – past, present and future

- Established in 1957 as a nuclear power research and development centre.
- Nine experimental reactors and numerous laboratories.
- Operations ceased early 1990s
- Significant progress in decommissioning
  - 7 reactors and majority of buildings decommissioned
  - Areas of land have been progressively released from nuclear regulation
- DRAGON, the Steam Generating Heavy Water Reactor (SGHWR) and liquid effluent system remain
  - ILW processing facilities in construction
  - Reactor core removal systems and processing facilities in construction
- Where next - Delivering the NDA and NRS missions
- *'Heathland with public access of amenity value to the local community…'*

Defining optimised approach to decommissioning and waste management

How do we deliver the next planned land use?

- Assess available options using a range of attributes
- Decision making with input from the local community
- **Balance benefits and detriments / risks in short and long term**

Winfrith Sea Discharge Pipeline

Construction

- Installed 1959/60, currently in use for effluent discharge
- Continuous welded
- Bitumen and asbestos coating
- Cathodic protection to inhibit corrosion
- 4 pipes, 12 valve pits, 2 ancillary structures

Terrestrial pipeline = 9.7km

- Constructed at 1.2m – 4.6m below ground level
- Bitumen and asbestos coating

Marine pipeline = 3.7km

- Discharge into restricted area of English Channel

The pipeline

Shallow Pipeline

Pipeline installed at approximately 1.2m below ground level through majority of length (circa 1960)

Current land use

- Arable farming, limited housing, roads, private estate (wedding and festival venue), business park

Next land use

- Planning application for 500+ houses to meet local needs
- On-going arable use including ploughing

Deep Pipeline

Crosses Ministry of Defence Lulworth tank firing range

Pipeline 2.4 - 4.6m below ground level

Restricted future development (firing range and pastoral only)

Remains in use as live firing range

Restricted operational access (6 weeks/yr)

Marine Pipeline

In MoD exclusion zone

Surface laid and concrete weighted

Annual maintenance required to keep in position

Restricted access (6 weeks/yr)

Options assessment

Required by Environmental Permit and GRR

Held a multi-stage process over 18 months

- Included landowners, tenants, regulators, and other external parties
- Technical assessment
- External assessment

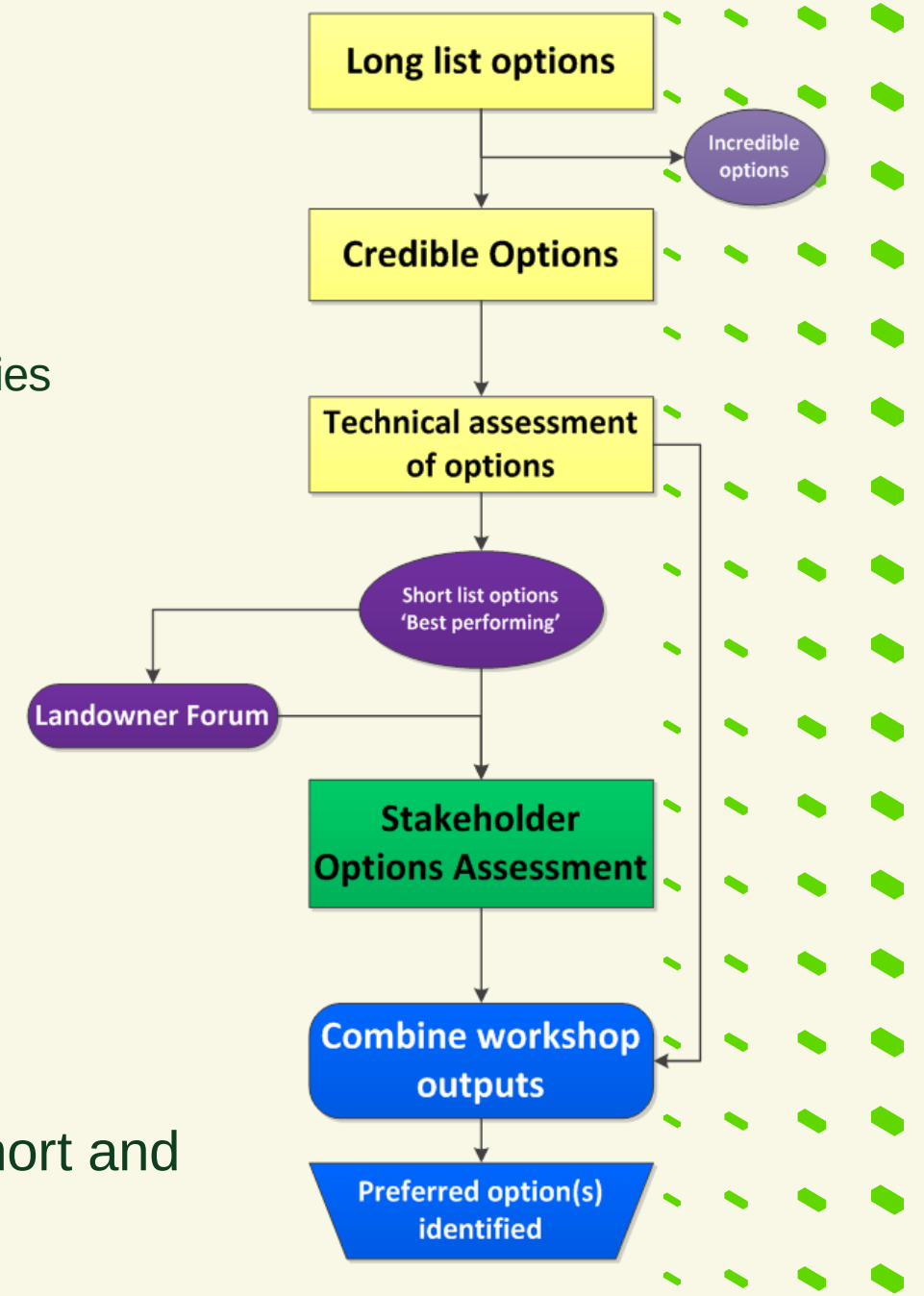
Sub-divided into zones

- By Landowner, current / planned land use and hazard
- Identify best option for each zone

Lessons learned from other sites and industries

- Soil erosion loss of 1m+ in some areas
- Contamination distribution is heterogenous
- Development restrictions are very difficult to enforce

Process sought to balance benefits and detriments in short and long term to identify overall most sustainable approach



Shallow Pipeline

In situ disposal

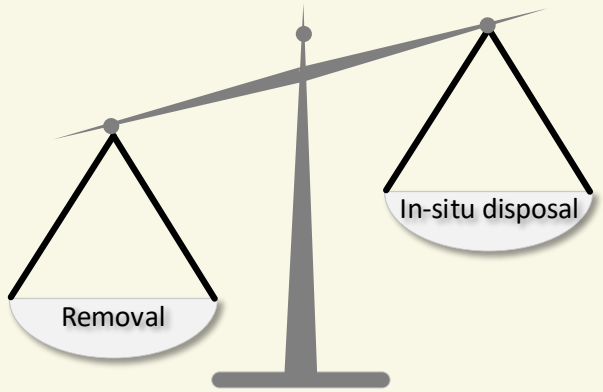
Benefits	Detriments
Minimises off-site disposal, saves disposal capacity	**Restricts future / next land use (blight)**
Minimises road transports and carbon footprint	Risk of human intrusion (radiological /asbestos)
Cost saving	Technical challenge to characterise

Removal

Benefits	Detriments
Unrestricted land use	**Carbon footprint, road transports, impact on national disposal capacity**
Eliminates long term risks to humans and environment	Cost
Removes subsidence risk	Worker safety

Removal preferred on balance as

- Eliminates long-term liability (human intrusion / asbestos) and reputational risk
- Allows unrestricted development – lessons learned from other sites…

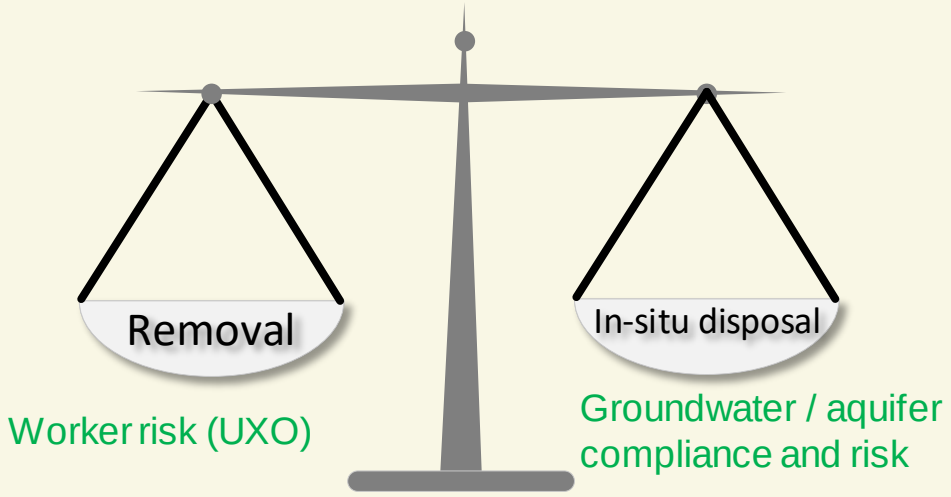


Deep Pipeline

Construction depth and land use modifies longer term risk

- In-situ disposal – deeper burial decreases risk of human intrusion, restricted access to area due to operations, restricted next planned land use
- Removal – Higher hazard to operatives from removal due to unexploded ordnance

Decision – further information to inform options appraisal



Marine Pipeline

Removal

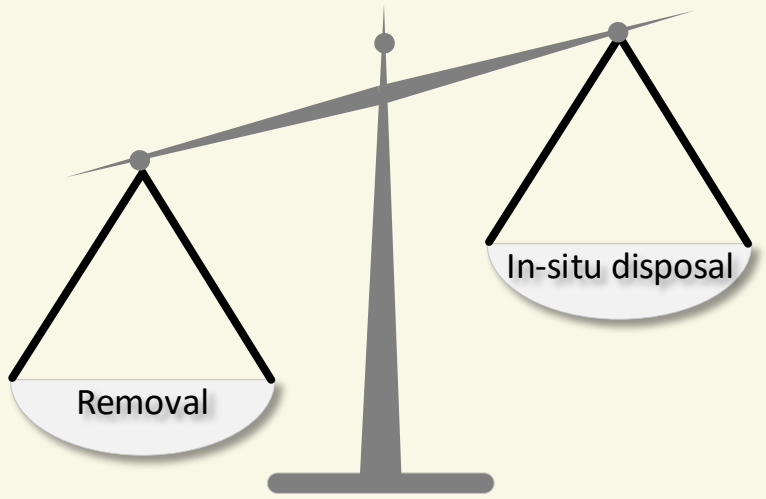
Benefits	Detriments
Eliminates long term risks to marine traffic	**Habitat loss**
Consistent with policy for oil and gas	Cost
	Waste transport, disposal, impact on disposal capacity

In-situ disposal

Benefits	Detriments
Minimises off-site disposal, saves disposal capacity	**On-going maintenance cost and risk to workers**
Minimises road transports and carbon footprint	Environmental and reputational risk
	Technical challenge to characterise

Removal preferred, on balance as

- On-going costs to maintain waste would be significant
- Risk to marine operations
- Reputational risk



Challenges and lessons learnt

No one size fits all – different locations / configurations may change outcomes

Stakeholder and community engagement

- Communities and landowners willing to consider in-situ disposal, if engaged early and included in decision making
- ‘Nuclear timescales’ between decisions and delivery leading to fatigue
- Early strategy decisions may not be reflected in changing communities
- Scope of community input potentially restricted by regulatory and technical constraints
- Community / landowner views can be difficult to quantify in assessments
- Takes significant time to explain technical aspects and decision-making process

Organisational mindset

- Pre-application proactive stakeholder engagement
- New disciplines / skill sets – resource pool
- Decommissioning → disposal: early decisions needed to minimise nugatory work

Integrated regulation

- Complex and overlapping regimes for same waste disposal operation

Winfrith AEA - Arish Mell Radioactive Effluent Sea-Disposal Pipeline - YouTube

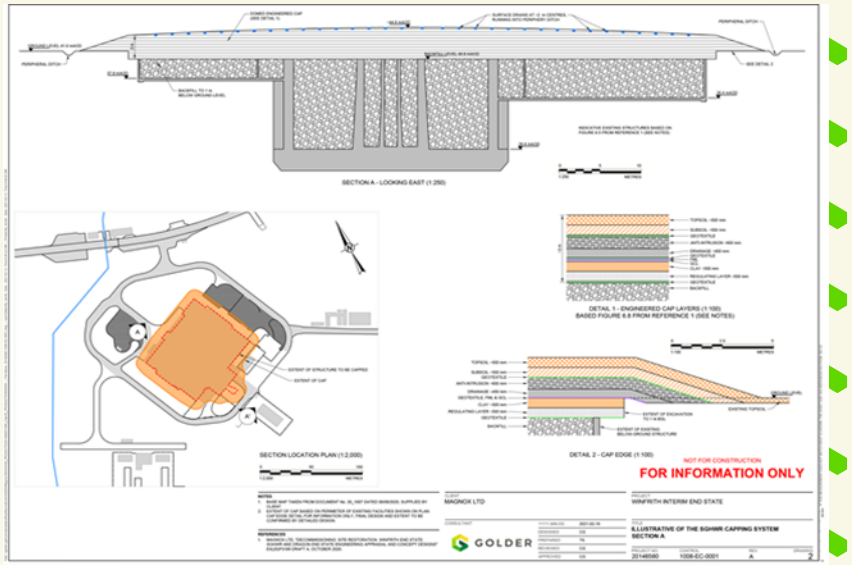
Assessing on-site disposals

Benefits

- Minimises road transports and carbon footprint (6000 lorries)
- Allows next planned land use
- Minimises worker risk
- Minimises impact on habitats
- Preserves national disposal capacity

Potential risks

- Long term, very low levels of radioactivity from disposal (below GRR thresholds)
- Alkaline backfill in acidic designated habitats



Site	End State	Total Activity (TBq)
Winfrith	*SGHWR*	*0.3*
	Dragon	*0.005*
	Total	*0.3*
Lillyhall	Full facility	5
Dounreay NLLWF	Full facility	15
Clifton Marsh	Full facility	80
ENMRF	Full facility	90
LLWR	Full facility	22000


30/09/2014


03/04/2014


22 06 2017


23 07 2018


10 07 2017


28 06 2017