Case Study:

Restoring Complex Sites

SAFESPUR - Harwell

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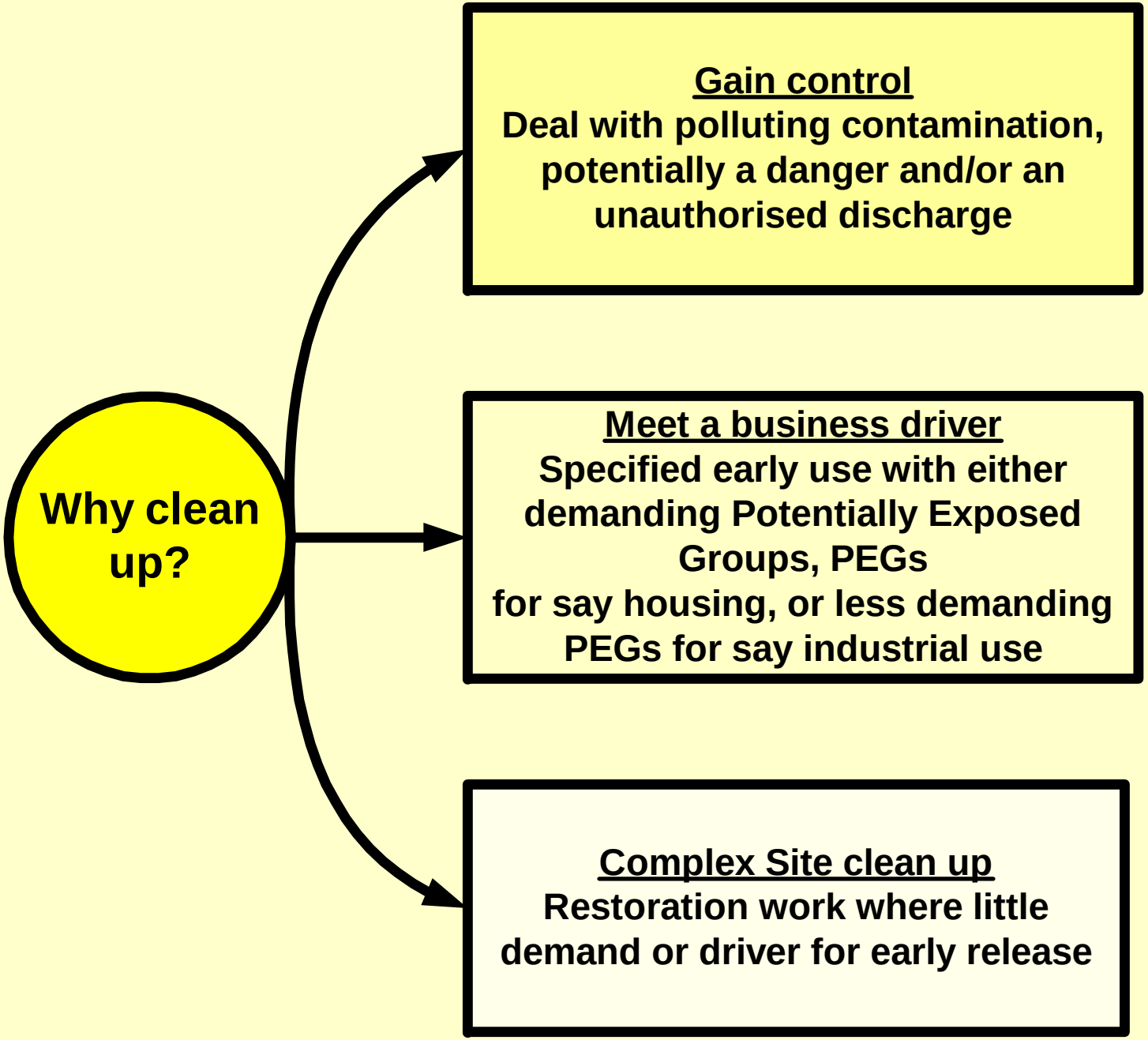
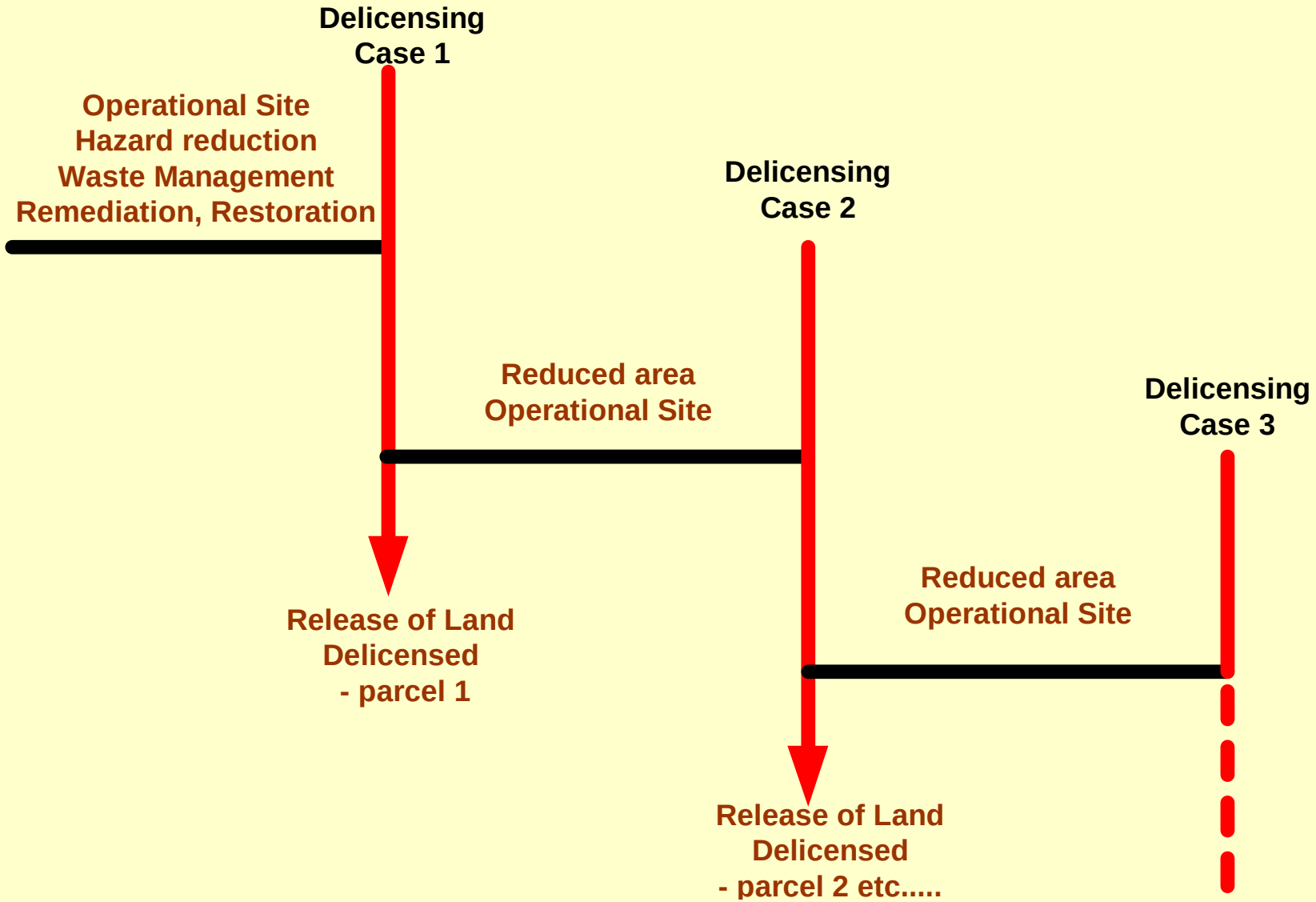

Why clean up?
Gain control
Deal with polluting contamination, potentially a danger and/or an unauthorised discharge
Meet a business driver
Specified early use with either demanding Potentially Exposed Groups, PEGs
for say housing, or less demanding PEGs for say industrial use
Complex Site clean up
Restoration work where little demand or driver for early release

UK practice so far generally restricted to delicensing easily delicensable parcels of land



De-licensing process on parcels of land with little contamination compared with complex sites

- ONR defined de-licensing requirements as:
  - no licensable activities
  - no danger from ionising radiation

- No danger is risk of death of 10^{-6}/a for member of public, and risk are shown to be ALARP *(As Low As Is Reasonably Practicable – ONR Delicensing Guidance – further reduction in risk would not be feasible at a reasonable cost, given the low magnitude of the risk)*

- Where contamination levels <IAEA Safety Guide on Exclusion, Exemption and Clearance values then site should meet 10^{-6} criterion *(IAEA RS-G-1.7)*

- If contamination >IAEA values then risk assessment needed. If estimated dose levels <10uSv/yr then demonstrates land meets de-licensing criteria.

What are Complex Sites in this context?

Differences between such sites from those being delicensed now?

- Significant ground rad/non-rad contamination
- Maybe continuing pollution, or the potential for pollution
- Still operational, with long-term nuclear use
- No commercial driver to release land early, or perhaps ever!
- Extent of contamination not fully known

What does this mean?

- No driver to go that extra mile in clean-up in order to sell
- Whilst remain legal and meet all regulatory obligations, can optimise clean-up to ensure clean-up costs controlled
- May lead to Interim Points along journey to end state

End State vision

- End state and end use
- Restrictions on land use beyond the end point
- Long-term waste storage/disposal plans
- Road map to any Interim Point(s) and the End Point

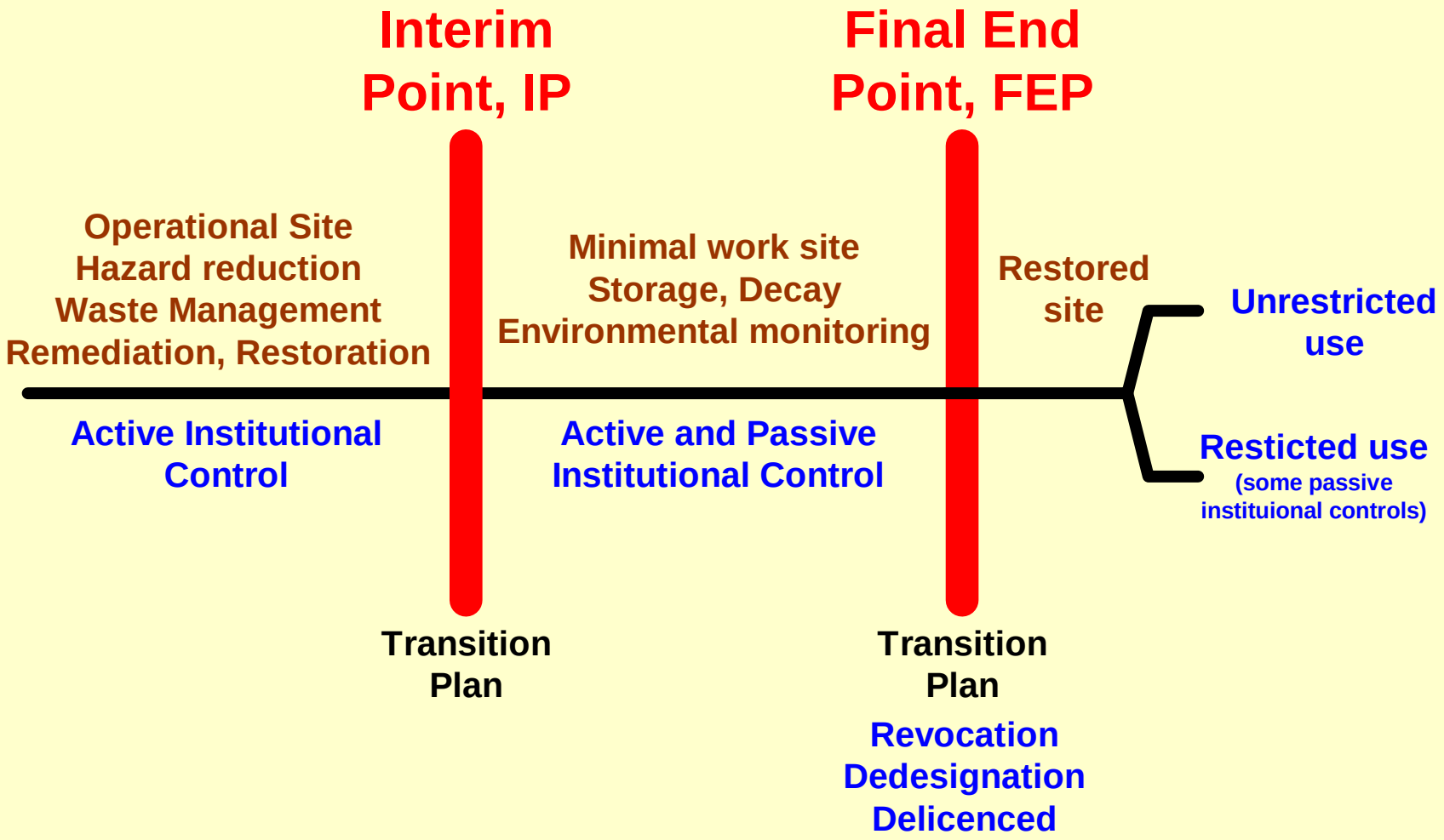
Environmental

- Contaminated land and materials left in-situ
- Practicable clean up levels
- Long-term monitoring results and contaminant/system behaviour
- Alternative scenarios are possible

Preservation aspects

- Asset re-use
- Heritage
- Landscape and Biodiversity

A restoration timeline for Complex sites might be...



Implementing the chosen end states….

- The NDA has more generally asked:
  - What level of restoration targeted?
  - How is it done?
  - When should clean up be prioritised?
- Considerable effort to align all sides on this
  - NDA, ONR, EA, SEPA, Sites involved
- As far as clean up criteria are concerned, it is up to the sites to make the case

All of this is work-in-progress

Some issues in developing site clean up criteria for complex sites - 1

Facts

- Don’t know everything - case cannot be written before decommissioning
- Remediation to get control
- Restoration to meet end state may take place later
- Restoration is a “long journey” Each zone one small step on the journey

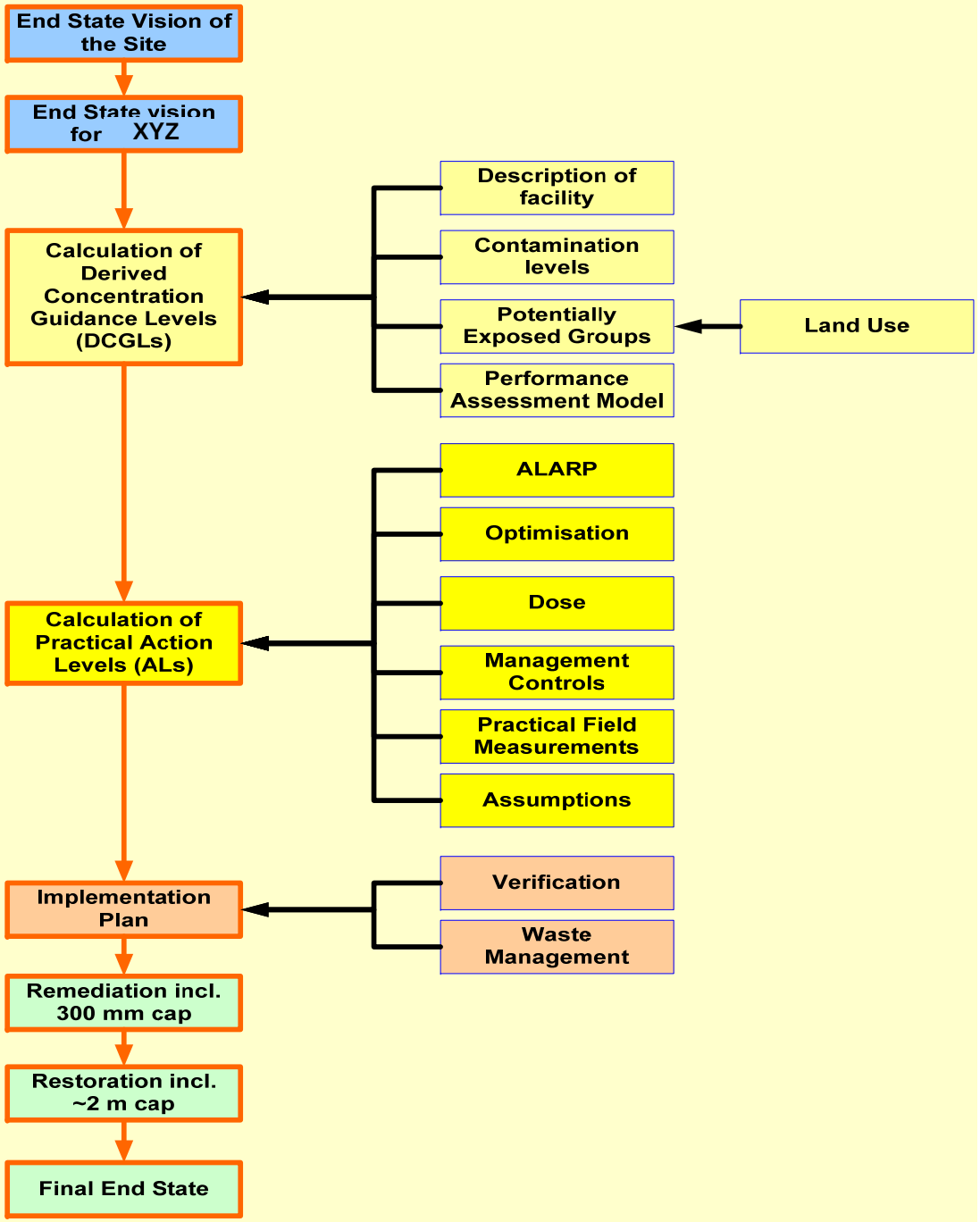
Integration

- Integrate clean-up with high hazard decommissioning/waste management - all ‘singing from the same hymn sheet’
- Keep the big picture in mind (or the tail wags the dog)
- Optimise work programme, clean up levels etc
- Do not revisit remediated/restored ground
- Awareness of pollution sources and unauthorised discharges
- Get timing and priority right
- High quality interpretation of conland behaviour
- High quality arguments in Case (Environment Safety Case, ESC)

Some issues in developing site clean up criteria for complex sites - 2

Strategy and tactics

- Work is one component within an overall site restoration strategy
- Excavation/remediation work done professionally
- Sampling strategy (Data Quality Objective, DQO or otherwise)
- Site restoration company provides robust supervision
- Can complete excavation even if contamination found below the last bucket
- Site trying ‘to do the right thing’
- Can sites be made safe without retrieving all contamination
- Is squeeky clean with all structures and contamination removed affordable
- Make case for site release dose >10 uSv/yr if right to do so
- Balance benefits with detriments – ALARP, Best Practicable Means (BPM)
- Engineered controls and IC acceptable as part of the case
- Unrestricted use after Institutional Control lost, or plan for restricted use
- Reasonable interpretation of forseeable uses of a restored site

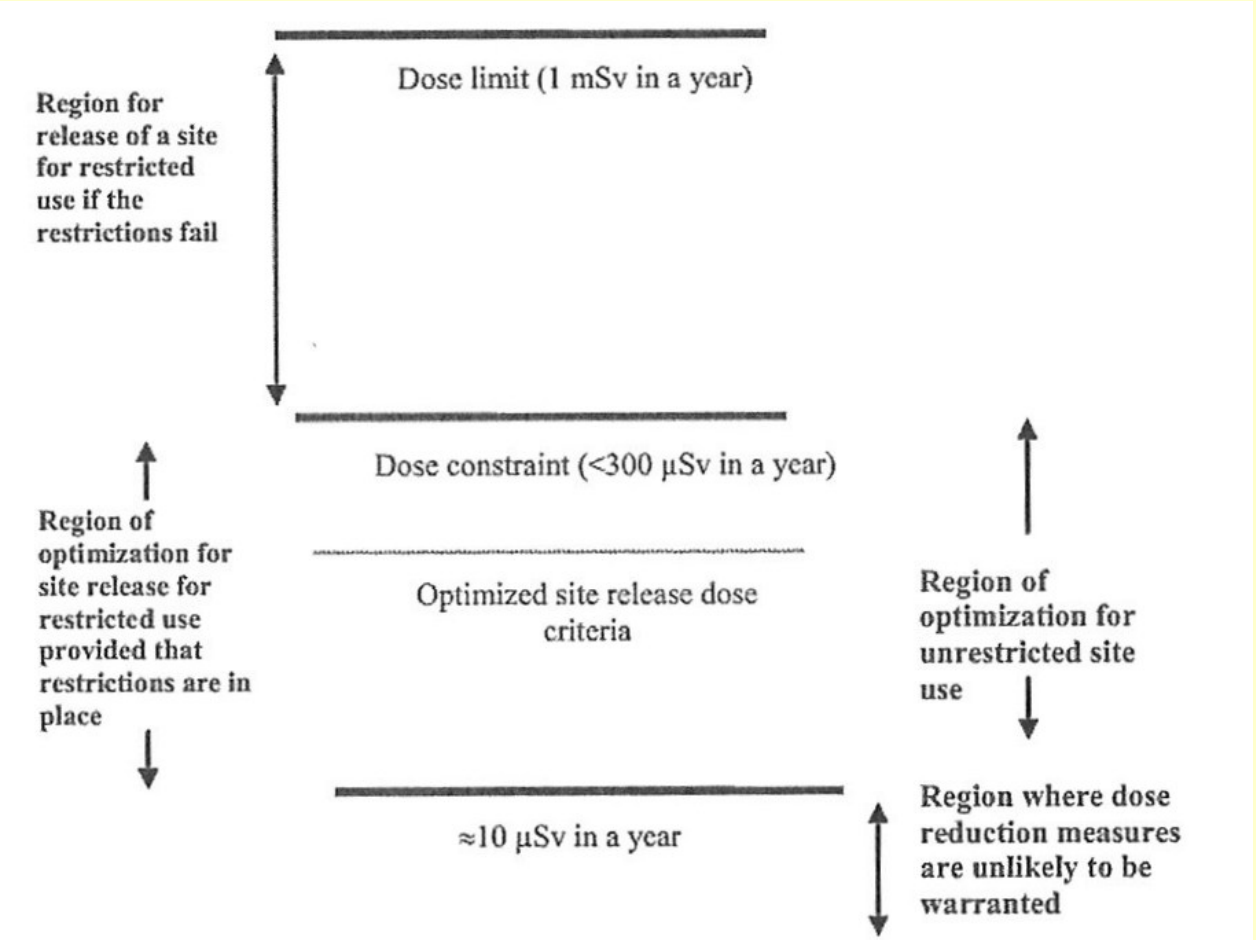

End State Vision of the Site
End State vision for XYZ
Calculation of Derived Concentration Guidance Levels (DCGLs)
Description of facility
Contamination levels
Potentially Exposed Groups
Land Use
Performance Assessment Model
Calculation of Practical Action Levels (ALs)
ALARP
Optimisation
Dose
Management Controls
Practical Field Measurements
Assumptions
Implementation Plan
Verification
Waste Management
Remediation incl. 300 mm cap
Restoration incl. ~2 m cap
Final End State

Setting Clean-up Levels

- **Work with the IAEA WS-G-5.1 values**
- **Factors to consider:**
  - **Region to aim for**
  - **Engineering**
  - **Length of IC**
  - **Management controls**
  - **Etc**

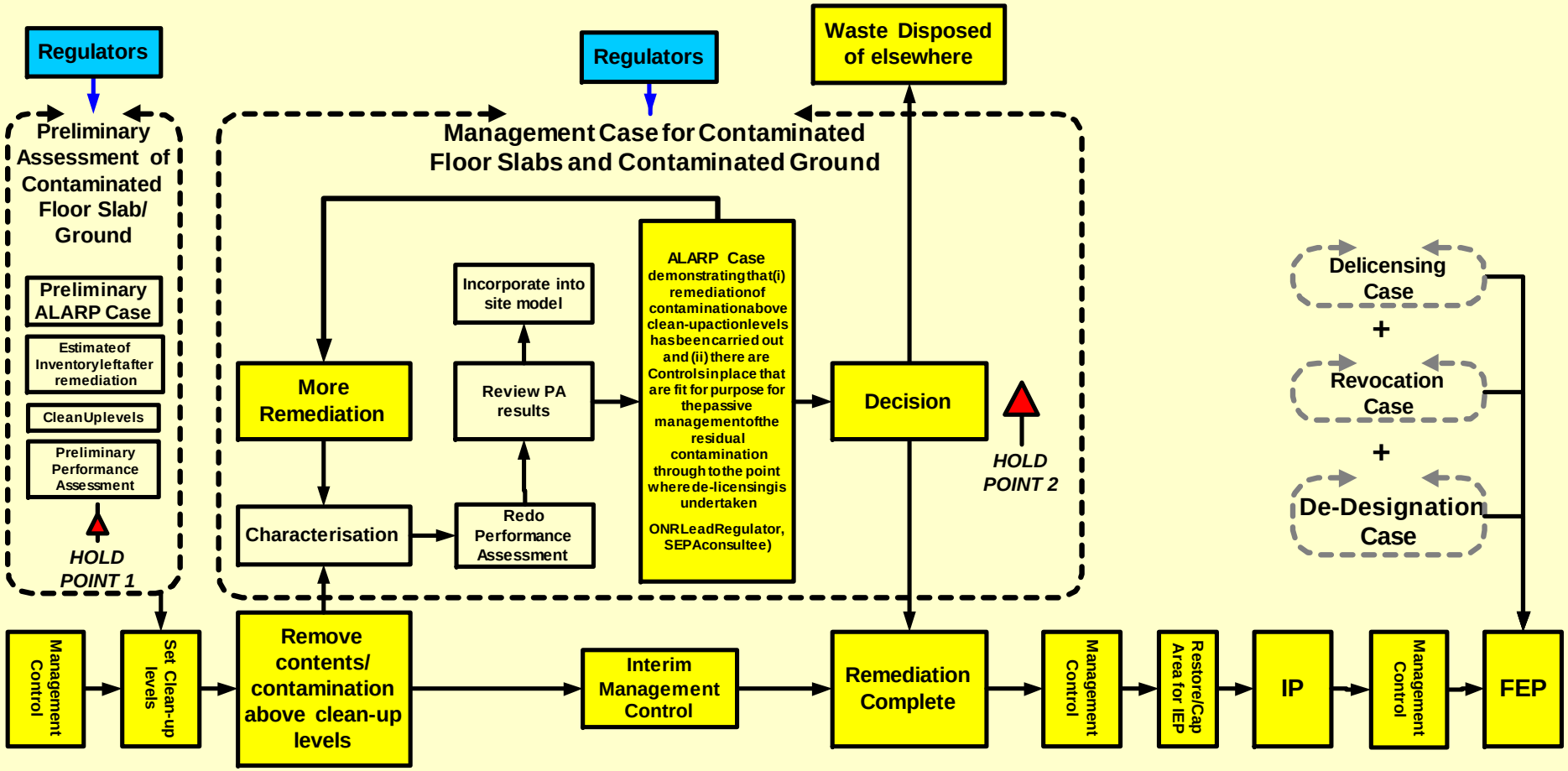
in order to optimise the field values in Bq/g

- **Other practical aspects adopted e.g. hot spot removal**



Optimise clean-up (higher below ground Bq/g field values):

- by making the ALARP/BPM case for a higher risk of 10^{-6} or even 10^{-5} ……
- by using a thicker cap or different cap to, say, restrict upward groundwater movement



Generic Route Map for deciding the End State of Contaminated floor slabs and Contaminated ground through to the Final End Point

- Assumes some contamination excavated, and residual contamination remains

Some conclusions

- Ground on sites with little contamination can be cleaned up/de-licensed.
- No complex sites (eg Dounreay, Sellafield, Magnox reactors) yet restored
- Optimal to restore these sites:
  - with clean up criteria based on IAEA dose criteria and practical use of BPM/ALARP arguments
  - aim to leave residual contamination, foundations, infrastructure and where case can be made
  - take credit for restoration engineering/management controls/IC
  - perhaps planning for restricted use after the final end state reached
- Case for restoring complex sites cost effectively ***work-in-progress*** in UK.
- Dounreay is key focus. Dismantling in hand, land being remediated. No land yet restored, but processes being developed, clean up levels used