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*Experiences with the Reuse of
Buildings on Nuclear Sites*



Introduction

- Re-using buildings which have had a nuclear use for other purposes.....
 - Other nuclear uses
 - Non - nuclear uses
 - Both whilst the site is under NIA licensing and after delicensing
- Avoiding or postponing waste generation
- Making more use of an existing resource
 - More sustainable
 - Avoid the resources of a new build
- Such reuse has happened in the UK and worldwide over decades
- So....
 - This is a practice we should promote when appropriate
 - Is an option to consider in options studies and planning

Acknowledgements
to IAEA for some
examples used in
this presentation



Waste Hierarchy

• *Building reuse is a form of prevention*

- Waste is avoided
- New resources are not utilised



Reuse/Redevelopment versus Demolition/Clearance (4)

Perspective	Demolition	Redevelopment	Perspective	Demolition	Redevelopment
Functional	Structures and assets with no useful function are removed.	Structures and assets with functional value for the next use of the site are retained and may be reconfigured for a new use.	Resource use	The land occupied by the nuclear facility is unavailable for use during decommissioning, demolition and restoration. The subsequent lead time needed for any new use will further delay access to the resource.	The land is returned to use earlier, allowing development on a brownfield site rather than on more sensitive or valuable land. (However, restrictions might be placed on use of a brownfield site.)
Physical	The site is returned to a state similar to its predevelopment state.	The site is transformed into new industrial, commercial, recreational or residential property, possibly with some portions of the facility retained.	Financial	Cash flows are negative until the completely restored site is leased or sold.	Costs of decommissioning and restoration are reduced, can be offset by the development value of the land and are recovered more quickly.
Ownership	The existing operator or owner may remain responsible for the facility for a long time after release from regulatory control, until a new owner takes over.	Ownership of the site is transferred during or soon after the elimination of radiological hazards. (Note: This process is based on national legislation.)	Decommissioner	The decommissioner is free to plan and execute the work within financial and regulatory constraints.	Planning and execution of decommissioning are carried out in consultation with the developer to maximize the redevelopment value of the site.
Risk based cleanup	Most conservative risk assumptions are used to determine remediation goals.	The proposed new site use determines the remediation goals, consistent with protection of human health and the environment.	Long term stewardship	The owner remains responsible for monitoring residual contamination and continues to maintain any institutional controls.	Management of all site activities becomes the responsibility of the new owner.
Community	Economic activity associated with the site is lost.	New economic activity replaces economic activity lost by closure of the nuclear facility.			
Decommissioning planner	The decommissioning end point is defined by what is known about the original state of the site and current legislative and regulatory requirements.	Identification of the decommissioning end point depends also on the planned end use and any redevelopment agreement.			
Liability management	The owner remains liable for harm caused by any failure to completely restore the site until it is released from regulatory control. (Note: Liability after release from nuclear control is subject to national legislation.)	The owner transfers the site and possibly the residual liabilities to the new owner. (Note: This process is based on national legislation.)			

In the UK delicensing requires returning the site to a condition suitable for any foreseeable future use

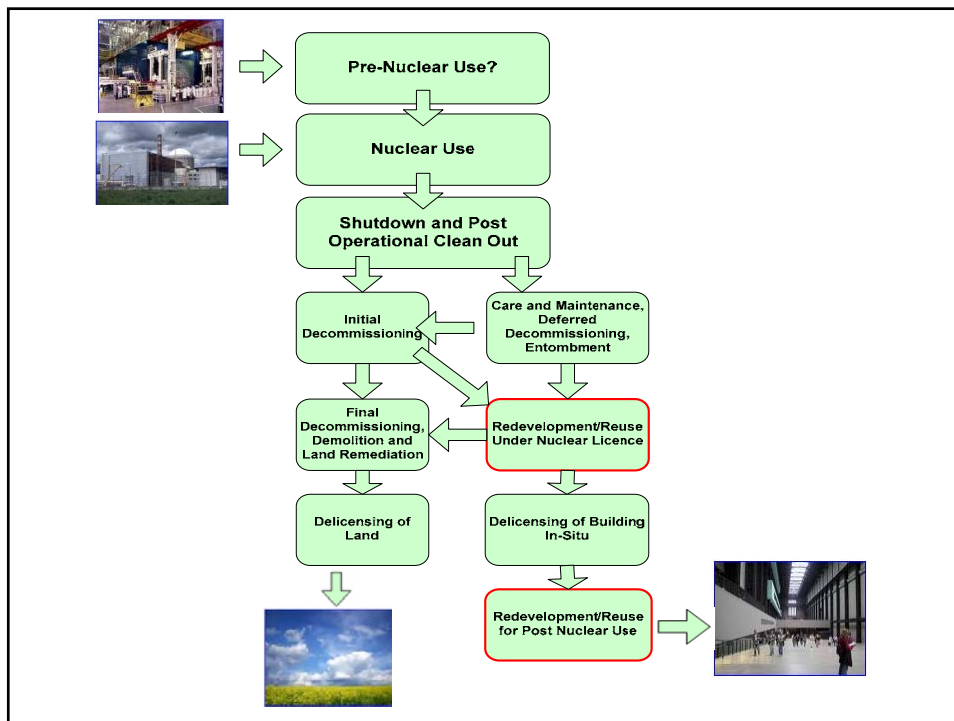
A Non-nuclear Example of Industrial Reuse Gasometer City, Vienna ⁽³⁾



- An example of an industrial facility converted for reuse.
- The new use was non-industrial.
- Benefited from being in a suitable economic neighbourhood
- Four Cylindrical telescopic town gas containers with brick facades.
- Built 1896 to 1899, retired in 1984.
- Initially used as film sets, rave venues etc.
- Redeveloped in 1995, 4 different designs, apartments, offices, entertainment, shopping.
- Opened 2001.



Research Sites
Restoration Ltd



Tate Modern

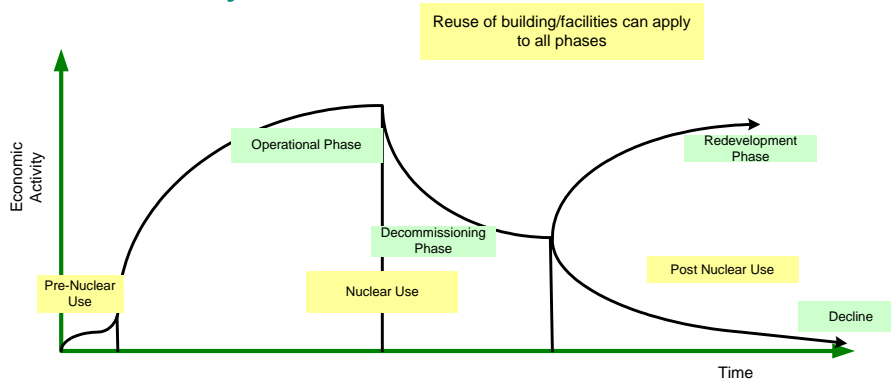
- Former Bankside Power Station, which was originally designed by Sir Giles Gilbert Scott, the architect of Battersea Power Station, and built in two stages between 1947 and 1963.
- The power station closed in 1981. The southern third of the building was retained as an electrical substation.
- Opened 2000.



Reuse over the Site Lifecycle

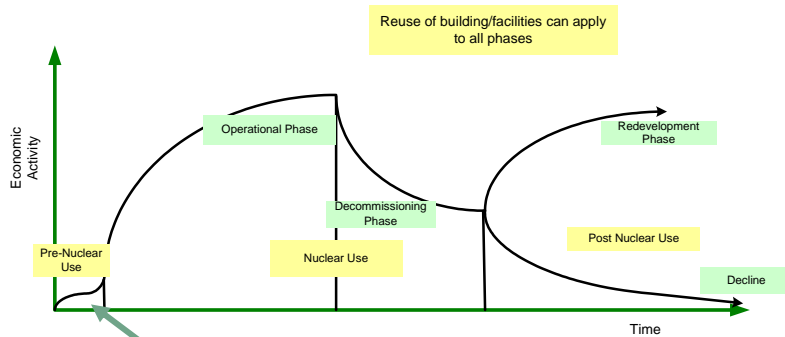
- Pre-Nuclear Phase
 - **Reuse of buildings** from the pre-nuclear phase for nuclear uses is unlikely to happen in the modern era, more common on the early sites
- Operational Nuclear Phase
 - **Reuse of buildings** is limited because few buildings become redundant during the growth of the site
- Decommissioning Phase
 - Priorities during decommissioning are:
 - Maintenance of safety
 - Hazard reduction
 - Release of Resources
 - Equipment, scrap value for materials, recycling
 - **Reuse of buildings**
 - Site Clearance
 - Demolitions, land remediation and clearance
 - **Reuse of buildings**
 - Delicensing
- Post-Nuclear Redevelopment Phase
 - **Reuse of buildings** which can be delicensed in-situ for post nuclear redevelopment uses

The Site Lifecycle



- Buildings can be reused from the pre-nuclear site phase
- During operations buildings can be reused in support of the mission
- During the decommissioning phase buildings become redundant and can be reused to support decommissioning or for alternative uses
- In the post-nuclear phase after site delicensing and release, buildings from the nuclear phase may be reused as part of the redevelopment of the site

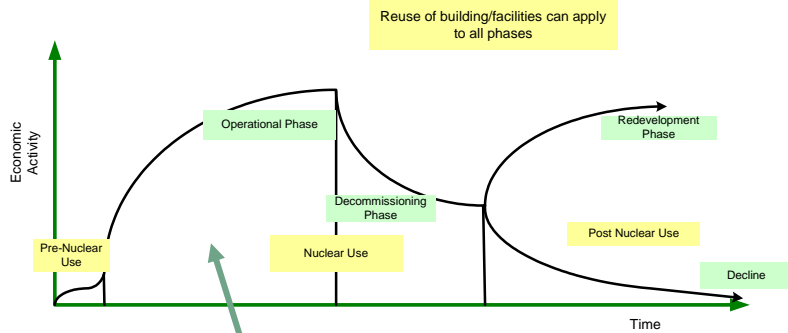
The Site Lifecycle – Harwell Example – “Pilot Area”



- Originally agricultural land and then airbase
- RAF buildings reused for nuclear uses



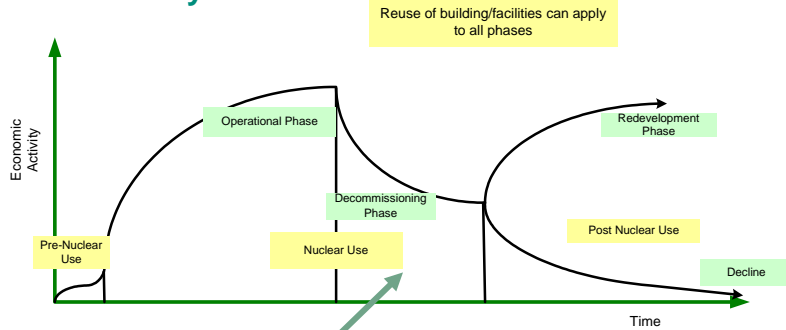
The Site Lifecycle – Harwell Example – “Pilot Area”



- Many new facilities constructed
- And reused...



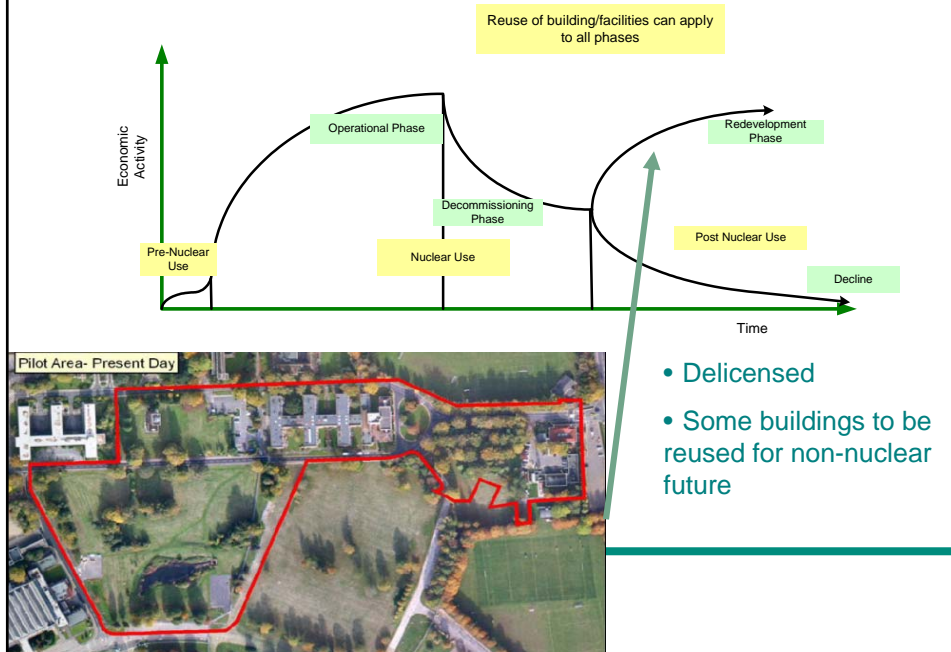
The Site Lifecycle – Harwell Example – “Pilot Area”



- Decommissioning Underway
- Delicensing/Land Clearance Surveys Underway
- Remaining buildings under new uses and tenanted

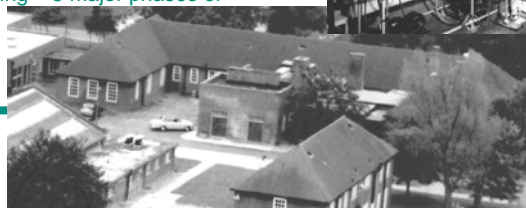
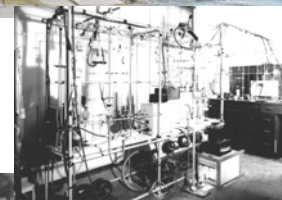
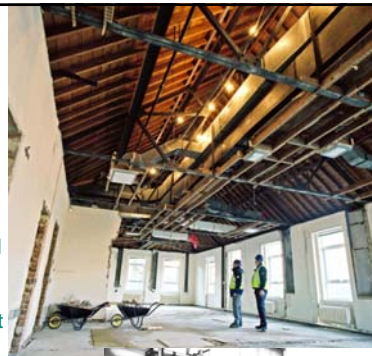


The Site Lifecycle – Harwell Example – “Pilot Area”



Building 146, Harwell, UK

- RAF Sergeants Mess 1930's.
- Modified 1946 to be radiochemical labs, vent system, glove boxes, early shielded facilities, alpha handling.
- Refurbished in 1980's – equipment removed, vent system sealed in position, fixed contamination sealed in position and placed under management control
- Reused as offices occupied by a tenant on the licensed site until 2006. Also part used as a non-nuclear laboratory.
- Final decommissioning in 2008 included removal of vent system and fixed contamination, sealed contaminated drains, asbestos.
- Removal of these systems rendered the building clean but unusable and it was demolished.
- Delicensing case for the land is currently under regulatory consideration.
- 70 to 80 years of use as a building – 3 major phases of usage.

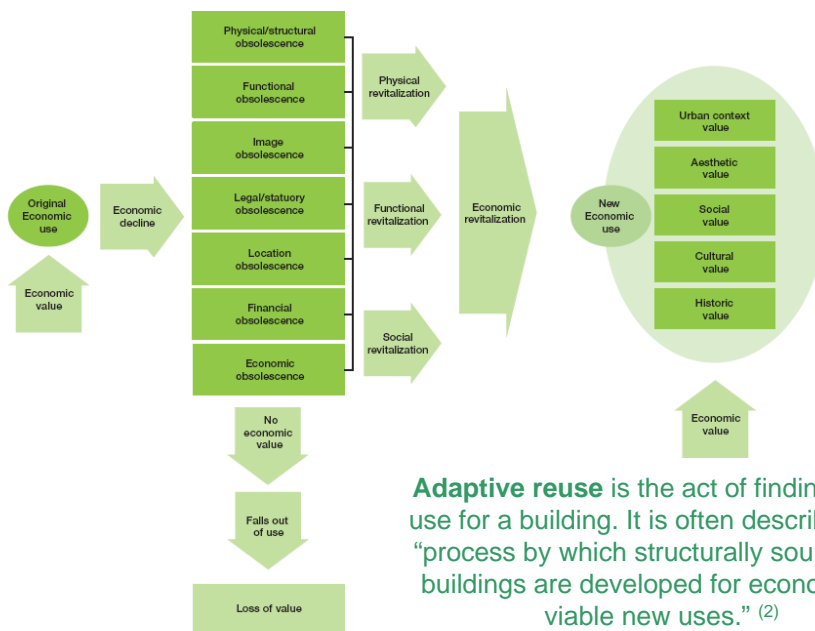


Building 149 Harwell

- Originally an RAF barrack block
- Modified in 1940's/50's for use as an early fuel processing laboratory
- First Plutonium in Europe isolated in this building
- Early issues resulted in contamination which was partially removed and the remainder sealed under concrete in the baseslab.
- Then reused as offices, an IT centre and a library by the operator and for tenants.
- Final clear out in 2009 – impossible to save the building after full decontamination of the original baseslab.

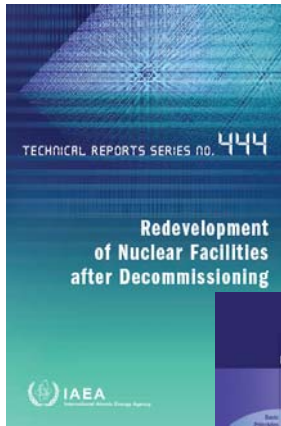


The Economics of Reuse ref (1)



Adaptive reuse is the act of finding a new use for a building. It is often described as a “process by which structurally sound older buildings are developed for economically viable new uses.” (2)

IAEA Guidance



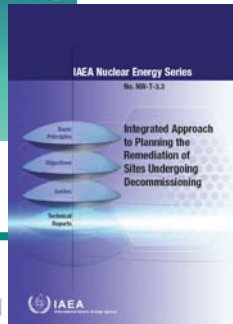
- TRS 444 ⁽⁴⁾ - Guidance and international examples for the redevelopment of nuclear sites. This covers whole site redevelopment, including building reuse.

- Upcoming guidance, not yet published (expected 2010):

"Redevelopment and Reuse of Nuclear Facilities and Sites: Case Histories and Lessons Learned"

- This focuses on nuclear buildings and facilities reuse

- NW-T-3.3 ⁽⁵⁾ is also useful – describes overall planning of decommissioning with site end states and reuse in mind



Nesca multi use research site – South Africa

- Uranium enrichment facility constructed in the late 70's.
- The enriched uranium was used for PWR fuel production.
- Terminated in 1995.
- Decommissioned 1995 - 99.
- Reused for waste storage and characterisation.



EWN – KGR (Kernkraftwerk Greifswald), Germany

- *Refurbishment of old buildings to create waste treatment centre for decommissioning:*



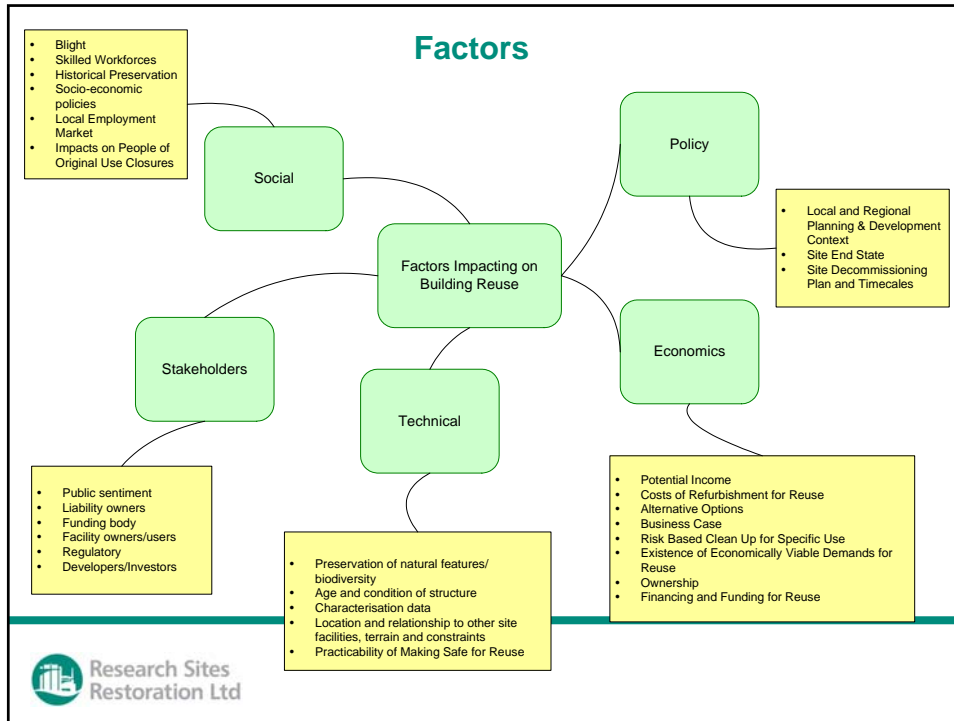
- Reconstruction of former auxiliary buildings and the former warm workshop to a new storage, treatment and decontamination centre.



Hangar 10, Harwell

- *Ex RAF Hangar*
- *Used for research reactor work*
- *Re-used for waste storage*





On nuclear licensed sites, licence condition 3 applies to certain reuse proposals...

3 RESTRICTION ON DEALING WITH THE SITE

The licensee shall not convey, assign, transfer, let or part with possession of the site or any part thereof or grant any licence in relation thereto without the consent of the Executive.

This Condition requires that the licensee does not let, convey, assign or transfer any part of the nuclear licensed site to a third party without seeking the permission of the HSE. This is to ensure that the licensee does not change the character of the activities on the licensed site and to prevent activities being carried out on the site which could put nuclear operations at risk. The licensee should be able to demonstrate that there are organisational procedures to prevent individuals within the company from conveying, assigning, transferring or granting any licences in relation to the site or parts of the site without first obtaining the Consent of the Executive.

Reuse does not always make sense...B336.3 Harwell

- Reuse is not always possible
- Wet processes liquid effluent building
- After decontamination of internal and external surfaces the building was unusable

- Land contamination may exist under the building which needs to be addressed



Building 413 Active Laundry, Harwell

- Building 413 constructed in 1955 - Chemical Cleaning Plant. Metal degreasing and surface treatment.
- 1970 - Eastern end of the building converted for use as Active Laundry and the Western end was converted for use as a radiological calibration facility.
- The building was used for work with radioactivity for 30 years.
- Yr 2000 - active laundry decommissioned. Removal of the laundry plant, removal of floor surfaces and removal of ventilation systems. Significant areas of low level radiological contamination removed.
- The cost of conversion was relatively low.
 - There was a use for the building that would result in rental income for a period prior to final removal.
 - The building did not need to be removed for licence termination purposes for some time.
 - The underground liabilities were not mobile.
 - There was interest from tenants to reuse the building and the reuse proposal was compatible with the building structure in a way that would not complicate later decommissioning.
 - The tenants were from within the nuclear industry, hence there were no issues of blight from previous nuclear uses.
 - The tenants were nuclear industry companies that would not interfere with residual contamination in the building.
 - The regulatory authorities had no concern with reuse of the building.
 - The building could not be decommissioned fully at the time because of funding priorities.
- In 2003 the building was converted. Site carpentry workshop and a calibration facility.



Nuclear sites may have some advantages for reuse...

- Nuclear new build may require ancillary facilities
- The reuse of nuclear facilities for nuclear uses may be easier than introducing nuclear uses in new areas
- Reuse with contamination locked in-situ maximises benefits of radioactive decay
- Reuse with contamination locked in-situ provides care & maintenance income streams and helps prevent the facility degrading
- Nuclear facilities may have specialised or robust infrastructure useful for new uses
 - High quality electricity supply connections
 - Office space.
 - Well established utility supplies (e.g. cooling water systems, steam supply, demineralised water supply etc.)
 - Well developed security systems (cameras, fencing etc.)
 - Well established underground features, e.g. vaults, tanks, pits, water supply systems, fire protection systems, sewage systems, and other waste retention systems.
 - Support services (e.g. catering, public transport).
 - A local workforce with a high level of technical skill.



Can the building be retained through license termination?

- At Harwell 70% of buildings were reused during the nuclear licensing period
- But only 5% are expected to be reusable through/after the licence termination process
- This is usually because of contamination, proving the absence of contamination, contaminated drains or underlying ground issues.



Summary

- Building/facility reuse on nuclear sites can be a useful option
 - Nuclear uses
 - Decommissioning Support, Waste Storage/Assay, Decontamination, Accommodation
 - Non-nuclear uses
 - In-house and tenants
- There are a number of constraints and factors to consider to determine if the option is practicable and economic
- Building/facility reuse through delicensing and into the post nuclear site phase can occur but is constrained by the delicensing criteria in the UK
- *What other experiences are there of building reuse on nuclear sites?*

Refs

1. [516] English Heritage, British Property Federation, Royal Institution of Chartered Surveyors and Drivers Jonas, *Heritage Works – The Use of Historic Buildings in Regeneration*, http://www.english-heritage.org.uk/upload/pdf/Heritage_Works.pdf
2. [513] CANTELL, S.F., *The Adaptive Reuse of Historic Industrial Buildings: Regulation Barriers, Best Practice and Case Studies, A Master Thesis, Virginia Polytechnic Institute and State University (May 2005)*
http://www.nvc.vt.edu/uap/docs/Student%20Projects/Cantell_Practicum.pdf
3. http://en.wikipedia.org/wiki/Gasometer,_Vienna
4. INTERNATIONAL ATOMIC ENERGY AGENCY, *Redevelopment of Nuclear Facilities after Decommissioning, Technical Report Series no 444, IAEA, Vienna 2006.*
5. INTERNATIONAL ATOMIC ENERGY AGENCY, *Integrated Approach to Planning the Remediation of Sites Undergoing Decommissioning, NW-T-3.3.*