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Lessons Learned at the Magnox Swarf Storage Silo Facility (Sellafield Nuclear Site, UK) on Planning and Optimization of intervention and Clean Up Approaches

Phil Hallington[1]
John Heneghan[1]
James T. Graham[2]
1 Sellafield Ltd, Seascale Cumbria CA20 1PG
2 UK National Nuclear Laboratory, Sellafield, Seascale, Cumbria, CA20 1PG.

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Introduction to Sellafield and the MSSS

Phil Hallington
Head of Policy, Sellafield Ltd

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Sellafield Site Overview

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Sellafield through the decades

1940s

Munitions, Nuclear Deterrent

- Nuclear build begins
- Initially a military programme
- Later civil programme begins

1950s – 1960s

Reactor Construction & Operation

- Waste stored safely – pending treatment
- Storage capacity extended incrementally
- Coarse segregation of waste arising from process
- Magnox reprocessing starts

1970s

Commercial Reprocessing

- Main expansion of site
- Major waste treatment focus
- Environmental impact substantially reduced

1980s – 1990s

Waste Management

- Commercialisation of reprocessing — Thorp comes online
- Waste arising from processes treated in ‘real time’
- Product waste forms compatible with disposal concepts

2000s

Multiple Missions

- Nuclear Decommissioning Authority formed
- Stop/start progress in Decommissioning
- Calder Hall ceased generating power after 47 years in operation

2010s

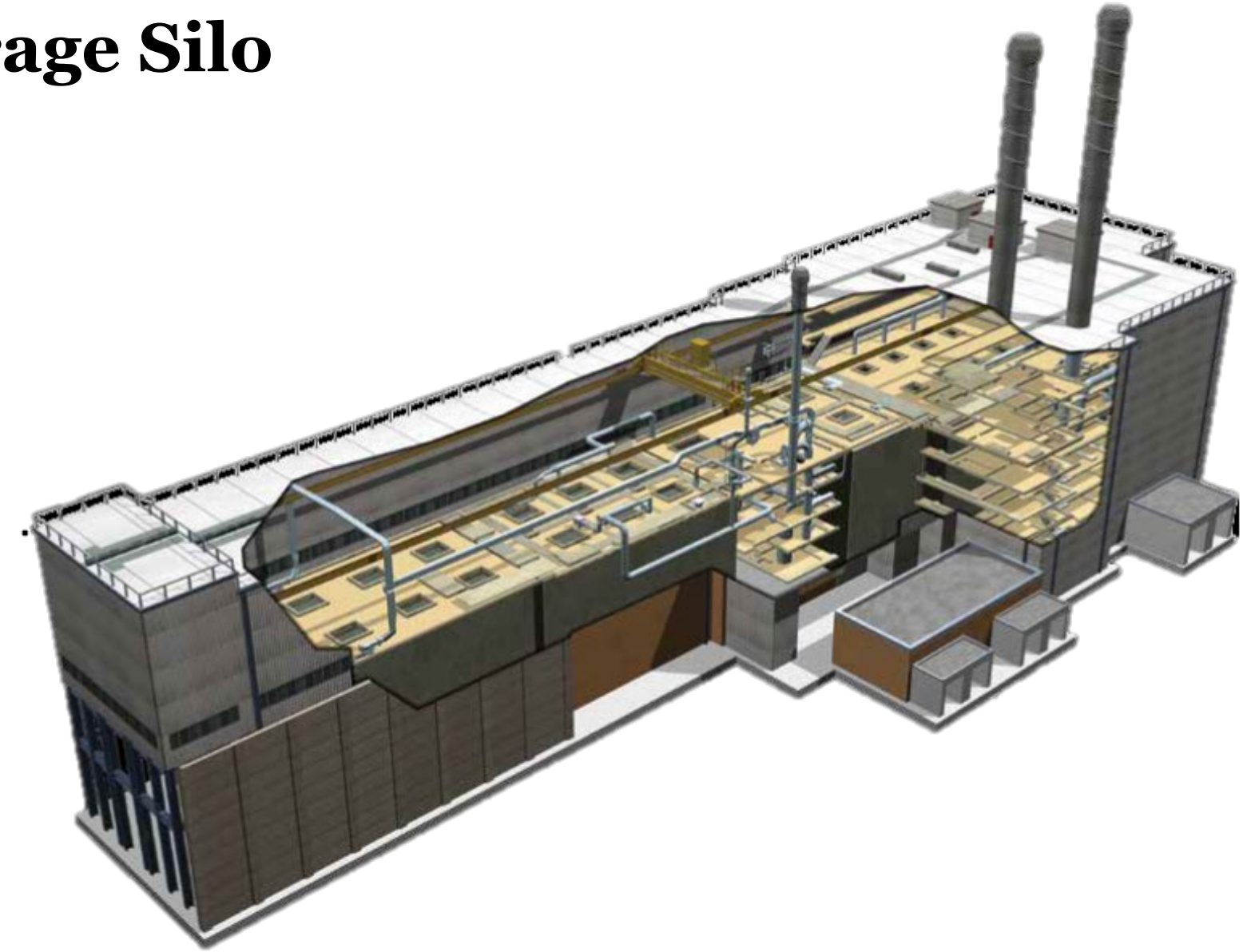
Risk & Hazard Reduction

- Decision taken to end Thorp reprocessing
- Vitrification of all overseas Highly Active Waste complete
- Decommissioning gathering pace with significant progress in remediation and retrievals
- First sludge and fuel exports from early Magnox pond

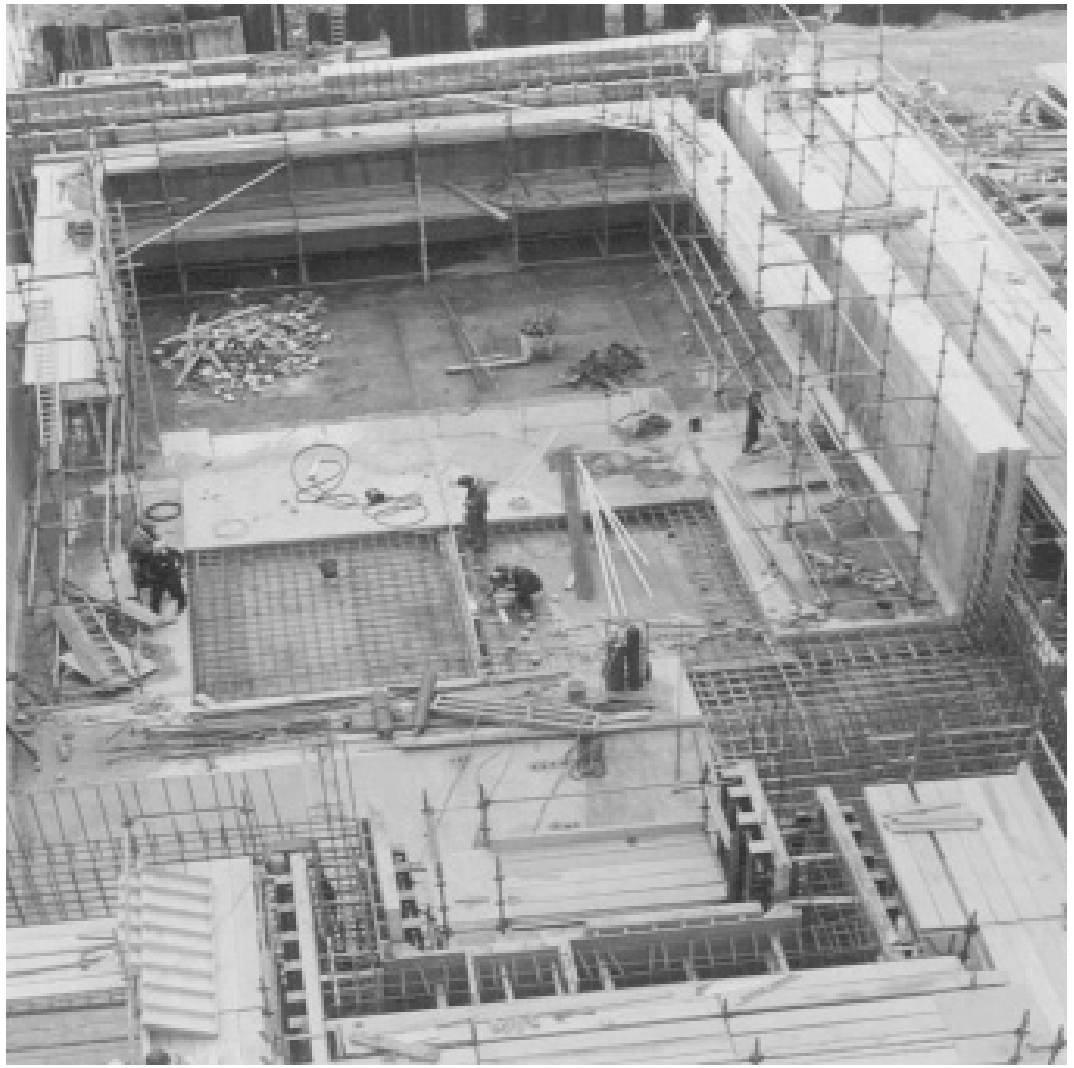
Magnox Swarf Storage Silo

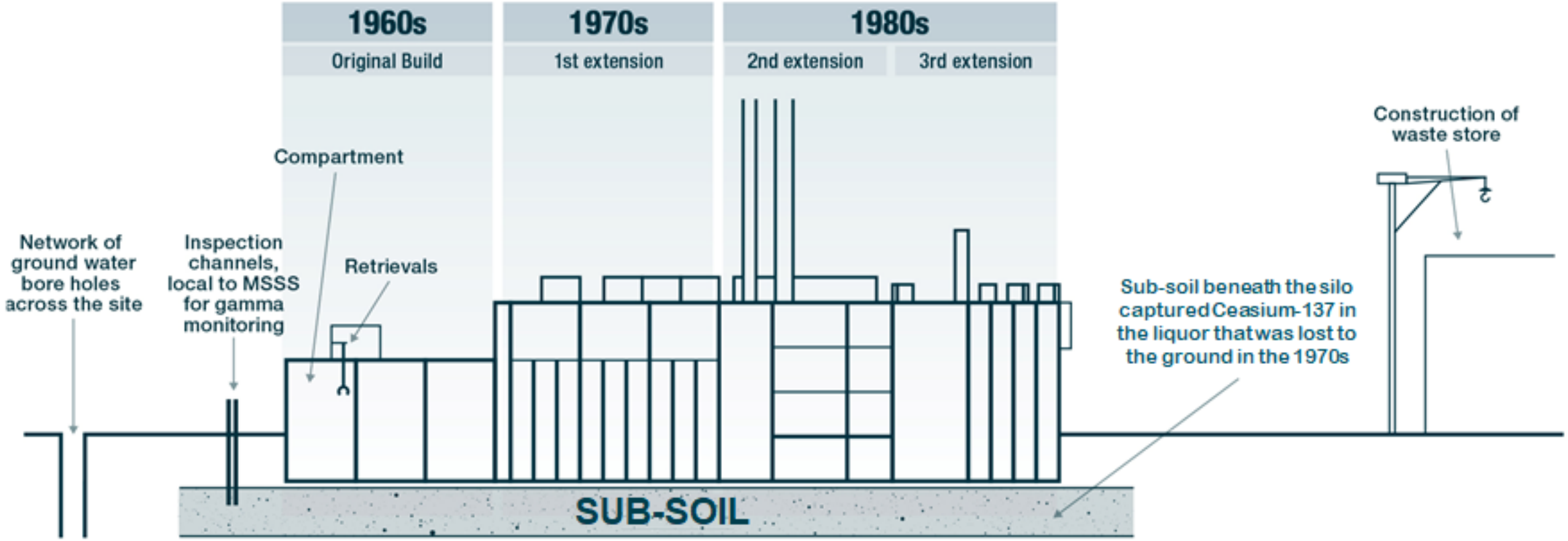
MSSS became operational in 1964 for underwater storage of swarf waste.

The swarf waste corrodes underwater resulting in the release of hydrogen and conversion to sludge.



MSSS Overview -video





WORKSTREAM 2

Measure/detect → **Compare** with predicted position → **Decide** if corrective action is required → **Additional** characterisation / **Intervention**

Monitoring

- Liquor Balance Monitoring and Modelling
- Building Movement
- Groundwater
- In-ground radiological monitoring
- Surveys and inspections
- Management reporting

Mitigation

- Wide range of possible approaches refreshed with new information
- Other techniques of interest e.g. sealing oil and gas wells permanently
- International experience sought including USA and Japan
- Overall the priority is to empty the Facility and move the waste to safe storage
- No single, simple solutions to this complex challenge

Safety and Environmental Aspects

- Leakage is occurring below ground
- Structural stability of the facility remains unaffected
- Modelling of groundwater flows informs the safety case
- Subsoil “captures” many nuclides very close to the facility
- Consequences evaluated and compared to Criteria $>10^{-6}$ per year risk to the public.
- Predominant hazard and risk remains the inventory of waste
- Priority for all remains retrieval of waste
- Separate team manages this programme to avoid distraction

Summary

- Planning for future adverse events
- Maintaining readiness of plans/strategies/management schemes
- Engaging stakeholders to develop and maintain trust and confidence
- Learning on potential mitigations and future clean up strategies

Thanks for Listening