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Characterisation of Calder Hall Heat Exchanger Asbestos

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Materials management in nuclear decommissioning – challenges and opportunities.

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Facility Characterisation

Scope

- Background
- Objective
- Project Execution
  - Provenance
  - Sample planning
  - Data assessment
  - Regulator dialogue
- Outcome

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Calder Hall Nuclear Power Station


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Background

- Four Reactors (16 Heat Exchangers)
- Operations stopped in 2003
- Deterioration in asbestos due to lack of heat – 'asbestos falls'
- Regulatory pressure to strip from HSE (safety issues)
- Largest asbestos strip in Europe (Approx 1000te)
- BPEO study conducted – landfill disposal deemed best option
- Characterisation playing catch-up (6 HExs already stripped)
- To maximise disposal to landfill, bag monitoring was expected to be required (approach of Bradwell and Chapelcross at the time)

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Objective

- To characterise Calder Hall Heat Exchanger (HEx) main body asbestos in order to technically underpin a final sentencing decision.

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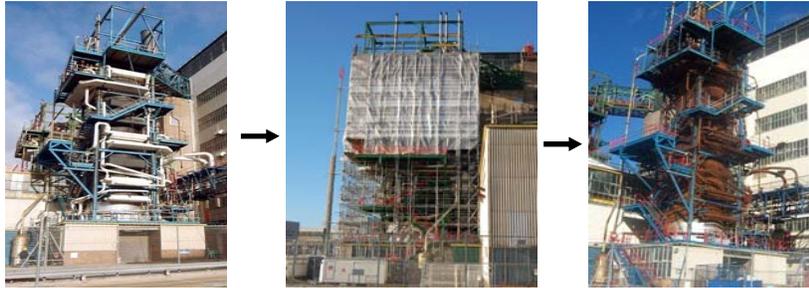
Provenance

- All Heat Exchangers considered to be similar in nature (proposal to treat as single population)

- No significant events resulting in contamination on main body of HEx

- Potential for contamination from site discharges over 50 year period

- Potential for elevated activity around Chemist Sampling Points

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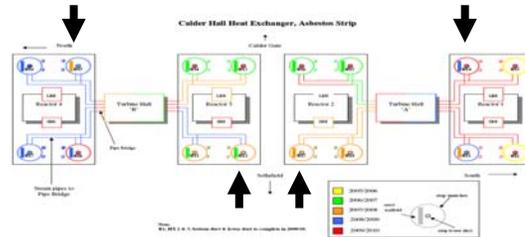
Execution – Phase 1

- **Objective**
  - Derive fingerprint to support bag monitoring in line with Sellafield Ltd Fingerprint standard
- **How**
  - 8 samples taken from length of one HEx (targeted 2 chemist sampling points)
- **Result**
  - Activity levels lower than expected
  - H-3 dominant contaminant
  - H-3 concentrations variable and did not track gamma activity
- **Assessment**
  - NICoP applied
  - Mean Concentration at 95% Confidence Level = 0.409 Bq/g
  - Result based on biased sampling
  - Technical Justification for Clearance and Exemption Produced
  - Dialogue with EA throughout

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Execution – Phase 1 Continued

- **Conclusions**
  - The Asbestos associated with this HEx was RSA Exempt
  - Bulk Exemption considered appropriate
  - Bag Monitoring not appropriate
  - Potential to bulk exempt all HEx asbestos but would require more sampling

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Execution – Phase 2

- **Objective**
  - Determine whether bulk exemption of all heat exchanger asbestos is feasible.
- **How**
  - Sample 3 additional heat exchangers (Cover all reactors and all 4 orientations; N, S, E and W – representative of all heat exchangers). 24 additional samples.

Execution – Phase 2 continued

- **Results**
  - Similar results to Phase 1.
  - H-3 variability – no pattern evident (all < 1Bq/g).
  - Low gamma activity throughout

- **Data Assessment**
  - NICoP applied & Technical justification produced.
  - The number of samples (32) was statistically underpinned.
  - Mean concentration at 95% confidence level = 0.36 Bq/g (all individual samples <2 Bq/g total activity).

- **Conclusions**
  - All HEx asbestos suitable for bulk exemption.
  - EA not satisfied that sufficient sampling carried out.
  - Pushing boundaries of NICoP (particularly number of samples and sentencing volumes).

Execution – Phase 2 continued

- **Additional work**
  - Further technical underpinning carried out
  - BPM case produced
  - Advice sought from C&EWG
  - Several meetings with EA
  - Compared data to other sites (Bradwell)

- **Outcome**
  - EA still uncomfortable with bulk exemption of all HEx asbestos
  - No objection to dispose of sampled HExs
  - Reassurance sampling required for remaining HExs

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Execution – Phase 3

- **Objective**
  - Satisfy EA requirements for reassurance sampling (EA check sampling conducted in parallel)

- **How**
  - Remaining HExs sampled. Only gamma scan and H-3 analysis requested, to compare consistency with existing data

- **Results**
  - With exception of 3 HExs, activity levels similar to Phases 1 and 2 data
  - 3 HExs associated with Reactor 4 showed higher Cs-137 and H-3 than all other data

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Execution – Phase 3 continued

- **Data Assessment**
  - Apparent differences between Reactor 4 HExs and rest of HExs. Therefore segregation for data assessment
  - EA check monitoring data supported exemption decision and did not support elevated activity for Reactor 4 HExs
  - Excluding Reactor 4 data, mean concentration at 95% confidence = 0.33 Bq/g

- **Conclusion**
  - All asbestos with the exception of three Reactor 4 HExs to be disposed of as RSA Exempt, EA raised no objection
  - Further investigation to understand Reactor 4 status

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Execution - Phase 4

- **Objective**
  - Investigate apparent discrepancies for Reactor 4 data

- **How**
  - Laboratory investigation (analytical error / cross contamination?)
  - Sampling investigation (cross contamination?)
  - Investigate potential source terms
  - Repeat sampling and analysis for Reactor 4 HExs
  - Analyse all of EA Reactor 4 check samples

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Execution – Phase 4 continued

- **Results**
  - No evidence of cross contamination at laboratory or during sampling
  - Re-analysis of all EA samples indicated consistent results with Phases 1-3
  - Re-sampling and analysis adjacent to original sample points indicated consistency with Phases 1-3

- **Conclusion**
  - Elevated activity appeared to be associated with a single batch of results but source unknown, deemed spurious
  - Remaining asbestos from Reactor 4 was RSA Exempt waste
  - EA raised no objection

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Outcome

- All asbestos from Calder Heat Exchangers sentenced as RSA Exempt waste to hazardous waste landfill
- Avoided unnecessary use of finite LLWR vault capacity
- Avoided double handling of 90000 bags of hazardous material
- Massive cost saving

Indicative Costs

Disposal to LLWR	Bag Monitoring (Assume 4 Monitors for 90000 bags)	Disposal to hazardous waste landfill	
Approx **£20M** (500 ISOs)	Approx **£2M** + significant manual handling	Approx **£280K***	•Analytical cost = £95k Resource costs = £30k Disposal cost = £155k

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