Case Study Decommissioning

Training Package on Occupational Radiation Protection in Uranium Mining and Processing Industry
Decommissioning Description

• Every uranium operation will eventually stop production and need decommissioning.
• Often the decommissioning is a long time after the finish of production. The knowledge of the operation may be poor.
• Sometimes decommissioning is undertaken progressively whilst the majority of the plant is still in operation.
• Where there is insufficient knowledge, a site radiation survey can be used to identify areas with the potential for higher exposures.
Some Aspects of Decommissioning

- Plant demolition and disposal
- Bulk material movements
- Stabilisation of surface structures
- Rehabilitation of surface structures
- Isolation of underground facilities
- Groundwater remediation (particularly for ISR)
Build your own Decommissioned Facility

• Choose the areas to be decommissioned? (*Process plant, tailings area, in-situ leach wellfield, waste rock dumps, miscellaneous contaminated waste, evaporation ponds*)

• Choose your disposal method? (*on or off site, on surface with cover, shallow disposal, in pit disposal, underground disposal*)

• Is the decommissioning during operations, just after closure or a long time after closure?
Model Answer Decommissioned Facility

- ISR Wellfield with a processing facility (ion exchange and calciner) and storage/settling ponds
- All wastes including plant not able to be decontaminated to be disposed of in an on site shallow pit (30m) specially built for the decommissioning
- The operation closed 15 years prior to decommissioning
Determine the Exposure Pathways for your Plant

• For each stage assign a relative level for the importance of the exposure pathway
  – VH-very high, H-high, M-medium, L-low, VL-very low

• Special is for unusual cases such as maintenance
## Exposure Pathways for your Decontamination Facility

<table>
<thead>
<tr>
<th>Stage/Pathway</th>
<th>Gamma</th>
<th>Radon</th>
<th>LLRD</th>
<th>Special</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wellfield</td>
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<tr>
<td>Plant decontamination</td>
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<tr>
<td>Plant disposal</td>
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<td>Disposal operation</td>
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## Model Answer: Exposure Pathways for your Decontamination Facility

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<td>VL</td>
<td>L(*M)</td>
<td>*potential for Ra226 Scales</td>
</tr>
<tr>
<td>Plant decontamination</td>
<td>L(*H)</td>
<td>L/(*M)</td>
<td>L(*H)</td>
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What are the potential critical areas for radiation protection
Model Answer Critical Areas

- Delay since closure means there is no operational knowledge of the site and where high radiation areas may be.
- Potential for high activity scales and uranium residues.
- Material all dry so decontamination and demolition (cutting and moving) may generate high activity dust.
- Thin layer of solids from the liquor storage may have high activity (radionuclide will not be in equilibrium and may contain other radionuclides as well as $^{238}\text{U}$, $^{234}\text{U}$, $^{230}\text{Th}$) and be very prone to dusting.
What Monitoring is Required

- **Gamma** – which groups need personal monitoring, can monitoring be optimised?
- **LLRD** – breakdown what radionuclides in what areas, how to determine activity measurement?
- **Radon** – where and when to monitor?
- **Contamination** – what is the critical areas and do you need biological monitoring (Uranium in urine)?
Model Answer Monitoring

- **Gamma** – For workers involved in areas with potential $^{226}$Ra scale and bulk scrapping of material use personal dosimeters otherwise use SEG average
- **Radon progeny** – No personal monitoring and some alpha track detectors for area monitoring
- **LLRD** – Occasional personal area sampling as a low priority with the exception of demolition activities and the scraping of the ponds
- **Contamination monitoring** not performed as not expected to be a significant pathway. Urine analysis only considered if there is a accident with the potential for direct ingestion or injection
What are Some of the Critical Controls
Model Answer: Critical Controls

• Conduct a site gamma survey to detect any areas of enhanced exposure due to $^{226}$Ra scales.
• Density gauges may still be on the plant and highlighted during survey.
• Dusting during demolition and scrapping should be minimised.
• Use of wet cutting, remote cutters or respiratory protection when cutting through process infrastructure.
Dose Assessment

• How to determine total dose?
Model Answer Dose Assessment

- For gamma, use personal TLD results or workgroup average.
- Assume radon is not significant unless alpha track detectors show enhanced levels.
- Calculate LLRD dose using the time the workers are on site, the workgroup average airborne activity and a dose conversion factor based on equilibrium and an AMAD of 5μm.
Key Messages

• For decommissioning, the biggest risk is the potential lack of knowledge about what are the potential exposure areas.
• A pre-decommissioning survey can help plan and manage radiation exposure.
• Particular care is needed for areas where radionuclides may have concentrated;
  – Scales
  – Solids remaining from evaporated liquids
  – Final product areas
  – Potentially old density gauges which are not recorded
Thank you!