

# South Africa's potential participation in the IAEA's International Decommissioning Network

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South African Nuclear Energy Corporation Ltd (Necsa)



# Background

- 1960's – Unique uranium enrichment process developed.
- 1970's – First enrichment plant (up to 90%  $^{235}\text{U}$  for military purposes and MTR fuel).
- 1977 – 1986: Establishment of conversion, enrichment (5%  $^{235}\text{U}$ ) and fuel fabrication facilities for the Koeberg nuclear power plant.
- 1990 – HEU facilities shut down (non-proliferation treaty signed in 1991).
- 1995 – 1999: All other fuel cycle facilities shut down (not commercially competitive).

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Fuel  
Fabrication



Enrichment  
(HEU)



Conversion



Enrichment  
(5%)

1 kilometer



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# Decommissioning & Waste Management Challenge

- 38 Redundant facilities (buildings, plants, laboratories):
  - Largest: 5% enrichment plant, 265 m x 65 m, 5 levels).
  - ~180 000 m<sup>3</sup> of contaminated materials, concrete and soil (main contaminant is uranium in various forms).
  - Spillages.
  - Thabana (closed waste disposal facility containing ~10 000 m<sup>3</sup> waste).
- > 12 000 m<sup>3</sup> drummed historical waste (including medical and industrial waste from external generators).

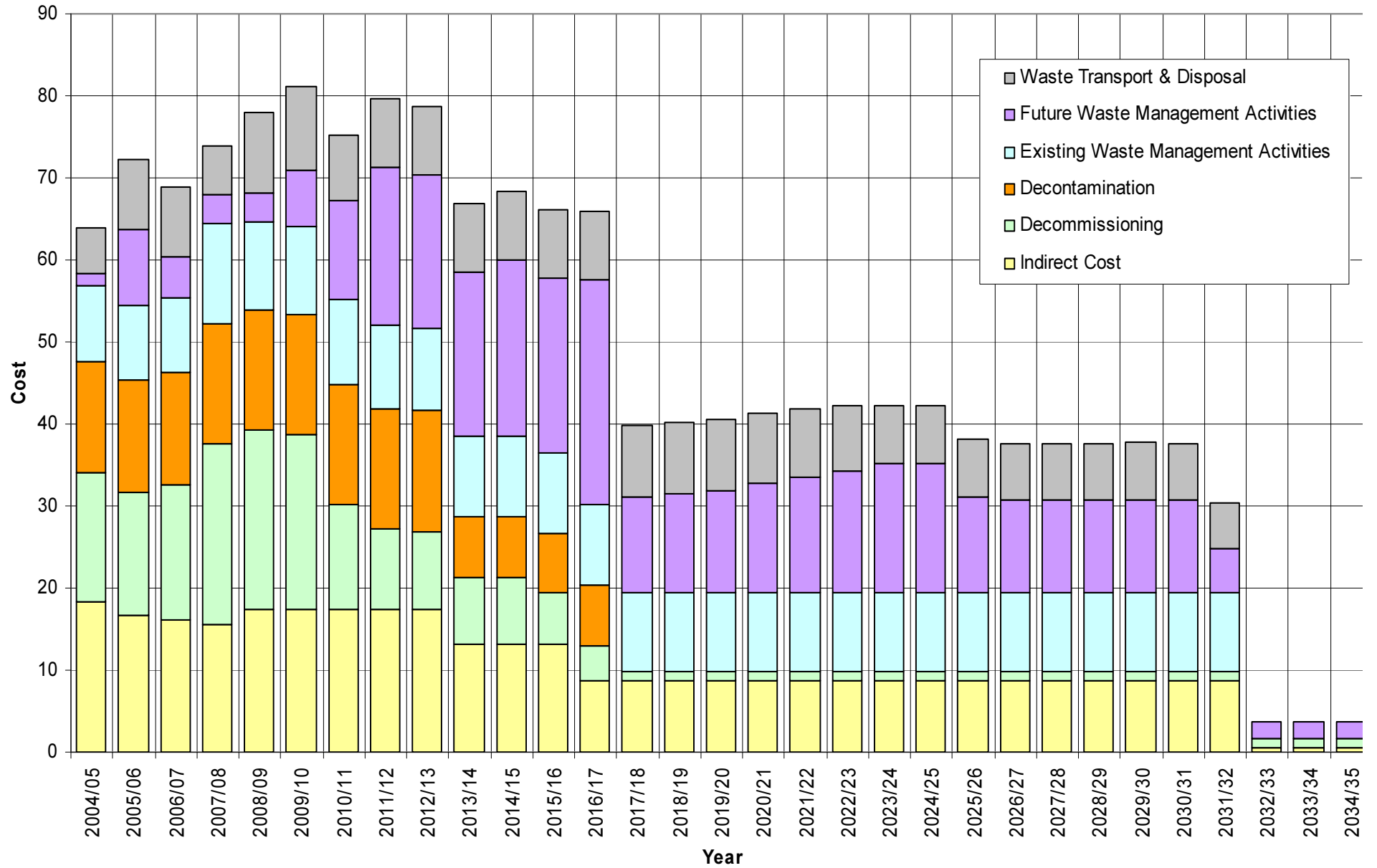
# Progress

- Decommissioning started in 1995 with enrichment plants.
- Progress to date:
  - Phase 2 decommissioning completed on most large plant facilities.
  - Limited Phase 3 work (possible reuse of buildings for nuclear work).
- Future work:
  - Conversion plant (last large plant facility).
  - Laboratories, workshops.
  - Phase 3.
  - Evaporation pans.
  - Thabana (waste disposal site).

# Organization and Planning

- Integrated decommissioning and waste management approach (including disposal).
- Nuclear Liabilities Management Dept (NLM).
- Decommissioning organization:
  - Manager, 3 Project Managers, ~55 artisans, assistant artisans and cleaners.
- Shared support services (SHEQ, finances, technical support, investigations and development projects).
- Optimized planning (long-, medium- and short-term planning, liability assessment system).

## Redundant Facilities Management Plan: Decommissioning & Waste Management



# Experience to share

Typical stages of a project as carried out at Necsa are as follows (assistance can be provided with regard to all of these):

- Scope definition:
  - Facility characterization (buildings, plants, spillages).
  - Nuclide and material inventory.
  - Definition of project goals.
  - Strategy & plan.
- Corporate evaluation process (to define required approvals):
  - Regulator (radiological safety).
  - Stakeholder & public involvement.
  - Dept of Water Affairs.
  - Safety Evaluation Committee (conventional safety).
  - Management (priorities & resources).

# Experience to share *(continued)*

- Detailed planning:
  - Comprehensive risk assessment and radiological protection plan.
  - Scheduling & resource requirements.
- License application.
- Resource acquisition & preparation.
- Readiness audit (compliance with corporate requirements).
- Project execution:
  - Approaches and methodologies (component categorization).
  - Decontamination (large scale), clearance.
  - Progress and cost monitoring and control (integrated system).
  - Safety audits.
- Close-out (project summary, including comparison of actual and estimated personnel exposures).

# Activities associated with assistance that Necsa can provide

Facility	Facility	Project Description	Remarks	Status & remaining duration
1. Area 14 Pipe Bridge.	Overhead steel grid and supports in building (250 x 20 m).	Decontamination for reuse.	Manual, <i>in situ</i> decontamination not successful, structure to be painted to immobilize contamination.	In progress. <b>9 months.</b>
2. Quarantine Camp.	Storage area for components that cannot be cleared after decontamination due to geometry constraints.	Processing of components (cutting and drilling) to enable clearance measurements.	Aluminium, mild steel and stainless steel.	In progress. <b>12 months.</b>
3. Area 27.	UF <sub>6</sub> transfer facility.	Transfer of residual UF <sub>6</sub> from 12 t cylinders to transport cylinders.	Proposal to cut up 12 t cylinders to facilitate decontamination being considered.	Awaiting license, start date: March 2008. <b>4 years.</b>

# Activities associated with assistance that Necsa can provide *(continued)*

Facility	Background	Project Description	Remarks	Status & remaining duration
4. Conversion Plant.	ADU to UF <sub>6</sub> conversion plant.	Full Phase 2 decommissioning to be carried out.	Large facility, limited working space, Type S uranium.	Corporate evaluation in progress, start date: April 2008. <b>5 years.</b>
5. Building 2700A.	Small-scale pilot U conversion plant & Zr recovery from materials containing NORM	Full Phase 2 decommissioning to be carried out.	Severe corrosion, Type S uranium.	Awaiting license, start date: Feb 2008. <b>15 months.</b>
6. Site spillages.	Spillages of (mostly) U-containing liquids.	Clean-up and remediation of spills.	Clearance levels for soil and destination of contaminated soil to be agreed with regulator.	Corporate evaluation in progress, start date April 2008. <b>4 years.</b>

# Activities associated with assistance that Necsa can provide *(continued)*

Facility	Background	Project Description	Remarks	Status & remaining duration
7. Evaporation pans.	Evaporation pans contain economically recoverable quantities of uranium.	Recovery of U-bearing sediments for uranium recovery at a mine and rehabilitation of the area.	Large volume of material (~ 20 000 m <sup>3</sup> )	Negotiations with contractors and mine in progress, start date: mid 2008. <b>2 years.</b>

# Needs

- Decommissioning of Pu-contaminated facilities.
- Hot Cell decommissioning.
- Phase 3 decommissioning.
- *In situ* decontamination and clearance.
- Rehabilitation of a disused waste disposal site

# Activities associated with needs

Facility	Background	Project Description	Remarks	Status & remaining duration
1. Building 1900 Pu Laboratory.	Research facility.	Full Phase 2 decommissioning to be carried out.	Pu and U contamination, average ~25 Bq/cm <sup>2</sup> , up to 1 400 Bq/cm <sup>2</sup> . Input required with regard to decommissioning and waste management.	Corporate evaluation in progress, start date: second half 2008. <b>15 months.</b>
2. Building 1700 Hot Cell no 3.	Used for preparing LTA fuel for post-irradiation examination.	Removal and conditioning of LTA waste & waste from <sup>99</sup> Mo process stored in cell.	Input required with regard to cutting up of equipment, volume reduction of silicon tubing, waste characterization and opening of 5 mm thick welded waste containers.	In progress. <b>5 years.</b>

## Activities associated with needs *(continued)*

Facility	Background	Project Description	Remarks	Status & remaining duration
3. Phase 3 decommissioning	Many buildings with contaminated concrete surfaces.	Decontamination of floors and walls for release or reuse.	Input required with regard to available technologies.	Lower priority.
4. Sub-surface pipelines	Contaminated underground pipelines, various diameters.	Possible <i>in situ</i> decontamination.	Input required with regard to available technologies.	Lower priority.
5. Thabana	Disused near-surface disposal facility.	Recovery of waste from trenches in soil and rehabilitation of site.	Input required with regard to waste recovery methods, characterization and treatment.	Lower priority.

# Conclusions

- Necsa has 12 years experience with regard to the decommissioning of nuclear fuel cycle facilities which it is prepared to share.
- Necsa is experiencing some difficulties with specific issues and hope to gain information through this forum that will lead to solutions.
- Thank you to the IAEA for the establishment of the IDN and for the opportunities that it will undoubtedly create.