Planning, Cost Estimates, Funding, Budgeting: Overview and Interrelation

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- Overriding Principles
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Objectives of the lecture

- Understand the importance of an early, good and reliable cost estimate
- Identify and understand key components of a cost estimate
- Identify factors that have a major influence on the overall decommissioning costs
- Understand the importance of funding
- Be aware of uncertainties involved
- Recognise that plan, costs, funds and budget are interrelated

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Purpose of the Cost Estimate

- To determine the necessary funds
- To ensure that adequate funds are available when needed
- To ensure safety and satisfy regulatory requirements
- To implement a link to decommissioning plan
- To show that cost calculation is one of the planning / decision making tools
- Note: Always include licensing costs!

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Key aspects / terms

- Planning: aiming at a final decommissioning plan with the necessary level of detail
- Cost calculation: determining the amount of money necessary to execute the decom. plan
- Funding: Make provisions early in advance for having funds available when needed
- Budgeting: Monetary plan for financing the execution of a decommissioning plan
- There are interrelations between planning and cost calculation / funding

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Planning (I)

- Planning is a prerequisite for cost calculation
- Cost calculation and funding are important prerequisites for safety
- No plan → No cost calculation → No funds → No safety!
- An overall decommissioning plan identifying the major decommissioning steps (work breakdown) has to be prepared and licensed
- These major decommissioning steps have to be planned and licensed on a logical time line

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Planning (II)

- Many (strategic) decisions are to be taken during planning (logical sequence, technical means, …)
- Ensure an ‘integrated approach’, i.e. that everything fits together from the beginning to the very end, without foreclosing options
- Planning includes the evaluation of options, based on safety + proven technology

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Contents of a Cost Calculation

- Description of the overall facility
  - Portions included in the cost estimate
- All assumptions
- Summary of information by major task
  - Cost
  - Man-hours and labor categories / Staffing levels
  - Amounts of materials and waste (volume, activity)
  - Uncertainties and contingencies
  - Cost to allow independent review
  - Funding mechanisms
  - Licensing

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Types of Costs (I)

- Activity dependent costs, e.g.

  Fuel management, characterisation, decontamination, clearance, dismantling, transport, waste management

- Local labour costs
  - Base rate, holiday, sick time, unemployment, tax, overheads, profits
  - Labour levels: supervisor, engineer, technician, …
- Equipment costs

  Purchase or rental, operation, maintenance, …

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Types of Costs (II)

- Waste management costs
  Decontamination, volume reduction, conditioning, transport, storage, disposal
- Other or ‘undistributed’ costs
  Energy
  Protective clothing
  Dosimetry and equipment (personnel, environment),
  Environmental survey: sampling, laboratory, QA, …
  Licenses: decommissioning, waste, termination, …
  Training

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Methods of cost calculation (I)

1. Unit Cost factor approach

- Applicable to large volumes of similar material (e.g. concrete) or equipment (e.g. piping)
- Unit cost factors incorporate local labor rates and productivity, equipment and material costs
- Example of output
  - Costs for the removal of a m^3 of concrete
  - Costs for cutting/ removing a meter of piping
  - Cost for clearing a ton of material
  - Cost for conditioning of a m^3 of waste
  - Cost for storage or disposal of a m^3 of waste

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Methods of cost calculation (II)

Unit Factor Example

Removal of piping - 2 to 10 cm diameter, insulated, contaminated

Contaminated pipe with a diameter of 2 to 10 cm will be cut with a reciprocating saw. The pipe will be cut into nominal 2 meter lengths during removal. The pipe will be placed into containers and sent to a shipping area. The insulation (5 cm fiberglass) will be removed and packaged for disposal.

				Labor Category 1 Title: Laborer $25.00			Labor Category 2 Title:			Total Activity		
Activity Description	Activity Duration	PLF	Adjusted Duration	# of Workers	Man Hours	Base Cost	# of Workers	Man Hours	Base Cost	# of Workers	Man Hours	Base Cost
Prepare area	10	1.52	15.2	2	0.51	12.67				2	0.51	12.67
Remove insulation	15	2.09	31.4	2	1.05	26.25				2	1.05	26.25
Remove pipe hangers	10	1.52	15.2	1	0.25	6.33				1	0.25	6.33
Cut pipe	5	1.52	7.6	2	0.25	6.33				2	0.25	6.33
Load pipe in container	2	1.52	3.0	1	0.05	1.25				1	0.05	1.27
	Total duration		72.4 min/ 2 meter piece					Craft Labor			2.11	52.85
		or	1.21 hr/piece			Supervisor ratio		5:1 rate $45.00/hr			0.42	18.90
		or	0.60 hr/meter					Subtotal labor			2.53	71.75
								Overhead & profit @ 0%			0	0
	Total Man-hours		2.53 man-hours/piece					**Total Labor Cost**			2.53	71.75
		or	1.27 man-hours/meter									

Equipment Costs:		
Consumables/Materials (Herculite)	4 sq m @ $2.00/sq m	8.00
Saw Blades	.1 @ $1.00/blade	0.10
Absorbent material	2 sq m@$5.00/sq m	10.00
Bag for insulation	1 @ $0.25 each	0.25
Subtotal		18.35
Overhead & Profit on equipment @ 10%		1.84
Total equipment cost		20.19

Total Task Cost to Remove Pipe		$91.94 /piece
	or	$45.97 /meter

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Methods of cost calculation (III)

2. Activity specific approach

- Applicable to individual activities that will not be repeated many times
- Estimates should provide all the details necessary to understand and later trace back the logic
- Staffing, equipment and other costs are to be included

Methods of cost calculation (IV)

Activity Specific Approach

Example of an activity specific calculation:

Mobilization:

	Rate/ Hour	Number	Hours/ Day	Days	Sub Total	50% Overhead	15% Profit	Total
Laborer	25.00	3	8	10	6000	3000		9000
Supervisor	45.00	1	8	10	3600	1800		5400
Total								14,400

Equipment / Direct Costs:

Transportation of equipment	5000	2500		7500
Misc. Supplies	2000	1000		3000
Temporary office & lab trailer (setup and initial month rental)	10000	5000		15000
Total				25,500

Grand total 39,900

Elements of a Cost Calculation (I)

1. Controlling information: to provide the basic details of the cost estimate

- End product requirements
  - What type of information is expected from the cost calculation?
  - Examples
    Total project costs; costs allocated to the elements of the work breakdown structure; man-hours; labour costs; cost for removal of contaminated or clean equipment; costs for removal of building structures; costs for waste conditioning / storage / disposal
- Site specific information relevant for cost calc.
  - Property records, site drawings, site description

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Elements of a Cost Calculation (II)

- Local radiological conditions or profiles
- Local labour and equipment costs

- Assumptions used in cost calculations
  - Work hours per day
  - Local labour rates
  - Fuel disposition and shipping schedule
  - End of life activation / contamination estimates
  - Hazardous materials (e.g. asbestos) at shut down
  - Waste minimisation, amounts, storage, disposal
  - Date of shut down
  - Expected end state (feasibility of decontamination)

Elements of a Cost Calculation (III)

- Regulatory constraints
  - Levels for removal from control / clearance
  - Re-use issues
  - Fuel and waste policies
  - Radiation protection / optimisation constraints
- Site survey / radiological profile
  - → The better the data the better the estimate
  - Extent of activation + contamination / decontamin.
  - Identific. of contaminated systems / components
  - Needs for protection of workers (shielding, tent …)
  - Requirements for packaging, transport, storage …

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Elements of a Cost Calculation (IV)

2. Cost calculations

- Define activities and sequence
  - ‘Mobilisation’
  - Training
  - Removal of contaminated equipment, incl. ‘trash’
  - Decontaminate or remove contaminated structures
  - Remove activated structures
  - Final survey
  - Release clean structure
  - Prepare detailed sequence of activities

→ The more detailed / the better the cost calculation

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Elements of a Cost Calculation (V)

- ‘Material takeoff’ sheets
  - Provide an inventory of equipment and materials
  - Can be prepared on a room by room basis or by system
  - Sheets typically contain:
    - Equipment to be decontaminated or just removed
    - Materials of construction
    - Volumes / amounts of material by type

  → important for unit cost factor approach

Elements of a Cost Calculation (VI)

- Develop cost of activities

Large number of similar tasks:

- use unit cost factor approach
- apply to system or component

Example:
2500m of 2-10cm diameter insulated and contaminated steel pipe with X $ per meter

- summarise costs by system or component

Unique items / tasks:

- e.g. remote cutting of reactor vessel:
- break task down to steps
- calculate costs per step

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Elements of a Cost Calculation (VII)

- Develop a decommissioning schedule
  - Driven by availability of funds and manpower
  - Identify ‘critical’ tasks (‘showstoppers’)
  - Develop a logical sequence of activities
  - Perform tasks in parallel, if possible
  - Perform non-critical tasks if staff is ‘idle’
  - Apply shortest possible schedule
  - Determine the funds needed per budget year
  - Expect surprises (unexpected contamination, incidents, mistakes, licensing issues …)
  - Re-schedule, as required

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Elements of a Cost Calculation (VIII)

- Other Costs

  - Do not forget to calculate costs not directly associated to the dismantling activities, e.g.

    · Management costs

    · Licensing costs (preparation of applications, costs of the regulator and independent experts involved)

    · Energy costs

    · Insurance

    · Health Physics supplies

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Elements of a Cost Calculation (IX)

- Contingencies
  - Cost calculations cannot be that precise
  - Contingencies should provide a better assurance that sufficient funding is available
  - Unknown / unforeseen costs may occur
  -NOT a safety factor for poor planning, but a coverage for bad weather, labour disputes …
  -Contingencies can be added to each task or placed on the total
  -Amount depends on maturity of the planning

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Elements of a Cost Calculation (X)

- If dismantling is deferred – do not forget facility and site maintenance costs
- At the end, a cost calculation should
  - contain a summary stating the total costs
  - Provide all the required information, e.g. man-power costs, materials management costs / waste management costs, including conditioning, storage and disposal

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Funding (I)

- Purpose: To have money available covering the liabilities remaining after operation
- Mechanisms:
  - Depends on national legal / regulatory framework
  - 'Polluter Pays' principle is widely applied
  - Private operations:
    - Payment prior to start of operation
    - Collection of money during operations
    - Who controls funds: operator, third party, State
    - How to invest to minimise the risk of loss

Funding (II)

- State operations:
  - · Government typically self-insures its facilities
  - · Providing of funds through annual State budget
  - · Statement of intent from the government
  - · Often funds are not available when needed
  - · Early cost estimates
  - · Early submission (e.g. 5-10 years in advance) of decommissioning expenses for inclusion into the State budget
- In any instance:
  Final (financial) responsibility is with the State!

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Funding Uncertainties (I)

- Uncertainties are associated with:
  - Long time scales and deferral of dismantling, e.g. safe enclosure
  - Precision of planning and of the cost calculation
  - Variation of currency exchange rate (see next slide)
  - Inflation / increase of prices and wages
  - Variation of interest rates / credit risks
  - Discounting (in private operations)
  - Proper liquidity planning
  - Economic stability / market risks
  - Practical decommissioning experience (first object)
  - Early shut down of a facility

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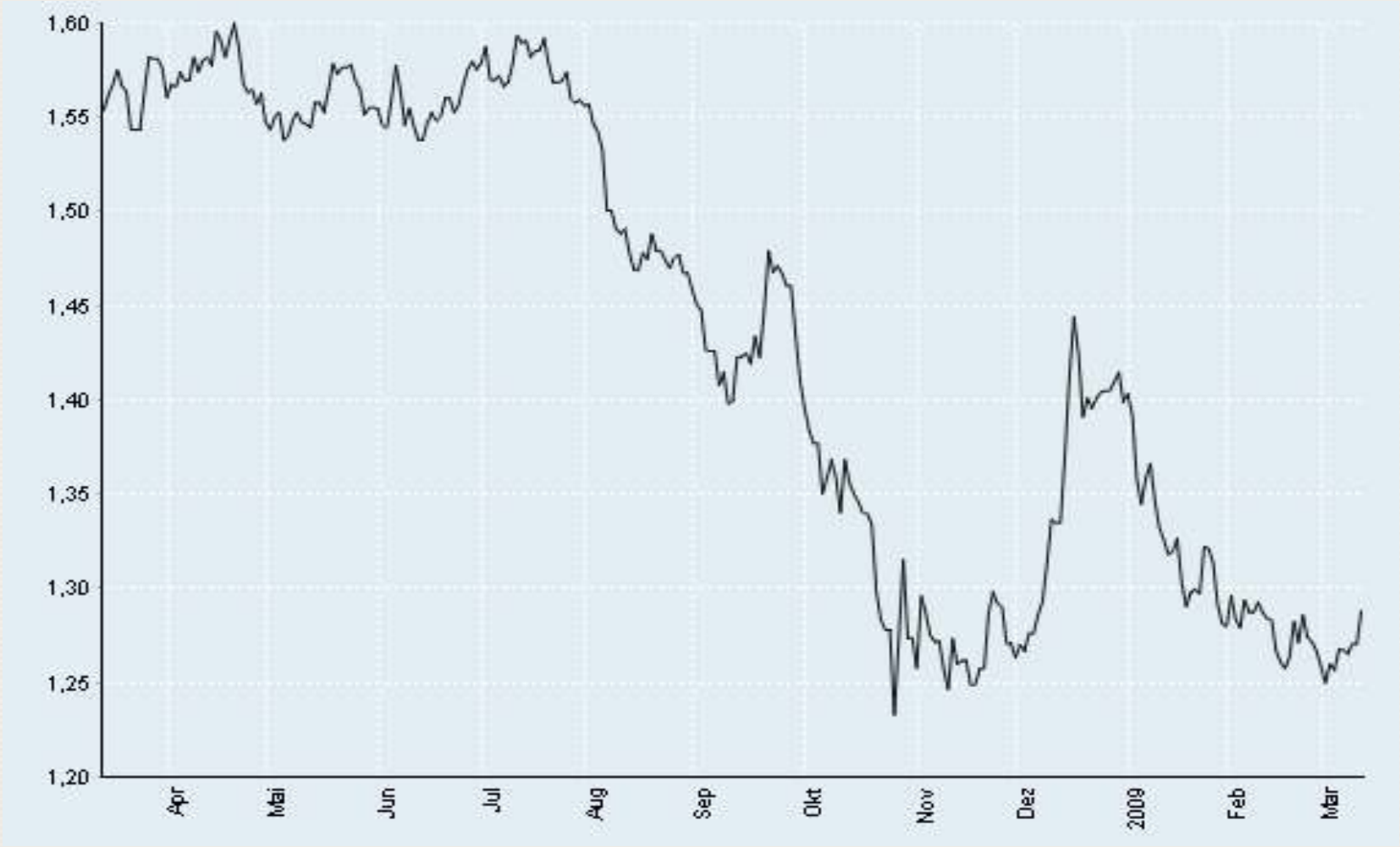
Funding Uncertainties (II)

Exchange rate US$ per Euro (2008/09)



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Funding Uncertainties (III)

- Conditioning of waste, in particular in the absence of waste acceptance requirements for disposal
- Storage of waste (for how long?)
- Disposal of radioactive waste, in particular in cases without disposal plans
- Changes in the legal / regulatory framework (e.g. clearance levels)

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Major Cost Factors

- Manpower costs
- Materials management / radioactive waste processing
- Radioactive waste disposal

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Comparability of Cost Calculations

- Decommissioning cost are quite variable
- It is often difficult to compare cost calculations
- There are many factors that cause differences
  - Size / type of reactor and operating history
  - Scope of the decommissioning activities, (complete costs, e.g. from fuel management to waste disposal)
  - Differences in national labour costs
  - Differences in labour productivity / effectiveness
  - Differences in approaches to waste management
  - Decommissioning strategy (immediate or deferred)
  - Fluctuations in exchange rates
- Use utmost care when comparing costs

Summary

- Cost calculation methodologies are available
- Good planning is a prerequisite for good cost calculations
- Good cost calculations are a prerequisite for funding, i.e. having the required funds available when needed
- Regular updates are necessary for planning and cost calculation
- Uncertainties in costing / funding have to be properly managed
- An early provision / request for the necessary funds is vital, including a funding timeline

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