

**Financial Mechanisms and
Resource Requirements for
Decommissioning**

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Basic Obligation for Funding of Decommissioning

“A mechanism for providing adequate financial resources shall be established to cover the costs of radioactive waste management and, in particular, the cost of decommissioning. It shall be put in place before operation and shall be updated, as necessary.”

**Predisposal Management of Radioactive Waste,
Including Decommissioning. IAEA Fundamentals
Document No. WS-R-2 (2000)**

Obligation for Decommissioning Funding (2)

“The State should ensure that the operating organization has a financing system for safe operation of the research reactor, for maintaining the research reactor in a safe shutdown state for extended periods if this becomes necessary, and for its decommissioning.”

Code of Conduct on the Safety of Research Reactors, Section 13.

BASIC PRINCIPLES FOR FUNDING DECOMMISSIONING

- **SUCCESSFUL DECOMMISSIONING DEPENDS ON ADEQUATE FUNDING TO COMPLETE THE WORK WITHOUT RISK TO PUBLIC AND WORKER HEALTH, SAFETY AND THE ENVIRONMENT**
- **THOSE WHO HAVE GENERATED WASTE ARE RESPONSIBLE FOR ITS DISPOSAL**
- **FUNDING MUST BE SUFFICIENT, AVAILABLE, TRANSPARENTLY MANAGED**
- **FUNDS MUST BE USED ONLY FOR THE PURPOSES FOR WHICH THEY WERE GATHERED**

**Some Basic Concepts for
Funding of Decommissioning
-- The Ten 'A's --**

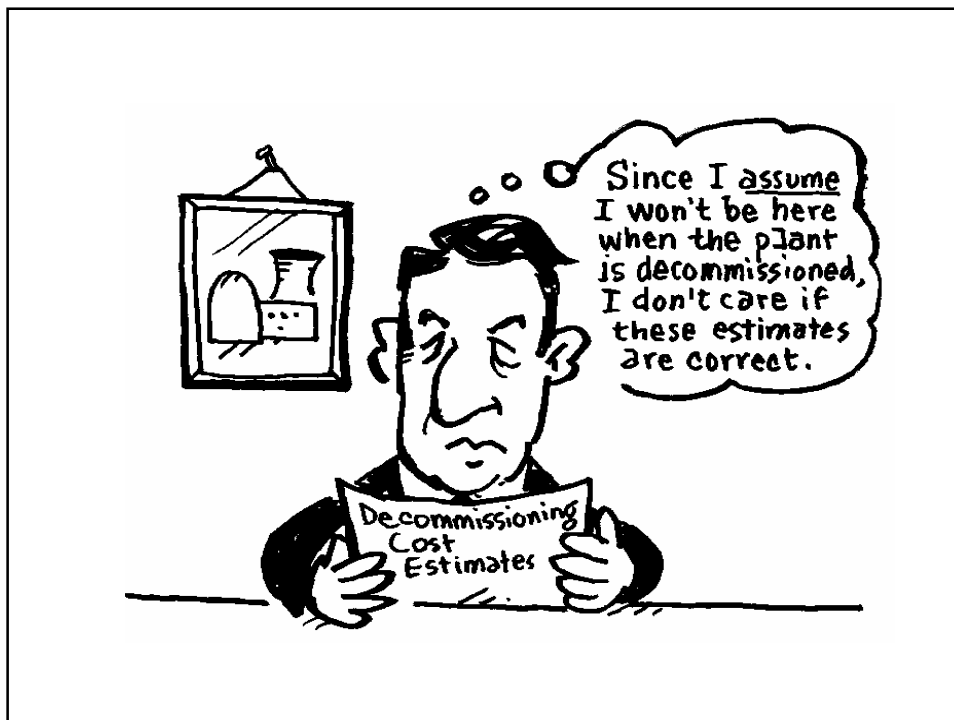
- **1. Alternatives**
- **2. Assumptions**
- **3. Adequacy**
- **4. Assurance**
- **5. Authorization**
- **6. Access**
- **7. Acceptability**
- **8. Affordability**
- **9. Accountability**
- **10. Adjustments**

(1) ALTERNATIVES

- **The level and timing of needed funding and the method for securing funds is fundamentally influenced by the strategy adopted for decommissioning**
- **Three basic approaches:**
 - **-- Immediate dismantling**
 - **-- deferred dismantling (or delayed decommissioning), with a minimum degree of early dismantling and maintenance and monitoring**
 - **-- in situ disposal with entombment in a structurally sound structure**

(2) ASSUMPTIONS

- Initial estimates of the level and mode of funding must be based on estimated costs of the decommissioning option chosen, including contingency factors. Major cost estimates to be considered include:
 - major activities and tasks
 - waste disposal
 - transport of materials
 - compliance with regulatory requirements
 - final survey of facility and site



(3) ADEQUACY

- **The level of financial resources available for decommissioning activities must be sufficient to cover all relevant activities in an approved decommissioning plan at the time such resources are needed**
- **If certain aspects of the total decommissioning program are to be covered by sources other than a separate, designated fund (e.g., from public funding), these funds need to be identified and subject to a legally-enforceable requirement**

(4) ASSURANCE

- **Financial arrangements for decommissioning must provide reasonable assurance that funds will be available when needed over the life of a facility and after closure**
- **Three methods of providing financial assurance have been typically adopted**
 - **prepayment of decommissioning costs**
 - **insurance, surety or financial guarantees**
 - **an external fund, controlled by a trustee**
- **External funds are most common, but a combination of other methods can be utilized**

(5) AUTHORIZATION

- **Funding arrangements for decommissioning must be subject to regulatory oversight through the authorization process**
- **Without formal approval of the regulatory body, licensees should not be permitted to make financial arrangements that will limit their ability to comply with regulatory requirements at the final stages of the operation**
- **The regulatory authority must specifically set out the standards and procedures to for necessary authorizations; to provide notice to licensees and necessary information for electricity rate-payers, citizen tax-payers, financial institutions and other government regulatory bodies**

(6) ACCESS

- **Access to dedicated decommissioning funds must be limited to prevent misuse of financial resources to cover unrelated activities**
- **Disbursements from the fund should be allowed only for:**
 - **decommissioning expenses**
 - **transfer of funds to another authorized assurance mechanism**
- **Funds should not be available for operational expenses of a facility (i.e., waste disposal while the plant continues to operate)**

(7) ACCEPTABILITY

- **The costs and funding arrangements for decommissioning must be acceptable to relevant stakeholders, including:**
 - **Operating organizations**
 - **Electricity rate-payers**
 - **Regulatory authority**
 - **Legislative body**
 - **Other national or local governmental bodies**
 - **Citizens**
- **The process of assuring acceptability should include various “transparency” options, including advance public information and participation in both the legislative and regulatory processes**

(8) AFFORDABILITY

- **Given the fact that decommissioning costs are a part of an economic activity (supply of electrical power), they must be judged by their “cost effectiveness”**
- **Both licensee management and regulatory authorities must pay close attention to the need to ensure that activities related to decommissioning are conducted efficiently and that all options for reducing costs consistent with assuring safety, security and environmental protection are thoroughly evaluated and implemented**



(9) ACCOUNTABILITY

- **Periodic regulatory review of the status of decommissioning funding programs is necessary to ensure that funds will be in place when needed and will be adequate**
- **Annual or bi-annual regulatory reviews are advisable, given changes in economic conditions and the potential for misuse of dedicated funds for purposes other than decommissioning**
- **Regulatory arrangements should ensure that financial reports are certified by the highest management level in the licensee organization**

(10) ADJUSTMENTS

- **Levels or even modes of funding must be capable of adjustment over time to reflect changes in circumstances, including:**
 - **changes in actual or expected costs (e.g., for labor, energy or low level waste burial**
 - **inflation**
 - **projected earnings on investments of the fund**
 - **new regulatory requirements**
 - **electricity market changes (deregulation)**
 - **technical develops affecting decommissioning options**
 - **political decisions**

IDENTIFYING AND ESTIMATING DECOMMISSIONING COSTS

- **COST ESTIMATES FOR DIFFERENT NUCLEAR FACILITIES ARE COMPLICATED**
- **METHODOLOGY FOR COST ESTIMATION FOLLOWS A STANDARDIZED MODEL**
- **IAEA-TECDOC-1476 “FINANCIAL ASPECTS OF DECOMMISSIONING” (NOVEMBER 2005) OUTLINES APPROACHES BASED ON WORK BY IAEA, EUROPEAN COMMUNITIES AND OECD/NEA**

**STANDARDIZED LIST OF ITEMS FOR
COSTING OF DECOMMISSIONING (1)**

- 01 – PRE-DECOMMISSIONING ACTIVITIES
- 02 – FACILITY SHUTDOWN ACTIVITIES
- 03 – PROCUREMENT OF GENERAL EQUIPMENT
AND MATERIAL
- 04 – DISMANTLING ACTIVITIES
- 05 – WASTE PROCESSING, STORAGE & DISPOSAL
- 06 – SITE SECURITY, SURVEILLANCE &
MAINTENANCE

**STANDARDIZED LIST OF ITEMS FOR
COSTING OF DECOMMISSIONING (2)**

- 07 – SITE RESTORATION, CLEANUP AND
LANDSCAPING
- 08 – PROJECT MANAGEMENT, ENGINEERING AND
SITE SUPPORT
- 09 – RESEARCH AND DEVELOPMENT
- 10 – FUEL AND NUCLEAR MATERIAL
- 11 – OTHER (FEES, PERMITS, LICENSES,
INSURANCE, OVERHEAD, ADMINISTRATION,
EMPLOYEE TRANSITION, ETC.)

BASIC TYPES OF COST ESTIMATES

- ORDER OF MAGNITUDE ESTIMATE: NO DETAILED ENGINEERING DATA; SCALE-UP BY RATIOS; SCOPE NOT WELL DEFINED (ACCURACY: -30 TO +50 %)
- BUDGETARY ESTIMATE: SCOPE DEFINED; DETAILED ENGINEERING NOT PERFORMED (ACCURACY: -15 TO +30 %)
- DEFINITIVE ESTIMATE: DETAILS AND SCOPE WELL-DEFINED WITH ENGINEERING DATA (ACCURACY: -5 TO +15 %)



FINANCING DECOMMISSIONING-- COMMERCIAL VERSUS GOVERNMENT RESEARCH REACTORS

- COMMERCIAL REACTORS CAN FINANCE DECOMMISSIONING ON THE BASIS OF ECONOMIC USAGE OF THE FACILITY**
- NON-COMMERCIAL (GOVERNMENT, UNIVERSITY, OTHER) REACTORS MAY REQUIRE FINANCING THROUGH DIRECT GOVERNMENT SUPPORT**
- FINANCING BY DIRECT GOVERNMENT SUPPORT CAN RAISES ISSUES OF TIMELINESS, ADEQUACY AND PREDICTABILITY**

Decommissioning Funding in the U.S. Background

- Private electricity companies construct, build and operate nuclear power plants and are responsible for decommissioning, including funding**
- U.S. nuclear power program is large (over 100 operating reactors)**
- The estimated costs for decommissioning a nuclear power plant in the U.S. range from \$300 to \$450 million**
- 19 nuclear power plant units in the U.S. have been permanently shut down and are in some phase of decommissioning**

U.S. Decommissioning Funding: Statutory Basis

Legislative basis for regulatory control of decommissioning funding in U.S. is very general. Section 182.a of the Atomic Energy Act of 1954, as amended, provides: “Each application for a license . . . shall specifically state such information as the Commission, by rule or regulation, may determine to be necessary to decide such of the technical and financial qualifications of the applicant . . . as the Commission may deem appropriate for the license.”

U.S. Decommissioning funding: Regulatory Framework

- **The U.S. Nuclear Regulatory Commission (as regulatory authority) has adopted detailed funding requirements and procedures to assure that licensees make adequate provision for decommissioning**
- **USNRC regulations for decommissioning are set out in Title 10, Code of Federal Regulations, part 20 subpart E and parts 50.75, 50.82, 51.53 and 51.95 (available on USNRC website: www.nrc.gov)**

U.S. Decommissioning Funding: Three Stages of Decommissioning

Regulation of decommissioning funding is related to the three phases of decommissioning activities subject to USNRC regulatory oversight:

- 1—Initial activities (certifications required prior to cessation of operation and Post Shut-down Decommission Activities Report [PSDAR] on schedule and costs)**
- 2—Major decommissioning activities (Licensee can use funds—from 3 to 20 per cent of available fund—without USNRC approval, after receipt of PSDAR and if certain conditions are met)**
- 3—License termination activities (Licensee must submit License Termination Plan [LTP] within two years of expected termination. LTP must include detailed information on costs and financial assurance)**

U.S. Decommissioning Funding: Three-stage process

USNRC process for assuring adequate funding for decommissioning is conducted in three stages:

- 1—Applicants for operating license (or more recent combined construction permit/operating license) must submit an initial report demonstrating how reasonable assurance for funding to decommission the facility will be provided**
- 2— Licensees must report every two years (annually within 5 years of end of plant operation) on the amount of decommissioning funding assurance available for a facility according to a specific formula**
- 3—Five years before cessation of operations, licensees must submit a preliminary decommissioning cost estimate**

U.S. Decommissioning Funding: Demonstrating Financial Assurance

Licensees can demonstrate financial assurance for for decommissioning by one or more of the following:

Prepayment – a deposit by the licensee at start of operation in a separate account or trust fund

Surety, insurance or parent company guarantee – assurance that decommissioning costs will be paid by another party should the licensee be unable to do so

External sinking fund – separate account outside the licensee's control, plus insurance or surety mechanism such that the total of both equals or exceeds costs of decommissioning

Most licensees select the third option

U.S. Decommissioning Funding: Cost Data for Release of Site

Before restricted or unrestricted release of a site from regulatory control, a licensee must submit to the USNRC for review/approval a report on the following:

- **cost assumptions, with basis and contingency factors**
- **cost estimates of major decommissioning activities and tasks**
- **unit cost factors**
- **costs of decontamination and equipment/structure removal**
- **estimated costs of waste disposal, with expected surcharges**
- **estimated transportation costs**
- **estimated cost of final environmental survey**

U.S. Decommissioning Funding: Exclusions

Under USNRC regulations, the costs of number of activities are not considered “decommissioning costs” for purposes of financial assurance—but are considered operating expenses. They include:

- demolition of decontaminated structures**
- site restoration activities**
- activities not involved with removing the facility from service or reducing radioactivity**
- constructing, operating, maintaining and decommissioning an onsite spent fuel storage facility or independent spent fuel storage installation(ISFSI)**

USNRC Documents on Decommissioning Funding Standard Review Plans

- Standard Review Plan on Power Reactor Licensee Financial Qualifications and Decommissioning Funding Assurance (NUREG-1577)**
- Standard Review Plan for Nuclear Power Reactor License Termination Plans (NUREG-1700, Rev. 1)**
- Standard Review Plan for Decommissioning Cost Estimates for Nuclear Power Reactors (NUREG-1713)**

**USNRC Documents on
Decommissioning Funding
Regulatory Guides**

- **Regulatory Guide 1.179 “Standard Format and Content of License Termination Plans for Nuclear Power Reactors”**
- **Regulatory Guide 1.184 “Decommissioning of Nuclear Power Reactors”**
- **Draft Regulatory Guide-1085 “Standard Format and Content of Decommissioning Cost Estimates for Nuclear Power Reactors”**
- **Regulatory Guide 1.159 “Assuring the Availability of Funds for Decommissioning Nuclear Reactors”**