



Science Centre
North Rhine-Westphalia
Institute of Work
and Technology



Institute for
Culture Studies

**Wuppertal Institute for
Climate, Environment and
Energy**

Comparison among different decommissioning funds methodologies for nuclear installations

Final Report

Examples of Regulation of
Decommissioning Financing in Non-EU
Countries and Non-Nuclear Areas

on behalf of the European Commission
Directorate-General Energy and Transport, H2

Service Contract TREN/05/NUCL/S07.55436

Wuppertal, 2007

Editor:

Wuppertal Institut für Klima, Umwelt, Energie GmbH
im Wissenschaftszentrum Nordrhein-Westfalen

TREN/05/NUCL/S07.55436

**Comparison among different decommissioning
funds methodologies for nuclear installations**

Examples of regulation of decommissioning financing
in non-EU countries and non-nuclear areas

Wolfgang Irrek, Wuppertal Institute

Antony Froggatt, Independent Consultant

Wuppertal / London, 31 October 2006

Contents

1	NUCLEAR DECOMMISSIONING FINANCING IN SELECTED NON-EU COUNTRIES.....	1
1.1	Canada.....	1
1.2	Switzerland.....	2
1.3	United States of America.....	4
2	DECOMMISSIONING FINANCING IN SELECTED NON-NUCLEAR AREAS.....	5
2.1	Conventional waste management and final disposal.....	5
2.2	Offshore petroleum installations	5
2.3	Mining.....	6

1 Nuclear decommissioning financing in selected non-EU countries

1.1 Canada

Canada has 18 reactors in operation, with an installed capacity of 12.6 GW. The reactors are fuelled by natural uranium and are of the CANDU design. The use of natural uranium increases the volume of spent fuel produced per kWh of electricity generated. The other major difference to the nuclear industries in Member States of the EU is the amount of uranium mining. Canada is one of the world's largest uranium producers and consequently waste management funding must allocate financing for the remediation of former mining land. Currently, it is estimated that there are 28,000 tonnes of spent fuel, 203,000 tonnes of low level waste, 8 million tonnes of uranium waste in active mining facilities and over 200 million tonnes in closed facilities.

With respect to these closed facilities, the financial responsibility is shared between different levels of Government.

The Canadian Government applies the polluter pays principle and through the 1996 Radioactive Waste Policy, which requires the owners of nuclear fuel waste to establish **segregated funds** to fully finance long term waste management activities (separated funds, which can be internally ones).

The Canadian situation is covered by a 2000 Regulatory guide on Financial Guarantees for the Decommissioning of Licensed Activities. The over-riding framework of the regulation requires that plans:

- Demonstrate that the planned decommissioning activities will remediate all significant impacts and hazards to persons and the environment in a technically feasible fashion;
- Assure compliance with all applicable requirements and criteria established in or under acts or regulation; and
- Enable credible estimates of the amount of financial guarantees.

The Canadian regulator (the Canadian Nuclear Safety Commission) does not have a specific requirement for the level of decommissioning funding for a specific reactor size or design, rather the operator is required to propose a specific estimate, which may or may not be approved.

Nuclear utilities are not required to hold their decommissioning funds in an external fund, but are required to have the funds *'structured so as to ensure that the funds or securities provided by the applicant or licensee to guarantee funding for an approved decommissioning plan are separated from its other assets'*. Furthermore, the regulator requirements suggests that *'withdrawals from a fund, or access to monies realised from other security vehicles, should only be permitted for approved purposes'*.

The decommissioning fund is required to meet a number of criteria. These **restrictions** include:

- **Liquidity:**
The proposed financial guarantees should be such that the vehicle can be drawn upon only with the prior acceptance of the regulator so that payout for decommissioning purposes is not prevented, unduly delayed, or compromised for any reason.
- **Certainty of value:**
Utilities should select funding or security instruments or arrangements which provide full assurance of their value.
- **Adequacy of value:**
The funds should be sufficient to fund the decommissioning plans for which they are intended.

There are a number of possible mechanisms that the regulator believes are suitable for giving the necessary **financial guarantees**, these include: cash, irrevocable letters of credit, security bonds, insurance and expressed commitments from a government (either federal or provincial). Furthermore, the regulatory guide states that 'parent company guarantees and pledges of assets do not satisfy these acceptance criteria'.

The Canadian regulations importantly do not permit credit for the salvage of equipment or materials in costing the implementation of proposed decommissioning plans – the so called 'below regulatory' concern aspects. Furthermore, cost estimates put forward should include an **indication of the expected reliability of the forecasts**. Therefore those estimates that are deemed to be the most accurate – Grade A- will include the smallest contingency allowance (10%) compared to those that are less predicted – Grade C – that have a larger allowance, in the range of 25-30%.

1.2 Switzerland

Switzerland has five reactors in operation, with an installed capacity of 3.2 GW having produced about 22.1 TWh in 2005. Decommissioning costs for the Swiss NPPs are estimated at 1.2 billion Euro₂₀₀₁ for decontamination, dismantling, demolition, etc., and 7.5 billion Euro₂₀₀₁ for spent fuel and radioactive waste management.

The objective of the decommissioning financing system is to make provisions in such a way that means of finance are adequate and available to pay for all decommissioning activities after 40 years of operation, i.e. in the year 2025. Total lifetime of the NPPs is expected to reach between 50 and 60 years. There are three ways how decommissioning costs shall be covered:

- Decommissioning costs already arising during operation are directly paid by the operators from their budgets. Cost items covered by direct payments are mainly reprocessing fees, exploration of disposal sites, construction and operation of the central interim storage at Würenlingen. Until the end of 2005, these costs had

summed up to 2.6 billion Euro (compared to 3.5 billion Euro expected in total over the whole lifetime of the plants).

- Decommissioning costs that have to be covered after the above-mentioned 40 years of operation are provided for by regular payments to central external funds:
 - Central fund for decontamination, dismantling, demolition, etc. (technical decommissioning) („Stilllegungsfonds“), with 0.8 billion Euro already provided for by the end of 2005a (compared to 1.2 billion Euro expected in total over the whole lifetime of the plants), and
 - Central fund for radioactive waste management („Entsorgungsfonds“), with 1.8 billion Euro already provided for by the end of 2005 (compared to 4.0 billion Euro expected in total over the whole lifetime of the plants).

This means that until the end of 2005, about 60% of expected lifetime decommissioning costs were covered by respective payments and provisions. The operators do not have to give their contributions to the central funds in cash, but can submit some guarantees or insurance claims instead. However, in 2005, none of the operators has used this option.

While the fund for technical decommissioning („Stilllegungsfonds“) was already established in 1984, the fund for radioactive waste management („Entsorgungsfonds“) was only introduced in 2000, with a transition period for the operators to pay their internally built, unrestricted funds into this central fund.

Both funds are organised in a similar way, with the same persons acting in the different boards and committees. The main board is an Administrative Commission appointed by the Federal Department for Environment, Transport, Energy and Communication (UVEK), and consisting of 9 persons, among others, representatives of the government, the operators and the consumers. The daily management is done by an office consisting of two persons who belong to an organisation offering special services for non-profit organisations. They are appointed by UVEK, too, but are suggested by the Administrative Commission. Furthermore, there is an investment commission giving recommendations with regard to the asset management, and a cost committee setting basic assumptions and main criteria for the cost estimation methodology. A consultancy yearly carries out an audit. The Federal Energy Agency is the regulatory authority supervising all activities of the fund.

Real performance of the funds (real interest rate) has been as follows:

- Central fund for technical decommissioning („Stilllegungsfonds“): +12.99% in 2005; +4.41% per year in the period 1985 – 2005.
- Central fund for radioactive waste management („Entsorgungsfonds“): +15.47% in 2005; +3.15% per year in the period 2002 – 2005.

1.3 United States of America

The United States has 103 nuclear reactors in operation with an installed capacity of 98 GW, giving the country the largest fleet in the world.

Any commercial nuclear facility is required to meet the Nuclear Regulatory Commission requirements on financial surety. These require that companies establish a decommissioning fund for each reactor. However, this only refers to the sections of a facility which have become radioactive. Funds are collected to pay for future decommissioning in one of three ways:

- Where the utility ensures that the decommissioning costs are incorporated into the cost of nuclear generated electricity – a so called '**external sinking fund**'- and this money is then set aside in a **trust fund** that is separately managed to generate adequate money for decommissioning. Money in the fund is set aside in an account separate from the licensee's assets and administrative control. It can be a trust, escrow account, government fund, certificate of deposit, government securities or other payment acceptable to the NRC.
- A **prepayment account** is set up so that the utility sets aside funding prior to start up of a facility.
- A **surety bond, letter of credit or insurance** (other acceptable decommissioning financial assurance mechanisms), which guarantees that decommissioning costs will be paid if the company defaults on its obligation.

Updates of decommissioning financing information are required every two years; during a plant's last five years of planned operation, the licensee must file reports annually. An annual status report will be required when "conditions indicate" that the plant will close within five years before its license expires or when the plant already has closed.

The estimated size of the fund is based on fixed amounts based on the size and type of reactor to be decommissioned. In the past, the required funding level has been criticised by the US GAO and now stands at 1100 MW PWR will cost \$280 million to decommission, while a generic BWR will cost around \$465 million. In 2002, the Financial Accounting Board adopted new financial reporting standards, which will require companies to report estimated decommissioning costs as liabilities in their financial statements – using a specified calculation methodology.

The regulation described only refers to technical dismantling, decontamination, demolition, etc. of a plant. Under the Nuclear Waste Policy Act utilities are required to pay for the costs for site characterization and development of geological repositories for the disposal of spent fuel and high level radioactive waste. This requires utilities to pay a fee of \$0.001 per kWh of nuclear electricity (as of mid 2006 a total of \$28 billion had been collected). This fee is collected by the utilities and deposited into the **Nuclear Waste Fund**. The US Congress appropriates funds annually for the development of the Yucca mountain facility. These funds are audited annually. Low and intermediate waste

management is undertaken on a State level, either in individual States or in groups and funded through the the individual reactors or facility decommissioning funds.

2 Decommissioning financing in selected non-nuclear areas

2.1 Conventional waste management and final disposal

In Germany, financial securities are required by law from operators of conventional waste disposal sites before start of operation (§32 (3) KrW-/AbfG i.V.m. §19 DepV; cf. Arbeitsgruppe der Bezirksregierung Arnsberg 2003?). There is a special scheme for calculating the expected size of the security to be provided on the basis of an estimate of decommissioning costs.

The security should usually be provided as a **bank guarantee**. Under special circumstances, a guarantee by the corporate group to which the operator of the disposal site belongs, can be sufficient, if complemented by a private insurance and audited by an external auditor.

It might be the case, that the public authority even approves internal unrestricted funds. However, the working group of the regional government of Arnsberg in Germany (Arbeitsgruppe der Bezirksregierung Arnsberg 2003?) argues that, in this case, external control of adequacy and availability of the funds by the public authority would be even more difficult than in the case of a guarantee by the corporate group to which the operator of the disposal site belongs. Furthermore, the main disadvantage of an internal, unrestricted fund would be that the operator has full access to the funds.

2.2 Offshore petroleum installations

As cited by Parente et al. (2006), according to Coleman (1998), in the coming decades, up to 6,500 offshore petroleum installations are expected to be decommissioned at an estimated cost situated in the range between 20 – 400 billion US\$.

As pointed out by MacKerron/Surrey/Thomas (1993), there are three similarities between nuclear and offshore petroleum decommissioning financing:

- There is only little experience of decommissioning large nuclear structures or large offshore structures.
- In both cases, no radically new technology is needed.
- Third, in both cases the timing of when production will cease cannot be predicted with confidence.

However, there are also two main differences:

- There is not technical advantage in delaying decommissioning of offshore petroleum sites.

- The degree of international regulation is greater in the case of offshore installations (through International Maritime Organisation, aiming to avoid interference with surface and submarine navigation and with fishing) than for nuclear reactors.

Financial 'risk reducers' applied to the offshore petroleum industry in different countries are the following (cf. Parente et al. 2006, MacKerron/Surrey/Thomas 1993):

- Adapting internal unrestricted provisions at regular intervals by reassessing decommissioning costs.
- The **Petroleum Act 1987** in **UK**, where oil and gas fields in the North Sea were developed jointly by groups of partners, demands full recovery of decommissioning costs from any parent, subsidiary or associate company of a defaulting partner.
- The security agreement for decommissioning of the **Ninian field**, UK, consists of letters of credit guaranteed by major international banks with 'double A' credit ratings. As an alternative, the partners can put their money into a trust fund investing in gilts.
- The majority of decommissioning regulations, especially those of UK, Norway, US and Canada, establish fines and obstacles to access funding.
- Some of the regulations suggest the creation of a compulsory contribution fund for all companies involved in the business.
- Parente et al. (2006) suggest the creation of dedicated, separated funds in the same way that pension funds are organised.

2.3 Mining

An overview of best practice in environmental management in mining by Commonwealth of Australia/UNEP (2002) indicates that most governments would not be satisfied with internal unrestricted decommissioning funds anymore but would „now require bonds to be lodged for mining operations in order to protect the public's interests and minimise ongoing liabilities.“ Commonwealth of Australia/UNEP (2002) refer to some principles for financial provisions in mine decommissioning that were defined by ANZMEC/MCA in 2000 as follows:

- „A **cost estimate** for closure should be developed from the closure plan;
 - Closure costs should be **reviewed regularly** to reflect changing circumstances;
 - The **financial provision** for closure should reflect the real cost;
 - **Accepted accounting standards** should be the basis for the financial provision;
- and

Adequate securities should protect the community from closure liabilities.“