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# Comparison among different decommissioning funds methodologies for nuclear installations

**Final Report**

## Country Report Slovak Republic

on behalf of the European Commission  
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Final Country Report: Slovak Republic

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## Summary

For a number of years there was no legislation in the field of financing of nuclear facilities decommissioning. From 1977 to 1993, the financial means for decommissioning (of the Bohunice A1 NPP reactor, which was the only reactor at this time to be decommissioned) were taken from the then federal budget of Czechoslovakia and then power generation company SEP. From 1993 onwards, funds came from the state budget of the Slovak Republic and the power generation company Slovenské Elektrárne (SE) a.s.

The first law of the Slovak Republic on decommissioning was approved on 1 June 1996. In addition to the financial means coming from the state budget and the operator of nuclear power plants, a fund called the "State Fund for Elimination of Nuclear Power-Generating Facilities and Spent Fuel/RAW Management" was established.

The Fund had the status of an independent legal entity at the level of an independent body unit ruled by the State. This Fund collected financial resources from a number of sources including:

- Contributions from the operators of nuclear facilities
- Bank credits
- Interests from the Funds deposited in the bank
- State subsidies.

A special case of financing past and on-going decommissioning activities is the Bohunice A1 NPP reactor, which suffered from several accidents in the years 1976-77. The total funds received for A 1 cannot be precisely calculated because of inconsistent numerical data provided by the ministries and because part of the costs was paid in kind. The need to finance the decommissioning of A 1 via the State Fund has resulted in the resources of the "State Fund for Elimination of Nuclear Power-Generating Facilities", which had basically been collected to finance decommissioning of other facilities, has been used to a large extent for payments of decommissioning activities at A 1 (a kind of cross-subsidy).

In 2006, a new law was adopted aiming at harmonizing Slovak legislation with relevant EU legislation. The existing fund was renamed the "National Nuclear Fund for Decommissioning of Nuclear Facilities and for elimination of Spent Nuclear Fuel and RAW". It was established as a special-purpose, state-governed fund to accumulate and process the necessary financial means. The new fund largely continues the activities of the old fund under the new name. The main difference of the new law is a requirement to open sub-accounts in the Fund for decommissioning of nuclear facilities as follows:

- 1.) Sub-account for decommissioning of nuclear facilities located at the Jaslovske Bohunice NPPs site so that each of those NPPs (A1, V1, V2) has its own independent analytical account:  
A1: 0 Sk, 0 €  
V1: 7570 Mil. Sk, 216 Mil. €  
V2: 6322 Mil. Sk, 180 Mil. €
- 2.) Sub-account for decommissioning of the Mochovce NPP:  
EMO: 2138 Mil. Sk, 61 Mil. €
- 3.) Sub-account for decommissioning of nuclear facilities that started their operations following the date when the National nuclear fund law came into force:  
Beginning with 1.7.2006: 0 Sk, 0 €
- 4.) Sub-account for treatment of nuclear materials and nuclear waste of unknown origin: 0 Sk, 0 €
- 5.) Sub-account for searching the localities, geological survey, preparation, designs, constructions, operation and for closing-up the deep repositories of RAW and spent nuclear fuel: 0 Sk, 0 €
- 6.) Sub-account for institutional control of (deep) repositories: 0 Sk, 0 €
- 7.) Sub-account for storage of spent fuel in independent nuclear facilities:  
0 Sk, 0 €
- 8.) Sub-account for financing the nuclear fund's administration:  
1789 Mil. Sk, 51 Mil. €

The actual balance (1.12.2006) on the account of the National Nuclear Funds (§8, law No.238/2006 Z.z.) comprises 16933 Mil. Sk (438 Mil. €; with 1 € = 35 Sk.)

The finances of the old fund have been transferred to the new nuclear fund and its individual sub-accounts. The funds have been allocated to each account corresponding to the share of electricity generated in the individual NPPs during 1978 - 2005.

The new law further requires that the licensees responsible for the operation of power-generating nuclear facilities set aside funds as follows:

- 9450 € per 1 MW of electric capacity annually
- 5.95% of the price of the sold electricity generated in the facility during the previous year.



The law has set the obligatory payment paid by the NPPs operators too low compared to the size of the liabilities and lower than determined before the law had been adopted. The amount required by the new law from the financial payments from the NPPs operators will not cover the costs of the decommissioning of nuclear the facilities. Therefore, unless additional funding sources - particularly from the state budget – are not acquired, the Fund's current deficit will increase. It has been calculated by Energia 2000 & Partners that to cover the full decommissioning costs would require an 2.5 – 2.8 times higher contribution from the operator that that required by the Law on the National Nuclear Fund.

In the case of the A1 NPP, there are special regulations since 2006 concerning the financing of its decommissioning. The regulations stipulate that no money for A1 was transferred to the new fund, although decommissioning is still ongoing and the environmental and health problems caused by the accidents are substantial.

For the year 2006, the financing from the state budget for decommissioning activities have been reduced from 1.8 billion Sk to 781.4 million Sk. Despite the fact that these funds would have been needed to prepare the A1 NPP so that dismantling could start as planned in 2007. Due to the reduction of the available finances, the work could not be completed in time.

However, the financing of the first stage of putting NPP A1 into a radiation safe state should now be temporary provided by law revision 528/2006 Z.z., which required that all works at NPP A1 will be financed from sub-account of NPP V-1. This law revision was adopted on 6<sup>th</sup> September 2006 by the Slovak parliament and entered into force on 15<sup>th</sup> October 2006. The financial deficit in the V-1 account is required to be balanced by 31<sup>st</sup> December 2011. However, it remains unclear what this will mean in detail and how this balancing should be done.

However, the authors of this report could not find out, how much money from which sources will now be available for future decommissioning activities at A1.

The low level of funds required from the operator in the Law on the National Nuclear Fund was proposed in order to fulfill the privatization conditions agreed between the Government and ENEL, who owns 66% of the Slovakian electricity company Slovenske Elektrarne. ENEL will not participate physically and does not seem to be responsible for the decommissioning of the facilities it operates (as far as this can be analysed without having access to the privatization contracts). It will only make payments to the National Nuclear Fund during the operation of the NPPs. These conditions had been agreed upon by the Slovak Government with ENEL during the privatizing negotiations.

There is also one further fund for decommissioning of NPPs: the Bohunice International Decommissioning Support Fund (BIDSF). It was established to finance some of the direct and indirect costs resulting from the early shut down of the V1 Bohunice NPP. During the EU accession negotiations, the Slovak Government committed to close the Bohunice V1 in 2006, and Unit 2 in 2008. EU assistance is not just foreseen for decommissioning of the reactors; equally important are issues related to security of supply (replacement capacity).

The Treaty of Accession foresees the provision of €90 million in 2004-6, recognising that decommissioning will continue beyond 2006, and that further assistance may be required beyond that date. This assistance is currently delivered through the BIDSF, managed by the European Bank for Research and Development, to which the EU is the major (but not the only) contributor.

A package of Community assistance amounting to €33 million for 2005 was approved by the PHARE Management Committee in July, and adopted by the Commission in September 2005. This accounts for the assistance foreseen for 2005 in the Bohunice Protocol. The 2006 package, consisting of a further €34 million contribution to the BIDSF, is likely to be adopted in October. The total EU assistance pledged since 1998 amounts to approximately €600 million of which €375 million are foreseen for the period 2007-2013. There are no plans to further EU assistance beyond 2013.

# 1 Introduction and overview

## 1.1 The Slovakian policy on the future of nuclear power

As a post-communist country, the Slovak Republic has been, and still is oriented to nuclear power as remains of the socialist economy that, for almost fifty years, was oriented solely to the Soviet primary energy sources, oil, natural gas and nuclear fuel, and to a lesser extent, also to black coal. This trend has been going until today. As one of the former Eastern Bloc's countries, Czechoslovakia, in the 1970-ties and 80-ties, almost exclusively focused on the nuclear program. The nuclear program in the former Czechoslovakia proposed to build nuclear power plants of 36 000 MW overall capacity to the year 2010. Of this, 12 000 MW el should be installed in four nuclear power plants in Slovakia. The locations for sites were also chosen : apart from Jaslovske Bohunice, they included also Mochovce, Kecerovce and East-Slovak Vojany vicinity sites. All nuclear power plants were to be of the Soviet type construction with VVER 440 and VVER 1000 reactors. The program was partly recessed after 1989; however, the power plants' concept remained unchanged (orientation to the Soviet VVER blocks). The preparatory works, partly implemented in 1989 for the Kecerovce nuclear power plant's construction site (four 1000 VVER reactors), were cancelled, and the designing works were stopped. The construction was implemented and completed only at the NPP Mochovce site (the construction of which began in 1982), as in 1989 this nuclear plant was already under construction, with originally planned four 440 VVER reactor blocks. Today, two 440 MW V-213 type blocks, have been already in operation, while the rest - two blocks (440 VVER reactors) are under construction.

The nuclear interest groups in Slovakia are very eager to complete the two Mochovce nuclear power plant's uncompleted blocks. The current right-wing Government, however, did not and does not agree with funding of the nuclear power plant's completion from the state budget. Therefore, it tried to privatize the power plant's owner and operator – the Slovak Energy company (100 % shares of the state) mainly to gain foreign capital for the plant's completion. The privatization process is currently almost completed. The privatizing company is the Italian ENEL joint-stock company with 66 % stocks portion. The state committed the privatizing company to complete the nuclear power plant's remaining blocks provided that the company will finance the rest of the completion from its own resources, with no requirements/claims on the state funding. The ENEL company has elaborated a feasibility study for the power plant's completion, which estimated that the plant will produce the 2-20 b. Sk loss during its 40 years operation. Therefore in frame of the privatization contract, the company literally blackmailed the Slovak state as to include the „advantages“ for the privatizing company in the contract, such as „tax holidays“ (tax break) for ten years, and the commitment of the state to buy all electricity generated during the power plant's operation etc. The privatization contract is confidential, not accessible to the public and not even to the Members of the Slovak Parliament.

Approved by the Government of Slovak Republic in January 2006, the energy policy of the Slovak Republic does not presume further building of any other nuclear power plants. However, the energy policy presumes completion of two remaining blocks 3 and 4 in the Mochovce NPP, with VVER 440 reactors of 2x440 MWel capacity, and increase of the existing NPPs' capacities, i.e. of the V2 J. Bohunice NPP and Mochovce NPP 1,2.

The Energy policy regulation of the Slovak Republic has been revised several times mainly due to principal comments made by the Energy Commission working at the Economic Committee of the National Committee (Parliament) Slovak Republic. At the Energy Commission's meeting, principal comments were made also by both 'Energy of the Third Millennium', and the 'Energy 2000' NGOs. Focusing on the replacement of the nuclear power use by renewable energy and by increase of energy efficiency of the existing energy sources. These comments were at least partially included in the final version of the Energy Policy of Slovak Republic. More emphasis was laid on the development of the electricity and heat co-generation. However, no sufficient steps were taken to support those energy sources, and therefore, nuclear power still remains the dominant source of electricity generation (over 60 % of generation) even following the adoption of the new Energy Policy of Slovak Republic.

## **1.2 General state policy of the future of nuclear facilities' decommissioning**

Until today, no Government in the Slovak Republic was interested to phase out the nuclear facilities, especially the NPPs. Moreover, by adoption of a resolution on NPPs' reconstruction (appr. 10 b. Sk), the Government of Slovak Republic attempted to extend the NPPs' designed lifetimes. Such a reconstruction had been implemented during 1995 – 2001 on the NPP V1, and until 2003, it has been implemented also on the NPP V2 in Jaslovske Bohunice.

The extension of the NPPs lifetime in Slovakia has been supported by the Nuclear Supervision Authority. Also in case of NPP V-1, even though it was decided on its phasing-out during 2006-2008 in frame of the Slovak Republic – EC accession talks, the Slovak Nuclear Supervision Authority is of the opinion that this NPP should be in operation until 2015. As for the nuclear facilities' decommissioning, the Slovak Government showed a low interest only in case of the crashed commercial NPP A1 in Jaslovske Bohunice, which has been shut down since 1977.

From the previous studies ordered by ministries of CSFR (the former Czechoslovakia) it becomes clear that evaluation of previous operation was reckless, because some results of experiments have to be solved by future generations. The main problems occurred by increasing of middle time of fuel elements from 2800 MWd/t to 4500 MWd/t, which became common rule. On the other side it was clear that 10% of fuel elements have by increased utilization damaged protection coverage. Other damages in fuel elements were caused by their cooling and storing in aqua medium 0,5%K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> (also called chrompik).

Chrompik as a cooling medium was in cases of long term deposit replaced (if it was possible) by another medium called dowthermom (difenil 26,5% + difenyloxid 73,5%).

Other results from the above mentioned studies are that problems of removal of burned down fuel and operational wastes were not correctly evaluated. This caused a situation where contamination of environment by high radioactive nuclear elements is real risk. The work with these materials requires huge amount of finances and strong requirements to technology. Failure of any component of used technology could stop the present works and create other radioactive contamination of the environment. This situation occurred in 1991 and caused delay in transport of nuclear fuel to the former Soviet Union.

The plant's accident caused its strong contamination, due to which the fuel could not be removed from the reactor up to the year 2000, and to the present days it was not possible to bring the plant in the radiation-safe state. The power plant has had also negative impacts on the environment, as it contaminated the environmental elements in the plant's vicinity by the radioactive materials. Therefore, the state was obliged to elaborate a special strategy for bringing the nuclear power plant in the radiation-safe condition, as well as for its decommissioning. Up to 1996, all works had been financed from the state budget. In 1996, the state fund for the nuclear installations decommissioning was established, with the contributions both from the state budget, and from the nuclear power plants' operator – the Slovak Energy company. The fund was established for decommissioning of all nuclear power plants.

### **1.3 Legislation basis for decommissioning in the country**

On April 7, 2006, the President of Slovakia signed the law on the nuclear account that defines the way of funding of the nuclear facilities' disposal. This law establishes the „State special-purpose fund“ called „The National Nuclear Fund for Decommissioning of Nuclear Facilities and for Elimination of Spent Fuel and Radioactive Wastes.“ The purpose of establishment of this National nuclear fund is to accumulate and manage the sufficient amount financial means designed for the back part of nuclear power , and in a transparent and non-discriminatory way, to provide persons defined by law, with these means to cover the costs connected with the NPPs decommissioning works.

Presently, the whole legislation is still in process of change, and execution regulations to this new law of 7 April 2006 have not been elaborated or approved yet.

Another law that in general defines the conditions for the nuclear facilities operation, is the Law No. 541/2004 Z.z. (Atomic law), approved September 9, 2004, by the National Committee (Parliament), and became effective December 1, 2004. The following executive regulations have been adopted to this law also concerning the decommissioning:

- Regulation No. 46/2006 Z.z. (Code), on special materials and facilities that fall under the supervision of the Office for the Nuclear Supervision of the Slovak Republic. *(in force from 1. 3. 2006)*

- Regulation No. 47/ 2006 Z.z. on details of maximum limits for nuclear materials and radioactive waste amounts, in which no nuclear damage is envisaged (*in force from 1. 3. 2006*).
- Regulation No. 48/2006 Z.z. that defines the details on the way of announcement of operational accidents and events during transport including details of inspection of their cause (*in force from 3. 2006*)
- Regulation No. 49/2006 Z.z. on periodic evaluation of nuclear safety (*in force from 1. 3. 2006*)
- Regulation No. 50/2006 Z.z. that defines the details of nuclear safety requirements for the nuclear facilities, during their locating, designing, construction, operation start, operation, decommissioning and during closure of the deposit, as well as the criteria for categorization of selected facilities into the safety classes(*in force from 1. 3. 2006*)
- Regulation No. 53/2006 Z.z. that defines details of requirements during treatment/management of nuclear materials, radioactive waste and burned nuclear fuel (*in force from 1.3. 2006*)
- Regulation No.54/2006Z.z. on records and control of nuclear materials and on the announcement of selected activities (*in force from 1. 3. 2006*)
- Regulation No. 56/2006 Z.z. that defines the details of requirements for the quality system documentation of the licence/permission holder, (*in force from 1.3.2006*)

It can be stated that after the nuclear account law approval, the legislation basis for the decommissioning is quite satisfactory in a sense that that the legislation of the Slovak Republic has been put in compliance with the EU legislation in this field. Everything will depend on how the till now non-existing executive regulations will be accepted and implemented.

## 1.4 Nuclear facilities in Slovakia

### 1.4.1 Nuclear power plants

**A1 Jaslovske Buhunice nuclear power plant** : power plant with KS 150 nuclear reactor of 150 MW el. capacity; fuel: natural uranium, cooling agent: carbon dioxide; moderator: deuterium oxide. The plant previously had an accident. Operation period: from 25.12.1972 to February 1977. There also occurred stops in operation from 5.1.1976 (the first dangerous accident) to September 1976. In February, 22<sup>nd</sup> 1977 after 5 month of operation after first accident it had an final accident, which definitely stopped its operation. From 1977 shut down. Currently works have been carried out to bring the plant in radiation-safe conditions. The first stage of decommissioning has been planned to start on January 1, 2008.

**V1 Jaslovske Bohunice nuclear power plant**: One of four nuclear power plants in Europe that has to be shut down due to insufficient nuclear safety, according to the EU resolution. Two light-water VVER 440 V-230 reactors of 2x440 MW el capacity. Construction period : April 24, 1972 – 1978. Operation : block I : December 1978 – 2006, block II : March 1980 – 2008. The block I. will be phased out from January 1, 2007 (440 MW el), and the block II (440 MW el) will be phased out from January 1, 2008. The stage 1 of decommissioning will start in 2011.

**V2 Jaslovske Bohunice nuclear power plant:** Two light-water VVER 440 V-213 type reactors of 440 MW el capacity. Construction period : 1976 – 1984 block I, and 1976 – 1985 – block II. The operation start : block I - 1978, block II – 1980. The presumed operation end in 2015.

**The Mochovce nuclear power plant:** two light-water VVER V213 reactors of 2x440 MW el capacity. The operation started : in 1998 – block I, in 1999 - block II. The construction of this NPP takes 16 years. The presumed operation end in 2030.

**The blocks 3 and 4 of the Mochovce nuclear power plant:** under construction, with two light-water VVER 440 V 213 reactors of 2x440 MW el. capacity. To now it is not definitely decided on the completion of this NPP. It is necessary to mention, that it is the same old technology from former Soviet Union as older NPP in operation.

#### **1.4.2 Deposit / surface / of radioactive wastes**

The Mochovce RAO (Radioactive waste) National Deposit for low and middle contaminated radioactive waste.

Operation from the year 2000. It is a multi-barrier surface-type deposit designed for final deposit of solid and solidified radioactive wastes generated through the operation and decommissioning of nuclear power plants, research institutions, laboratories and hospitals throughout the Slovak Republic.

The deposit consists of a storage boxes system arranged in two double-rows, 40 boxes in each of row. It is possible to deposit 90 fibre-concrete containers in one box. The overall capacity of the deposit is 7200 containers amounting to total 22 320 m<sup>3</sup>. The inner volume of a fibre-concrete container is 3,1 m<sup>3</sup>. The pressed and bitumened waste in it are fixed by an active or non-active concrete matrix.

#### **1.4.3 Interim (temporary) storage of radioactive wastes**

The interim storage of the radioactive wastes is a facility aimed at storage of the radioactive waste (hereafter „RAW“) pursuant to the approved „Complex strategy for radioactive waste management in the Slovak Republic“. The proposed solution is to secure the safe storage of the treated radioactive waste from decommissioning of the exiting A-1 NPP facilities (hereafter A-1 NPP), institutional RAW and materials contaminated by the radionuclids caught/found in the Slovak Republic that cannot be deposited at the Mochovce National Deposit of Radioactive Waste (ND RAW Mochovce), as well as from decommissioning of other nuclear-powered parts of the „Nuclear Installation in the Jaslovske Bohunice“. The aim will be to concentrate those materials in one site in order to provide the environmental conservation, and the materials' central records and control.

The user will be the GovCo (renamed to JAVIS from June 2006) company, established to implement the decommissioning of all nuclear facilities in the Slovak Republic. The Interim storage will be situated at the NPP Jaslovske Bohunice's site, in the Jaslovske Bounice municipality local area.

By creation of possibilities for centralized storage of the treated radioactive waste produced by the NPP's elimination and institutional radioactive wastes, the preconditions for continuous disposal of individual parts of technologies and buildings of the disposed of nuclear facilities will be achieved. Simultaneously, conditions will be prepared for to now only insufficiently addressed safe disposal of the institutional kinds of wastes.

The purpose of the proposed activity is the gradual phasing out of the existing storage premises located at various places within the original NPP A-1 site, as well as the transfer to the centralized storage of radioactive wastes that are created in the whole complex of the NPP J. Bohunice facilities, i.e. RAW from the NPP V-1 and NPP V-2. The Interim storage will create conditions for the continuous progression of decommissioning works in the NPP A-1 that will not depend on the necessity of the RAW storage in frame of the RAW management system, and on the progression works on the deep deposit development. By the NPP A-1 decommissioning, RAW have been created that are not storable in the surface-type of deposit – ND RAW Mochovce almost throughout the whole course of decommissioning, including the stage 1. This is the fact by which the NPP A-1 differs from the other neighbouring NPPs decommissioning, in which such RAW will be produced during the last stages.

From the accessible conceptual information concerning the NPPs decommissioning it follows that the implementation, start and operation of the Slovak Deep Deposit will start not before 2037. The original concept of National RAW Management System did not consider the inter-storage of the treated waste prior to their Mochovce deposit. The demand for such an inter-storage arose from the practical progress of the NPP A-1 decommissioning including the existing RAW management.

The Interim storage will serve also the storage of the RAW divided in four groups:

- 1 *radioactive waste* that – following the packaging in the certain prescribed form – generally could go to the ND RAW Mochovce, but they cannot be adjusted immediately in the approved packaged form, or they cannot be transported and deposited immediately after packaging ;
- 2 *waste representing the large-scale metal RAW* that will have later to be adjusted by fragmentation according to their dimensions as defined by the inner volume of the a standard fibre-concrete container (hereafter TCC);
- 3 *metal waste, storage of which will have to be carried out seperately from other radioactive waste*. Pursuant to the definition of the waste categorization approved by legislation, it includes so called transition wastes that – following the defined storage period, i.e. following the decrease of their radioactivity to the legislation-approved value – could be released in the environment ;



- 4 radioactive waste coming from the use of the ionizing radiation in the medicine, industry and research in the Slovak Republic, i.e. the institutional RAW that from the storage needs view can be divided in the following groups :
- a) *interim solid or solidified RAW that, following their centralized collection, will be later released in the environment.* In case of quality work of the systems supervising the ionizing radiation departments, it could be secured that such a waste could be released in the environment directly from those departments ;
  - b) *adjusted institutional RAW prepared for deposit in the National Deposit of RAW Mochovce;*
  - c) *the solid or solidified institutional RAW, adjusted to such a radiation level that could not be deposited in the National Deposit of RAW.* The most important part of those wastes *include* the closed emitters (higher activity <sup>137</sup>Cs emitters, or the alfa emitters);
  - d) *radioactive waste of the unknown origin, or co salled, caught radioactive wastes'.*

#### 1.4.4 Production cyclotrones

##### **The Cyclotron center of Slovak Republic:**

In the cyclotron center of Slovak Republic, three cyclotrones in total have to be installed. Two of them are of the CYCLONE 18/9 type, and one of DC-72 type of Russian production.

Cyclotron CYCLONE 18/9 is the production cyclotron with the energy of the bundle 18 MeV for protons or 9 MeV for deuterons. Maximum intensity of the proton bundle is 100 mA. It will be used for production of positron radionuclides that will be further used for production of radio-pharmacy. It involves production of open radioactive emitters.

The cyclotron DC-72 is both research and production cyclotron with energy of protons 72 MeV and intensity of bundle 50 mA, with possibility of acceleration of up to 200 MeV for protons, deuterons and multiply charged heavy ions up to 18 Xe<sup>+</sup>. It has issued bundles with opposite direction of the accelerated particles movement. It will be used for production of radionuclides that will not be able, due to low energy of accelerated particles, to be produced at the CYCLONE 18/9 and for the purposes of research that are not precisely specified. Possibility to accelerate the protons to as much as 200 MeV suggests that it will be possible also to conduct experiments in field of nuclear fission on this cyclotron, as well as various transmutation experiments, also for military purposes, not closely specified. This object under construction is situated in the densely populated settled area of Bratislava, in a valley with wind fluctuation to other parts of the city.

As for the decommissioning costs, the most significant nuclear facilities in Slovak Republic include commercial nuclear power plants and production cyclotrons.

This report will focus on decommissioning funding of commercial nuclear power plants as follows: A1 J. Bohunice, V1 J. Bohunice, V2 J. Bohunice, JE Mochovce 1,2 nuclear power plants.

Table 1 Overview on nuclear power plants in Slovakia

Nuclear facility	Short name	Country	Kind of facility*	Output (power in MWel for NPP)	First criticality (in case of reactors)	Operational period	Operating company	Name of quoted companies holding shares in the nuclear facility, if any*	Percentage of shares held *** [%]	Decomm. started in year	Decomm. stage****	Analysed in this report
Nuclear power plant A1 Jaslovske Bohunice	NPP A1 J.Bohunice	Sk	NPP	150 MWel	1972	1972 – 1977	GOvCO a.s. from 1.4.2006 JAVIS a.s. from 6.2006	State represented by Min. of economy	100%	2008	0	X
Nuclear power plant V1 Jaslovske Bohunice	NPP V1 J. Bohunice	Sk	NPP	2 x 440 MWel	1978	1978 - 2007 1980 - 2008	GovCo a.s. from 1.4.2006 JAVIS a.s. from 6.2006	State represented by Min. of economy	100%	2011	0	X
Nuclear power plant V2 Jaslovske Bohunice	NPP V2 J.Bohunice	Sk	NPP	2 x 440 MWel	1978	1978-today	SE a.s. Bratislava	SE a.s. Bratislava Enel Italy	34% 66%	appr. 2020	0	X
Nuclear power plant Mochovce 1,2	NPP Mochovce 1,2	Sk	NPP	2 x 440 MWel	1998	1998-today	SE a.s. Bratislava	SE a.s. Bratislava Enel Italy	34% 66%	appr. 2035	0	X

## 2 Decommissioning strategies and costs

### 2.1 Main decommissioning strategies

#### 2.1.1 The A1 Jaslovske Bohunice nuclear power plant

The crashed nuclear power plant with KS 150 reactor type made in Czechoslovakia (Skoda Plzen). Following the second accident of the reactor in 1977, the plant was shut down, with the primary loop strongly contaminated. Due to the second accident, greater amount of radioactive waste stock/inventory is situated at the NPP premises that could not be deposited at the Mochovce RAW National Deposit site, when compared with the inventory of other NPPs after their shut down following the routine operation. Some of the environmental components within the NPP vicinity are strongly contaminated: mainly the earth and underground waters. It was caused by the wrong construction and operation of liquid radioactive waste storage tanks according to the designing approaches of that time. Currently such approaches are not allowed any more.

Currently, the working stage called the „bringing the NPP into the radiation-safe conditions“ stage should end to December 31, 2007. The decommissioning should start on January 1, 2008. The last shipment of fuels was transported from the reactor's active zone to Russia in 2000, where it would be deposited in a permanent deposit.

The selection of this NPP's decommissioning scenarios, following the 30 years duration (since 1977), is defined by the presumed radiation situation in 2007 and following 2007, from the view of the technical devices and premises utilization at that time. It will be based on the following factors :

- 1.) In 2007, the NPP will be shut down for 30 years. Through this period of time, various activities have been carried out with the aim to reach the NPP's state as in other NPPs with standard routine operation ending in 2007. The principal turn in situation was achieved mainly through the export of spent fuel and through processing and treatment of liquid and solid radioactive waste.
- 2.) During this period of time, a number of new technological devices, for the RAW management or for the NPP's decommissioning, have been built in the NPP A-1 premises, and the building of others is considered. For this purpose, a part of the premises and buildings have been re-constructed and re-categorized for activities like processing and treatment of RAW and its storage. These premises will be presumably used also for the further decommissioning of other nearby nuclear facilities, and the further re-categorization of premises/buildings for this purpose is possible: e.g. the machine room with previously stored turbines and electric generators, these were dismantled, and now the devices for fragmentation and decontamination of metal materials from dismantling of out-of-operation technological devices, are placed in the building.

- 3.) Radio-isotopic composition of radioactive wastes from the NPP A-1 decommissioning differs from the RAW composition from the decommissioning of the NPPs with the routinely ended operation. The principal difference lies in the fact that the share of the radionuclid Cs137 is more significant in the RAW (half-time of decay is 29,4 years) in comparison with the Co60 (half-time 5,7 years). It is necessary to wait longer for the radioactivity decrease to the determined level by natural decay; i.e. the prolongation of the time period in this NPP will not have such an effect as it would have had in case of a relatively more dominant Co60. Moreover, an inventory of long-life radionuclides is also found at this NPP site. These long-life RAW could be definitely stored in the deep repository only; therefore, the conceptual considerations on this NPP's decommissioning period will be related with the deep storage implementation – i.e. after 2037.
- 4.) The auxiliary non-active buildings that provide the technological media supplies will not be included in the decommissioning, as they will be re-categorized in other kind of buildings.

For decommissioning, three scenarios were considered:

- Scenario 1: Decommissioning with the implementation method of NPP's closure with surveillance.
- Scenario 2: Decommissioning with implementation method of protective storage of the reactor.
- Scenario 3: Continual decommissioning.

These three strategies have been adopted from the EIA (Environmental Impact Assessment) reports on decommissioning of NPPs A1 a V1 J. Bohunice and were approved by the Ministry of Environment of the Slovak Republic.

As for the original non-operational devices, Scenario 3 basically equals with the closure with surveillance scenario (Scenario 1). It varies only in the time course of decontamination and dismantling works. The technological devices are, according to Scenario 3, continuously dismantled, gradually from the lowest contamination devices up to the highest-contamination devices and to the induced-activity devices (reactor). The progression of dismantling works is based on the precondition not to depend on the deep storage, as the waste suitable for deep storage will be processed during the dismantling, and stored during the treatment, in the safe devices of the interim storage. The civil engineering of the buildings in the main production block will not be shut down, but after the decontamination of building surfaces, the buildings will be re-categorized to another building scheme for further use during other nuclear devices' decommissioning in the site.

Scenario 3 reflects the current presumed procedure and links among individual activities during decommissioning. This scenario is a smart compromise between other scenarios and a possibility of immediate decommissioning of the NPP basically to „green field“.

The strategy of the A 1 power plant's decommissioning was defined as a continual scenario. Decommissioning will be carried out gradually – starting from the least contaminated premises and devices – up to the premises and devices/facilities with the highest contamination. Decommissioning should be completed in 2033. The overall period of decommissioning should be 26 years. This scenario is characterized by a continuous, step-by-step implementation of individual decommissioning activities. The first activity will include pre-dismantling decontamination, dismantling, post-dismantling decontamination, decontamination of buildings' surface and processing of created wastes. The important condition of this strategy is financing of all necessary technology components and activities.

## **2.1.2 The V1 Jaslovske Bohunice nuclear power plant**

### 2.1.2.1 Overview on three decommissioning scenarios

The nuclear power plant is currently in operation. According to the Slovakia - EC pre-accession negotiations, it was determined that this power plant has to be shut down till 2008 end at the latest due to safety reasons. The power plant with dangerous VVER 440-230 reactors is obsolete as for construction type.

The decommissioning of this power plant has been proposed in three scenarios:

- Scenario of closing with surveillance.
- Scenario of protective storage.
- Scenario of continual decommissioning.

The main activities in all three scenarios, carried out in frame of the process, will be identical. The individual scenarios of decommissioning vary in when and in what extent they will be applied in a specific situation. Individual activities, of which the decommissioning consists of, are as follows:

- Preparatory works for decommissioning
- Pre-dismantling decontamination of technological facilities and building surfaces.
- Dismantling.
- Post-dismantling decontamination.
- Dismantling of a technology that is part of the construction including demolition of building elements (civil engineering).

In addition, regular activities carried out at each nuclear facility also during routine operation, will be implemented during the decommissioning as follows :

- management of radioactive wastes inside the nuclear power plant JE V – 1 throughout decommissioning,
- dosimetric control, i.e. radiation checking of workers and checking of the premises/site, surfaces,
- monitoring of outlets, checking of materials released in the environment

The last group of activities includes external activities evoked at other nuclear facilities, or the related external activities, such as:

- Process of releasing of low-active materials into the environment
- Transport of radioactive waste to the treatment
- Treatment of radioactive waste
- Storage and laying of packaged forms of radioactive waste following the treatment
- Management of radioactive material from the decommissioning

#### 2.1.2.2 Scenario „closure with surveillance“

As this scenario has been, according to the conceptual decommissioning plan updating, recommended for implementation, we will elaborate in more detail. The time schedule of decommissioning stages is planned up to 2062. The time schedule of decommissioning is as follows:

Phasing out of operation	- year 2008
Phasing out of operation after stopping the reactor 2	- year 2008 - 2012
Treatment of remaining radioact. waste from operation	- year 2012 - 2017
Closure with surveillance	- year 2017 - 2047
Final dismantling	- year 2047 - 2062

Activities that will be carried out during decommissioning are arranged in 11 groups, as follows:

The first stage of decommissioning includes shut-down - elimination of the following buildings/premises:

Group 1: The premises, operation of which was shut down as early as during the power generation operation of NPP V – V1. It includes the washing water tanks, waste from the washing water tanks, dosing of hydrochlorid acid.

Group 2: Premises built during the operation period to increase safety. This group includes the following devices/facilities: cooling station for ventilation block 1, cooling station for accident of ventilation block 2, cooling towers for technical water important

block 1, cooling towers of technical water important block 2, filling station of technical water important block 1, filling station of technical water important block 2, over-ground collector of technical water important.

Group 3: Premises securing the electricity supplies, such as diesel-aggregate station with annex, oil management.

Group 4: Buildings for cooling water, apart from one cooling tower. These include buildings for leaching-out the circulatory loop, filling station/pumps for discharge of cooling water pipelines, cooling towers.

Group 5: Premises providing the supplies of compressed air, cooled water, hydrogen, nitrogen, oils, supplementary water from Pecenady. These include premises of the compressor station and central cooling station, central and filtration station, extrusion pipeline Ms 800 Pecenady, storage of hydrogen, storage of nitrogen, oil management.

Group 6: It includes premises for chemical treatment of water, de-mineralized water tanks, building of de-mineralized water tanks, inoculating/injecting station for sulphuric acid

Group 7: Distribution points/switching stations, links, transformer. These include: outer distribution point 220 kV, basements of transformers including oil tank, outer distribution point NPP V-1 for emergency power from the NPP A – 1, small building for relay protection, compressor station of distribution point, safety /security fencing of distribution point, link 220 kV for NPP A-1 – NPP V-1.

Group 8: Machine room and etageres, which include: premises of machine room, crosswise etagere block 1 and 2, longitudinal etagere 1. A2. Block, central filling station, cooling tower 2, administration building and a civil defence shelter, dining room and gatehouse, guardhouse for NPP V-1, equipment of the construction site, inner roads, gatehouses for yards and courts (50 %)

The following buildings will remain in closure with surveillance (guarded) during 2017-2047, and will be disposed of in the final stage of decommissioning :

Group 9: Reactors building, air-ducts of ventilation smokestack, building of auxiliary operations including extension of annex and over-annex, operation building and civil defence shelter, ventilation smokestack.

Group 10: Other premises that served as service through the decommissioning. These include inner trailers, outer lighting, inner roads including yards and courts (5), parking lot, bus platform.

Group 11: Underground canals, furrows, drinking water supply system, sewers. These include: furrows and canals of strong cables, furrows and canals for lighting including cabling, furrows for grounding, pipeline furrows, clean pipeline canal, canals for cooling water pipelines, rainwater drainage, terminal drainage collector from NPP V-1 to Socoman, sewage system, industrial sewage system, drinking water supply system, fire water system.



Other decommissioning activities:

In frame of the preparatory activities, decontamination of the primary loop of the power plant as a whole, apart from the above mentioned activities, will also be carried out. The decontamination will be carried out immediately after hauling away of all fuel from the relevant block's reactor. The reason of this activity, performed immediately after the fuel hauling away, is the accessibility of the functional needed technology and presence of the skilled operational staff.

The representative analysis of the corrosive layer samples will be carried out prior to the decontamination of primary loop. Only on the basis of this analysis, the detailed and concrete decontamination procedure will be elaborated. The circulation of decontamination agents will be provided by the main circulation pumps.

During the closure with surveillance, the following activities will be carried out:

- radiation control
- control of state of technological devices and construction barriers
- control of the neighbouring area /environment (including underground waters)
- maintenance of operational devices, systems and barriers,
- preparation of auxiliary operations for disposal of closed buildings /premises and devices.

During the closure with surveillance, the following facilities will continue their operations:

- ventilation systems providing good conditions for staff with their control of premises and facility; at the same time, they could help temper the rooms and premises with aim to create suitable conditions for minimization of corrosion,
- adjusted special drainage with wastewater drainage system,
- radiation control of technologies and rooms adjusted by a stable system and portable devices, including control of gaseous and liquid outlets,
- control system of state of devices,
- control system of tightness of construction barriers, signalization of leakage,
- lighting of rooms, providing the devices with electricity
- pipelines / mains for media distribution (fire water, drinking water for sanitary loop etc.),
- underground water control system in the vicinity of buildings

The maintenance of devices and systems, and of the electric, measurement and regulation and radiation control equipment, will be continuously provided according to the scheme defined in advance. During the 30 years closure with surveillance, it is vital to consider also the restoration of devices including exchange of cabling after finding some inconvenient conditions in insulation. If needed, maintenance (restoration) of

building parts (roofs, perimeter covering, basement of constructions) will be provided in regular intervals. The presumed maintenance intervals will be defined in operation regulations.

Electricity supplies for operational systems will be provided through the permanent operation of reduced and adjusted systems of power supplies. The operational systems' management control will be carried out through operation of adjusted management control systems.

The radiation and dozimetric control will be provided by the existing radiation control system, which will be regularly complemented and adjusted in dependence on its physical wear. It concerns mainly measurement of dosage input in premises, or of the volume activity of aerosols; it also concerns sampling with consequent laboratory assessment.

The operation will be provided by a very limited staff with a greater number of workers in one shift. Other activities will be provided by patrols / rounds and by contracts with firms.

#### 2.1.2.3 Scenario of protective deposit

Time schedule of decommissioning is as follows :

End of energy generation operation	- year 2008
Phasing out after the reactor 2 stopping	- year 2008 - 2012
Adjustment of RA waste remains, building of protective deposit	- year 2012 - 2026
Protective deposit	- year 2026 - 2056
Elimination of protective deposit of devices	- year 2056 - 2062

This scenario differs from the previous one by the fact that the initial stage will be longer - up to the year 2026 (to the year 2017 in scenario of closure with surveillance). In this period, a protective deposit has to be built. However, the protective deposit will last shorter – from 2026 to 2056, and the terminal stage – elimination of facilities that were situated in the protective deposit – will last shorter (2056 – 2062) than in scenario with closure and surveillance.

Apart from elimination of devices, the main objective will include preparation for deposit of the most active parts of the power plant so that only the most inevitable activities will be carried out during the next 30 years (of a considerably smaller extent than in closure with surveillance). The subject of protective deposit will include the reactor itself, water biological protection, backfilling and the temperature shading that are in the adjusted part of the reactor. Inside the reactor: they include all intra-reactor parts, shading cartridges, absorptive parts of accident canals and connecting parts of absorber with fuel part, as well as parts of intra-reactor measurement. The verification calculation of statics for the project of the reactor's protective storage in its shaft and the demolition works at the reactor's building, will be immediately followed by re-construction works on the reactors' shafts to provide protective storage. The following works are presumed to be necessary for this part of activities:

- after the demolition works and after the release of brickwork around the reactor's shaft, the protrusions will be evened up/smoothed by additional concreting so that the insulation of the peripheral wall, including protective additional brickwork layer, can be carried out,
- part of basement slab/board will be in the ring around the reactor's shafts in frame of the demolition of the building „reactor-room“ removed in such a way that it will be possible to make a vertical insulation of the basement slab/board to become water-proof,
- the building hole that will remain after the basement with ripped-off ceilings will be covered by the earth and by fine debris,
- all passages and unnecessary opening/gaps in the walls situated both above the earth surface level and under it, will be fixed with concrete,
- hermetic doors will be fixed in the existing building openings leading to: the space both under the reactor, above the water biological protection and to the space above the reactor's top lid,
- 24 openings will be closed up at the inlet and outlet ducts of the reactors' primary cooling agent through welding on,
- 122 openings will be closed up at the reactor's top lid ducts by screwing,
- all protrusions situated also above the earth surface (up to 11,802 m height) and created by demolition of the reactor building's adjoining parts, will be fixed with concrete and completed so that the building's outer frontage in the protective deposit could be solid/tight and its condition could be checked
- the drainage tank of the reactor's shaft will be preserved so that it would be possible to provide the control of possible leakage and to drain/ pump water
- the top lid will be fixed on the supporting structure of the protective storage, and the roof insulation will be made at it
- persisting material that will secure the long-lasting durability of the ferroconcrete construction will be sprayed at the outer frontage,
- the area neighbouring with the shafts will be adjusted for communications so that
- the regular control of outer barriers could be carried out,
- part of the NPP V-1 site's communications will be maintained during
- the protective deposit (appr. 20 %),
- connection to the rainwater drainage and part of main route of rainwater drainage sewers, including the fire water supply system, will be maintained during the protective deposit,

- electricity supplies will be provided by a connection with a circuit breaker and a power point for connection of pumps that will pump the possible leakage from the drainage tank of the reactor's shaft
- fencing with alarm signaling will be provided.

#### 2.1.2.4 Scenario of continual decommissioning

Time schedule of decommissioning is as follows:

End of power generation operation	- year 2008
Phasing out of operation after stopping the reactor 2	- year 2008 - 2012
Adjustment of remaining radioactive wastes, dried state, decontamination in the primary loop, dismantling of unnecessary inactive systems, demolition of inactive unnecessary building premises	- year 2012 - 2019
Decontamination of other devices, dismantling of active and gradually also the remaining supporting systems, final demolition of building premises	- year 2019 - 2033

In this scenario, the stages immediately follow each other without breaks as in the previous scenarios. The resulting state for the stage 2, or for the borderline between the stage 1 and 2 of decommissioning, is as follows:

- decontamination of the primary loop as a whole is implemented,
- dismantling of the inactive devices is implemented in the selected unnecessary building premises,
- demolitions of the selected buildings will be implemented that previously have been dismantled,
- both radioactive and non-radioactive waste still remaining from the operation as well as from the initial stage of decommissioning, are processed and removed to be prepared for further disposal,
- construction of the decontamination and fragmentation facility, provided with equipments and furnishing, is implemented,
- construction of a special fragmentation facility for dismantling and division of reactors with equipment, provided with equipments and furnishing, is implemented,
- trained staff is prepared for carrying out the dismantling works in the active premises.

The final stage of continual decommissioning (2019 – 2033) comprises of the following activities:

- Audit of the state of buildings and devices carried out with focus mainly on the existing technological and building barriers functions. According to the needs, local containments will be installed.
- Sanitary seals, or provisional hygienic loops will be installed, and their operation will start.
- Radiation situation in buildings will be checked.
- The functionality of the existing facilities and systems that are needed for the performance of work will be verified.
- Certain systems and devices will be decontaminated.
- The power supplies for the dismantled devices, or for the disposed of buildings, will be disconnected.
- Installation of substitutive or modified electricity supplies for needed systems will be carried out (ventilation, transport device, means for dismantling and demolitions).
- Dismantling will start in buildings - room by room - according to the building program and to the immediate radiation situation.
- Following the removal of dismantled technology and dismantling means, decontamination of the buildings surfaces will start.
- In frame of the buildings' demolition, the built-in elements of special sewers, doors, bushings, plaster of rooms etc. will be dismantled.
- After the radiation control is carried out, confirming that the residual contamination of buildings' surfaces allows their safe demolition, the buildings will be disposed of.
- All radioactive wastes will be processed continuously, and transported to the treatment and further disposal.
- The soil after the demolitions will be checked by radiation control bodies and released for the final earth adjustments.

#### 2.1.2.5 Comparison of individual scenarios' characteristics

The decommissioning in all three scenarios involves bringing the site in the „Green Meadow“ state. For comparison of individual scenarios, the current characteristics are shown in Tab 2.

Table 2 Characteristics of considered scenarios of the NPP V-1 decommissioning

Characteristic parameter of decommissioning	Unit	Continual decommission	Protective storage	Closure with surveillance
Overall costs	mil. Sk	<b>373.24</b>	<b>373.04</b>	<b>397.27</b>
Collective dosage equivalent of staff	man.Sv	18.81	17.01	2.82
Duration of whole decommissioning process	months	216	612	612
Laboriousness	thous. hours	12 125	12 386	13 470
Amount of liquid RA waste (prior to treatment with considered saltification of 200g/dm <sup>3</sup> )	m <sup>3</sup>	3 776	3 777	2 440
Amount of highly active metals	tons	930	930	930
Number of packaged forms of RA wastes storable in surface deposit	Number of currently used containers	3 215	3 216	1 970
Number of packaged forms of RA wastes non-storable in surface deposit	Number of currently used containers	38	38	38
Duration of presence of NPP V – 1 radioactivity in the location	months	210	607	606
Overall activity of liquid outlets	Bq	$1.58 \times 10^{13}$	$1.59 \times 10^{13}$	$1.10 \times 10^{13}$
Overall activity of gaseous outlets	Bq	$3 \times 10^7$	$2.9 \times 10^7$	$0.9 \times 10^7$
Amount of metals (non-active, or releasable to the environment)	thous. tons	62 712	62 712	63 663
Amount of recyclable building material	thous. tons	370 725	371 506	371 109
Amount of municipal waste	thous.tons	11 555	12 562	12 600

The table shows that the parameters in individual scenarios do not vary much - apart from amount of radioactive wastes storable in the surface-type despoti - that are the lowest in the scenario with closure and surveillance, and the overall costs that are, on the contrary, the highest in this scenario, as well as in collective dosage equivalent of staff that is the highest in continual decommissioning scenario, while it is lowest in closure with surveillance scenario.

Up to now, the continual decommissioning scenario has been preferred in this power plant. All three decommissioning schemes could also be used in decommissioning of both the NPP V2 Jaslovske Bohunice and JE Mochovce 1,2, nuclear power plants, as both of them are the equal types of power plants with equal reactors – VVER 440.

## 2.2 Method of waste management and its disposal

### 2.2.1 Overview

Waste management divides in two forms as follows :

- Management of the radioactive waste
- Management of non-contaminated and low-active waste.

Waste management consists of:

- Processing and treatment of radioactive waste created during decommissioning.

- Storage and transport of radioactive waste in frame of the power plant's site and out of the site.
- Depositing of treated radioactive waste.

### **2.2.2 Basic technologies for processing and treatment of radioactive waste**

Basic technologies considered for processing and treatment of radioactive waste are the following:

- Vaporization of liquid radioactive waste – the product is a concentrate that is bitumened or concreted, and a concentrate that is cleaned and released in the environment.
- Bitumenation – the product is a barrel with bitumen.
- Vitrification – the product is a glass/vitreous matrix.
- Low-pressure pressing – the product is a barrel with pressed waste.
- High-pressure pressing – the product is a pressed piece.
- Combustion – the product is the ashes that is pressed or cemented in barrels; and the contaminated waters made during the combustion products cleaning are processed as other liquid radioactive waste.
- Recasting – the product is a recasted metal that is released in the environment directly, or after the storing, in order to reduce the radioactivity; or the recasting is used for reduction of radioactive waste volume.

Within the Jaslovske Bohunice nuclear power plant's site, the Bohunice Processing Center /Bohunice Spracovatelske Centrum BSC/ is situated, in which the essential devices have been concentrated for the treatment of radioactive waste to be prepared for the permanent deposit, and for processing of radioactive waste prior to its final treatment.

For the final treatment of radioactive waste for the deposit storage, the cementation technology is determined. Currently the only package of the packaged forms of waste suitable for deposit at the Mochovce National Deposit, is the fibre-concrete container.

In the building, there are devices for thickening of liquid radioactive wastes, incineration plant for solid and liquid combustible wastes, high-pressure press and device for separation of radioactive waste.

Radioactive waste is transported in the premises either through the pipelines, or in the transport containers. The building has its own ventilation smokestack with the device for control of gaseous emissions, including the control of gaseous emissions of non-radioactive character, from the BSC incineration plant.

### **2.2.3 Storage of radioactive waste**

In the premises of the nuclear power plants, there is storage space, in which the treated radioactive waste will be stored while waiting for the final processing in packaged form to be deposited in the Mochovce National Deposit. From the year 2010 on, an interim storage will be in operation within the nuclear power plant's site premises, in which all radioactive waste will be long-term stored that has been stored

today in various storages and that will not be able to be deposited at the Mochovce National Deposit of Radioactive Waste.

Following the year 2007, there will be no liquid radioactive waste from the power plant's operation found at the NPP V1 premises.

The storage of the contaminated earth from A-1 will be implemented at the storage of contaminated earths or in the barrels as a non-solid radioactive waste. To 2007, the building of a contaminated earth's storage is presumed, in which all contaminated earth in the site will be stored. A sandwich-type of storage structure is presumed, in which the layers of contaminated earth will be layed alternately with the zeolits layers.

#### 2.2.4 Radioactive waste transportation

Transports in frame of the nuclear power plant's site will be provided as follows:

- Transport from the dismantling will be implemented in closed transport containers with free laid radioactive waste.
- Transports of processed radioactive waste in barrels will be implemented in closed shaded transport containers and barrels.
- Transports of liquid wastewaters from the technologies and from the drainage collectors will be implemented through the pipeline routes of active pipeline canals.
- Transports of liquid radioactive sludges and higher-activity sludges will be implemented in the closed shaded transport containers with device for their safe fixation and pumping over.

#### 2.2.5 Deposit of radioactive waste

Deposit of low-active and mid-active waste with limited inventory of individual radionuclides will be implemented in the Mochovce National Deposit.

Deposit of all radioactive waste that is not storable at the Mochovce National Deposit, including the burned fuel, will be implemented in the deep deposit.

### 2.3 Start and expected end of decommissioning activities

Start and end of individual nuclear power plants' decommissioning is shown in Tab. 3. It should be noted that this is only a rough estimate, these are not exact values. The exact values depend on the scenario chosen.

Table 3 Predicted start and end of decommissioning of nuclear power plants

Nuclear power plant	Decommissioning start (year)	Decommissioning end (year)
A1 J. Bohunice	2008	2038
V1 J. Bohunice	2011	2033
V2 J. Bohunice	2023	2056
NPP Mochovce 1,2.	2040	2073



## 2.4 Management of decommissioning

Management of decommissioning will be carried out by a stock company with 100-% shares of state. On April 1, 2006, contracts and permission became effective for the GovCo (renamed to JAVIS from June 2006) stock company that took the responsibility for operation of the V1 NPP and decommissioning of nuclear power-generating facilities in the Slovak Republic, and for management of the radioactive waste and spent nuclear fuel in the Slovak Republic. The company was founded July 6, 2005, and its only shareholder is the State represented by the Ministry of Economy of Slovak Republic.

This company took the management and operation of selected nuclear power plants from the SE a.s. Bratislava assets. The assets also include the NPP A1 J. Bohunice and NPP V1 J. Bohunice as well as all the radioactive waste disposal facilities. The GovCo (renamed to JAVIS from June 2006) company activities include also the safeguard of the NPP V1 operation, power generation, preparation of the NPP V1 operation end, decommissioning of all nuclear installations in Slovakia, and processing, treatment and deposit of radioactive waste. The ENEL company does not play any role during the decommissioning process of the NPPs and it has no duties in this process.

## 2.5 Estimates of decommissioning costs

The official access to the decommissioning costs estimation is possible through the EIA process; from the Slovak Power company a.s. documents that have been published in the daily press for the NPP V1 Jaslovske Bohunice. For the NPP A1 J. Bohunice, it was possible to get to the costs estimates through the EIA process. For the NPP V2 J. Bohunice, and for the NPP Mochovce 1,2, the official access is not possible. However, by mathematical calculation methods, it is possible to calculate the cost estimates for the both NPPs.

Price bases for those estimates were calculated on the basis of comparison with the costs as spent and calculated abroad (more specifically: NPP Greifswald, Germany), and calculated over to the economic conditions in the Slovak Republic.

Apart from the NPP A1 J. Bohunice, the costs of the NPP V2 J.Bohunice decommissioning can be assigned/transposed also to all NPPs in the Slovak Republic, as all of them are the equal types of NPPs with the VVER 440 reactors.

Costs items in NPP V1 J. Bohunice were defined as direct costs of individual activities. However, in the past, they used to be underestimated, as the author – the State Fund for Elimination of Nuclear Facilities - deliberately underestimated these costs, as ordered by the state. Currently, the situation is different, and the newly defined estimates were calculated by the Slovak Energy Company a.s. are doubled. However, they are much more realistic which has been influenced by the privatization process. The decommissioning activities have been defined on the basis of the requirements on

work needed for decontamination, demolition of buildings and devices, for processing and deposit of radioactive and non-radioactive wastes.

The old specification of costs of NPP V-1 decommissioning for considered scenarios is shown in Tab 4. It was the first estimation and was deeply underestimated.

Table 4 Older specifications of costs of the NPP V-1 decommissioning for considered scenarios in m. EUR

No.	Specification of costs	Continual decomissionig	Protective storage	Closure with surveillance
1.	RAW preparation	0.81	0.81	0.81
2.	Preparatory works	22.58	22.75	23.42
3.	Continuous activities	58.03	58.63	59.38
4.	Investments	13.70	13.94	15.94
5.	Initial stage of decommissioning	46.77	230.83	55.58
6.	Protective storage, or enclosure with surveillance		2.51	60.41
7.	Final stage of decommissioning	211.51	23.35	160.41
8.	Completing works	2.33	2.44	2.44
9.	Reserve 5 %	17.51	17.78	18.88
<b>Total costs (m.EUR)</b>		<b>373.24</b>	<b>373.04</b>	<b>397.27</b>
Total costs (m. Sk)		<b>13 611</b>	<b>13 823</b>	<b>14 668</b>

The costs have been calculated by the State Fund for Elimination of Nuclear Power-generating Facilities that April 1, 2006, has been renamed for the „National Nuclear Fund for nuclear facilities´ decommissioning and for spent fuel and RAW elimination“. The shown costs estimates had been deeply underestimated. Therefore, in 2005 the Slovak Power Plants a.s. Bratislava stock company elaborated new estimates with overall estimated decommissioning costs (for the continual decommissioning scenario) amounting to 25 b. Sk. This estimation contains allegedly also the costs of electricity distribution network changes due to early shut down of the NPP V1 Jaslovske Bohunice. The Slovak Energy company Bratislava did not publicized more detailed costs specification.

No independent institution with sound experts supervises the calculation of costs. The public control of the decommissioning cost estimates does not exist.

Nevertheless, there are usable reference cases, with which we can compare the calculated estimates: it is the NPP Greifswald, Germany, with the equal types of nuclear reactors installed (VVER 440) as those in all NPPs in Slovakia.

Table 5 Overview on decommissioning costs for NPP V1 J. Bohunice in Slovakia (in prices of 2004) already in the process of decommissioning; otherwise a typical calculation for a future decommissioning (calculation by the Slovak Energy company)

Decommissioning activity	Years the activity took place / is expected to take place	Total decommissioning costs [Mio. Euro]	Annuity of decommissioning costs in relation to output over lifetime [ct/kWh; 4%]	Remarks
Facility shutdown and pre-decommissioning activities	2008-2011	432 m. EUR		
Spent fuel management	2011-?	Unquantifiable - eternal debt. 675 m.EUR ++	Unquantifiable	++ Estimation is made only for construction of the deep deposit and processing of highly active waste. The sum corresponds with/equals/the share of appr. 750 tons of spent fuel, i.e. 1/3 of costs of deep deposit construction costs. Operational costs of the deposit for 100,000 years cannot be quantified and have to be added.
Management of other (low and intermediate) radioactive wastes arising from reprocessing, and storage and elimination of these wastes covering the whole lifetime of the NPP	2012 – appr. 2019	+		To now has not been quantified
Management of other radioactive waste from operation of the NPP covering the whole lifetime of the NPP	2012 - appr. 2030	+		To now has not been quantified
Safe enclosure	2029 - appr. 2033	102 m. EUR		Costs of production and capsulization / entombment of spent fuel in the containers ready for deep deposit.
Dismantling (nuclear) and decontamination activities	2012 - 2019	+		They have not been calculated separately.
Decommissioning waste management	2019 - appr. 2029	+		They have not been calculated separately.
Decommissioning of non-radioactive parts	2019 - 2029	+		They have not been calculated separately.
Site restoration, cleanup and landscape	2028 - 2033	+		They have not been calculated separately
Total costs of dismantling, decontamination and demolition (all lines/items +)	2011 - 2033	675 m. EUR		In items marked with +, the individual sums are not estimated. Only overall sum is estimated amounting to appr. 675 m. EUR
Supporting programmes for employees	?	-		They are not included in decommissioning
Supporting programmes for regional development	?	-		They are not included in decommissioning
<b>TOTAL</b>		<b>1 884 m. EUR</b>		

+ costs have not been calculated separately

++ share of costs (according to amount of produced spent fuel) for the deposit's construction and for production of containers for deep storage of spent fuel of appr. 860 tons, costs of the deep storage operation are not included.

Table 5 shows the costs of the NPP V1 J. Bohunice decommissioning with the 2005 price level. However, this NPP's decommissioning has its special features: the decommissioning is allegedly too early, which is not true, as as early as ten years ago the EC indicated the NPP as one of the most dangerous NPPs in Europe, and demanded to shut down its operation after the designed lifetime of about 20 years. The Slovak Government, however, ignored this demand, and in 1995 decided on its alleged „increase of nuclear safety“ to the „world“ or the „European“ standards. The SE a.s. (the Slovak Energy Company) Bratislava invested appr. 10 b. Sk (270 m. EUR) in the increase of nuclear safety. Therefore the Slovak Government applied in the EC and obtained appr. 400 m. EUR subsidies as a compensation for the „too early“ decommissioning of this NPP, what is 1.5x more than in reality spent for the alleged increase of nuclear safety. Therefore, the data on the overall costs of decommissioning cannot be regarded as directive also for other NPPs decommissioning.

The experience from the Greifswald Germany NPP's decommissioning show that the sum 26 b. Sk can be regarded as very realistic for decommissioning, and appr. 6 b. Sk for pre-decommissioning activities for a NPP with two VVER 440 reactors (NPP V2 and NPP Mochovce 1,2). On the basis of those data, the overall costs of the NPP's decommissioning with two VVER 440 reactors can be estimated to 32 b. Sk (864 EUR), with the 2005 price level.

The sum of 25 b. Sk (675 m. EUR), estimated for the spent fuel management, includes only the sum of construction of the deep deposit, deposit of containers with spent fuel, the deposit's operation, and closure of the deposit. The sum does not include the costs of the deposit's operation after the deposit's shut down for 10.000 years time.

## **2.6 Future decommissioning strategies**

### **2.6.1 The main strategies of decommissioning**

The future decommissioning strategies will differ from the NPP V1 J. Bohunice decommissioning strategy probably by the fact that they will be heading towards the scenario of deferred decommissioning with protective storage of the NPP with various time endurances. By time endurance we mean various activities and their various distribution in time.

In all NPPs (V1, V2, J. Bohunice, NPP Mochovce 1,2), three decommissioning scenarios are taken into consideration:

1. Closure with surveillance
2. Protective storage
3. Continual decommissioning

However, the decommissioning with protective storage might be chosen for the NPP V2 J. Bohunice and NPP Mochovce 1,2. Until today, no preferred strategy for those NPPs has been defined – all three strategies are still possible. The strategies will be defined later.

### 2.6.2 Radioactive waste management

Radioactive waste management varies according to its state as follows:

- Gaseous RAW will be released in the the atmosphere after filtration
- Liquid RAW will become thicker, thus minimizing their volume; they will be consequently fixed in the tissue-concrete containers that will be stored in the National Deposit Mochovce. Part of the liquid RAW will be, after watered down, released directly in the NPPs' sewage drainage systems. The liquid RAW that are not possible to be deposited at the National Deposit Mochovce, will be temporarily stored at the interim storage and consequently at the deep deposit. Unsolved questions remains with liquid RAW with solid higly radioactive elements.
- The solid RAW will be deposited at the National Deposit, after being previously processed in the tissue-concrete containers; while the rest will be stored at the interim storage and consequently in the deep deposit.
- The spent fuel will be stored at the temporary storages located directly within the NPPs' sites, and after the construction of the deep deposit, it should be presumably stored without foregoing processing.

In Table 6, for calculation of estimated decommissioning costs for the V1 J. Bohunice NPP, the budget costs estimation was used. For other NPPs – V2 J. Bohunice and Mochovce 1, 2, the same method was used, with regard to the time value of the costs.

The GovCo (renamed to JAVIS from June 2006) joint-stock company took the responsibility for the decommissioning costs from the April 1, 2006, with the 100 % share of the state. ENEL plays no role in the GovCo (renamed to JAVIS from June 2006) company, even it has nothing to do with the decommissioning. Both – ENEL and National nuclear fund – are independent legal entities. There is no relation between the GovCo (renamed to JAVIS from June 2006) company and ENEL, and neither there is relation between National nuclear fund and GovCo (renamed to JAVIS from June 2006). National Nuclear Fund is aimed to manage, accumulate and distribute the financial means designed for decommissioning. GovCo (renamed to JAVIS from June 2006) is responsible for the physical process of decommissioning. Up to that time, i.e. from June 1, 1995 to March 31, 2006, the State Fund for Elimination of the Nuclear-Power Facilities and for the Spent Fuel and RAW Management, with 100 % shares of the state, was responsible for the costs.

The access to the detailed estimates of decommissioning costs is basically not possible. What we managed to get were only the rough decommissioning cost

estimates from the State Fund for Elimination of the NPPs and Spent Fuel / RAW Management. The costs estimates from the responsible institution - GovCo (renamed to JAVIS from June 2006) stock company - are not accessible.

There is no public or independent control of estimated costs.

There are algorithms and generally acceptable software for the decommissioning cost estimates by the State fund for elimination of nuclear facilities.

The estimates shown in this document, in NPPs V2 J. Bohunice and Mochovce 1, as well as the costs of deep deposit implementation including costs of the spent fuel management, were elaborated by the, Energy of the Third Millennium' NGO on the basis of the costs estimates performed abroad, and from the data of today non-existent State Fund for Elimination of NPPs (100 % state shares).

There are reference cases, on which the cost estimates are based, i.e. the decommissioning cost estimates of the Greifswald NPP, Germany.

Table 6 Expected total costs of future decommissioning of nuclear installations in Slovakia (in prices of 2005)

Short name of nuclear facility	Kind of facility	Years decommissioning activities are expected to take place	Total decommissioning costs estimated [Mio. Euro]	Annuity of estimated decommissioning costs in relation to output over lifetime [ct/kWh for NPP; 4%]	Remarks
A1 J. Bohunice	NPP	2008 - 2038	378	-	Precise data on power generation are not published
V1 J. Bohunice	NPP	2011 – 2033	1 884	1.3	Value is approximate (142 TWh)
V2 J. Bohunice	NPP	2023 - 2056	1 620	0.9	Value is approximate (182 TWh)
JE Mochovce 1,2	NPP	2040 -2073	1 620	0.82	Value is approximate (196 TWh)

## 3 Funds and fund management

### 3.1 Setting aside funds

#### 3.1.1 Overview

For a number of years there was no legislation in the field of financing of nuclear facilities decommissioning. From 1977 to 1993, the financial means for decommissioning (of the Bohunice A1 NPP reactor, which was the only reactor at this time to be decommissioned) were taken from the then federal budget of Czechoslovakia and then power generation company SEP. From 1993 onwards, funds came from the state budget of the Slovak Republic and the power generation company Slovenské Elektrárne (SE) a.s.

The first law of the Slovak Republic on decommissioning was approved on 1 June 1996. In addition to the financial means coming from the state budget and the operator of nuclear power plants, a fund called the "State Fund for Elimination of Nuclear Power-Generating Facilities and Spent Fuel/RAW Management" was established.

The Fund had the status of an independent legal entity at the level of an independent body unit ruled by the State. This Fund collected financial resources from a number of sources including:

- Contributions from the operators of nuclear facilities
- Bank credits
- Interests from the Funds deposited in the bank
- State subsidies.

A special case of financing past and on-going decommissioning activities is the Bohunice A1 NPP reactor, which suffered from several accidents in the years 1976-77. The total funds received for A 1 cannot be precisely calculated because of inconsistent numerical data provided by the ministries and because part of the costs was paid in kind. The need to finance the decommissioning of A 1 via the State Fund has resulted in the resources of the "State Fund for Elimination of Nuclear Power-Generating Facilities", which had basically been collected to finance decommissioning of other facilities, has been used to a large extent for payments of decommissioning activities at A 1 (a kind of cross-subsidy).

In 2006, a new law was adopted aiming at harmonizing Slovak legislation with relevant EU legislation. The existing fund was renamed the "National Nuclear Fund for Decommissioning of Nuclear Facilities and for elimination of Spent Nuclear Fuel and

RAW". It was established as a special-purpose, state-governed fund to accumulate and process the necessary financial means. The new fund largely continues the activities of the old fund under the new name. The main difference of the new law is a requirement to open sub-accounts in the Fund for decommissioning of nuclear facilities as follows:

- 9.) Sub-account for decommissioning of nuclear facilities located at the Jaslovské Bohunice NPPs site so that each of those NPPs (A1, V1, V2) has its own independent analytical account:
  - A1: 0 Sk, 0 €
  - V1: 7570 Mil. Sk, 216 Mil. €
  - V2: 6322 Mil. Sk, 180 Mil. €
- 10.) Sub-account for decommissioning of the Mochovce NPP:
  - EMO: 2138 Mil. Sk, 61 Mil. €
- 11.) Sub-account for decommissioning of nuclear facilities that started their operations following the date when the National nuclear fund law came into force:
  - Beginning with 1.7.2006: 0 Sk, 0 €
- 12.) Sub-account for treatment of nuclear materials and nuclear waste of unknown origin: 0 Sk, 0 €
- 13.) Sub-account for searching the localities, geological survey, preparation, designs, constructions, operation and for closing-up the deep repositories of RAW and spent nuclear fuel: 0 Sk, 0 €
- 14.) Sub-account for institutional control of (deep) repositories: 0 Sk, 0 €
- 15.) Sub-account for storage of spent fuel in independent nuclear facilities:
  - 0 Sk, 0 €
- 16.) Sub-account for financing the nuclear fund's administration:
  - 1789 Mil. Sk, 51 Mil. €

The actual balance (1.12.2006) on the account of the National Nuclear Funds (§8, law No.238/2006 Z.z.) comprises 16933 Mil. Sk (438 Mil. €; with 1 € = 35 Sk.)



The finances of the old fund have been transferred to the new nuclear fund and its individual sub-accounts. The funds have been allocated to each account corresponding to the share of electricity generated in the individual NPPs during 1978 - 2005.

The new law further requires that the licensees responsible for the operation of power-generating nuclear facilities set aside funds as follows:

- 9450 € per 1 MW of electric capacity annually
- 5,95% of the price of the sold electricity generated in the facility during the previous year.

The law has set the obligatory payment paid by the NPPs operators too low compared to the size of the liabilities and lower than determined before the law had been adopted. The amount required by the new law from the financial payments from the NPPs operators will not cover the costs of the decommissioning of nuclear the facilities. Therefore, unless additional funding sources - particularly from the state budget – are not acquired, the Fund's current deficit will increase. It has been calculated by Energia 2000 & Partners that to cover the full decommissioning costs would require an 2.5 – 2.8 times higher contribution from the operator that that required by the Law on the National Nuclear Fund.

In the case of the A1 NPP, there are special regulations since 2006 concerning the financing of its decommissioning. The regulations stipulate that no money for A1 was transferred to the new fund, although decommissioning is still ongoing and the environmental and health problems caused by the accidents are substantial.

For the year 2006, the financing from the state budget for decommissioning activities have been reduced from 1.8 billion Sk to 781.4 million Sk. Despite the fact that these funds would have been needed to prepare the A1 NPP so that dismantling could start as planned in 2007. Due to the reduction of the available finances, the work could not be completed in time.

However, the financing of the first stage of putting NPP A1 into a radiation safe state should now be temporary provided by law revision 528/2006 Z.z., which required that all works at NPP A1 will be financed from sub-account of NPP V-1. This law revision was adopted on 6<sup>th</sup> September 2006 by the Slovak parliament and entered into force on 15<sup>th</sup> October 2006. The financial deficit in the V-1 account is required to be balanced by 31<sup>st</sup> December 2011. However, it remains unclear what this will mean in detail and how this balancing should be done.

However, the authors of this report could not find out, how much money from which sources will now be available for future decommissioning activities at A1.

The low level of funds required from the operator in the Law on the National Nuclear Fund was proposed in order to fulfill the privatization conditions agreed between the

Government and ENEL, who owns 66% of the Slovakian electricity company Slovenske Elektrarne. ENEL will not participate physically and does not seem to be responsible for the decommissioning of the facilities it operates (as far as this can be analysed without having access to the privatization contracts). It will only make payments to the National Nuclear Fund during the operation of the NPPs. These conditions had been agreed upon by the Slovak Government with ENEL during the privatizing negotiations.

There is also one further fund for decommissioning of NPPs: the Bohunice International Decommissioning Support Fund (BIDSF). It was established to finance some of the direct and indirect costs resulting from the early shut down of the V1 Bohunice NPP. During the EU accession negotiations, the Slovak Government committed to close the Bohunice V1 in 2006, and Unit 2 in 2008. EU assistance is not just foreseen for decommissioning of the reactors; equally important are issues related to security of supply (replacement capacity).

The Treaty of Accession foresees the provision of €90 million in 2004-6, recognising that decommissioning will continue beyond 2006, and that further assistance may be required beyond that date. This assistance is currently delivered through the BIDSF, managed by the European Bank for Research and Development, to which the EU is the major (but not the only) contributor.

A package of Community assistance amounting to €33 million for 2005 was approved by the PHARE Management Committee in July, and adopted by the Commission in September 2005. This accounts for the assistance foreseen for 2005 in the Bohunice Protocol. The 2006 package, consisting of a further €34 million contribution to the BIDSF, is likely to be adopted in October. The total EU assistance pledged since 1998 amounts to approximately €600 million of which €375 million are foreseen for the period 2007-2013. There are no plans to further EU assistance beyond 2013.

### **3.1.2 The State Fund for the Nuclear-Powered Facilities and Spent Fuel/RAW Management 1995 - 2006**

The decommissioning of the nuclear facilities in the Slovak Republic has been financially provided by the State Fund for the Nuclear-Powered Facilities and Spent Fuel/RAW Management from June 1, 1995 to June 30, 2006. The Fund was established by the law No. 254/1994 Z.z. with effect from January 1, 1995. The Fund's financial resources were kept on a separate account in the National Bank of Slovakia. The application submitted to apply for contributions from the Fund were assessed by the Fund Board consisting of seven members and appointed by the Minister of Economy Slovak Republic, comprising mainly the nuclear power, health care, environment, economy and municipality experts.

The Fund's mission was to accumulate the financial contributions that will serve as a source for long-term purposes, with the aim to finance the disposal works of the decommissioned NPPs and spent fuel and RAW management. The Fund had the

status of an independent legal entity at the level of an independent body unit ruled by the State.

The incoming part of the Fund was created as follows :

- Contributions from the operators of nuclear facilities
- Bank credits
- Interests from the Funds deposited in the bank
- State subsidies.

Furthermore, there were other resources pursuant to a special regulation and penalties taxed by the Nuclear supervision office of Slovak Republic for the physical and legal entities pursuant to special regulations, which were not very substantial funding sources.

For the Fund evaluation purposes, its expenditure was divided in the following basic cost groups:

- Costs of the NPPs dismantling, decontamination and demolition including research and development of new technologies,
- Costs of the back part of the fuel cycle consisting of the a long-term deposit including transports, research and development.
- Costs of the RAW processing and depositing at the National Deposit, including new technologies research and development.
- The Fund's management costs.

The Fund's means are deposited on the current account, and on the fixed-term / blocked deposits in the National Bank of Slovakia (NBS). According to the Fund's contract with the NBS, the time deposit accounts are paid interest by the actual interest rate for the purchase at the international deposits market (BRIBID), and the current account is paid interest by the NBS's interest rate for one-day sterilization business.

In 2003, the Fund was using the time deposit accounts in NBS with the fixed-term/blocked deposit's termination for two weeks and one month. The Fund's revenues/incomes from interests on bank accounts in 2003 amounted to appr. 16.5 m. EUR (618 m. Sk) before taxation. The Fund payed a 15 % tax from the mentioned interests, thus decreasing the incomes from interests to appr. 14 m. EUR (524 m. Sk.)

The real interest of the Fund's resources in 2003 is, due to higher inflation and lower interest rates, at the -3 – -4 % level, when compared with +3.2 % level in 2002. The similar development is expected also for 2005.

The utilization of Fund's resources till 2005 is not transparent. It is not clear how the finances have been used and how the different payments were calculated.

For protection of the Fund against the devaluation, it would be vital to cancel the duty of the Fund's incomes taxation, as well as to seek for the way for the higher interest of the accumulated resources. The development of creation and expenditures of the Funds in 2003 is shown in Table 7. During the last appr. five years, the resources grow

approximately in tune with the expectations. The Ministry of Economy's goal to increase the efficiency of spent resources as to increase the sum of the Fund's resources, reflected in a significant increase of resources at the Fund's deposits.

In general, the costs of the back part of the fuel cycle should be fully paid from the National nuclear fund. The expenditures mentioned in the table 7 have been mostly used for works connected with the introduction of the NPP A1 into the radiation-safe condition, and for projects connected with disposal of and processing of the radioactive waste.

Table 7 Overview of creation and expenditures of the Fund's resources (in m. EUR)

Year	Contributions of owner N.Fac.	Other incomes	SE a.s. penalties	UJD fines	Interest	Subsidies from state budget	Total expenditures	Balance
1995	21.32				0.41	9.42	6.31	24.84
1996	38.78				2.25	3.76	17.75	51.88
1997	22.64				1.59	2.41	32.29	46.23
1998	32.27	0.054			1.49	4.05	46.10	37.94
1999	42.29				3.59	1.74	30.87	54.72
				0.0054				
2000	52.47	0.00021	0.0026		3.69	1.53	13.31	99.10
				0.004				
2001	68.72	0.00045	3.64		8.87	1.60	17.83	160.46
				0.032				
2002	72.26	0.00008			13.381		19.01	227.09
2003	70.71	0.00016			14.162		20.99	290.97

### 3.1.3 Coverage of the different cost items of the back part of fuel cycle

#### 3.1.3.1 Costs of the deep repository of Slovak Republic according to the State Fund for Elimination of nuclear-powered facilities

The calculation of the costs of the development, construction, operation and closure of the deep deposit in Slovak Republic was based on the to now published reports in frame of the deep deposit SROV development program. The results of the costs specification are summarized in Tab 8. In this case, the deep deposit was dimensioned with certain reserves for the amount of 2500 tons of the Spent nuclear fuel. The source studies, which served as the basis, were solved in price levels of the year 2000, and the deep repository's costs originally amounted to 58,583 b. Sk. The 2003 price level costs were set for 1,922 b. EUR (71,125 b. Sk) calculated with regard to the inflation. According to the feasibility study, the start of the deep repository's operation is presumed for 2037.

Table 8 Costs of the deep repository of Slovakia in 2003 price level.

Activity	Costs of deep repository (m. EUR)	Costs of deep repository Slovak Republic (m. EUR)
	2000 price level	2003 price level
Research, development, design, work	251.75	300.52
Deep repository's construction	546.21	652.02
Containers for spent fuel	283.78	338.75
Deep repository's operation	440.48	525.81
Gradual shut down	71.89	85.82
Closure of repository	16.21	19.36
<b>Total</b>	<b>1 610.32</b>	<b>1 922.27</b>

### 3.1.3.2 Costs of operation of the spent nuclear fuel storage

The annual operational costs of the Bohunice wet inter-storage of spent fuel (after the NPP's operation end) were estimated to 30 m. Sk. while the annual operational costs of the Mochovce dry inter-storage were estimated to 15 m. Sk. The implementation costs of the Mochovce dry inter-storage of spent fuel are not planned to be financed by the Fund's resources; the costs of the seismic endurance for the Bohunice wet inter-storage are also considered.

### 3.1.3.3 Treatment and storage of low and intermediate active RAW

The planned resources in this field include mainly the Fund's participation in implementation of the RAW processing lines at the Bohunice sites. Other resources will be obtained from BIDSF funds, or from the SE a.s. company Bratislava resources.

In evaluation of the overall expenditures of the Fund, the extension of the Mochovce National Deposit for low and intermediate RAW is also considered, in compliance with the nuclear facilities decommissioning needs. From the long-term point of view, the Mochovce National Deposit's operational costs represent the most significant part of it, amounting to 1.21 m. EUR annually.

### 3.1.3.4 Projects proposed to be financed by the International Support Fund for the V 1 Bohunice NPP shut down (BIDSF)

The BIDSF Fund was established in November 2001. It is managed by the European Bank for Restoration and Development (EBRD). It aims to finance or co-finance the selected projects for appr. ten years. The projects' financial support is submitted to the BIDSF Board of Contributors for decision-making that may modify the projects' contents.

The proposed projects require the provision of supplies, project management and engineering consulting services for support, compilation, translation and approval of the

engineering documentation required during the planning process and approval procedure conducted through the V-1 NPP decommissioning. Moreover, they include preparation of safety analyses and operational documentation for the V-1 operation end stage, supplementation of the existing RAW management technologies, replacement of capacities and generation of power, and measures to be made for the key switch room adjustments following the V1 shut down.

The EC promised to make an over 150 m. EUR contribution for projects, what makes it being the most significant contributor to the BIDSF Fund. Countries like Denmark, Holland, Austria and Ireland have already signed their participation in projects, while Spain and France showed also an interest in the project. The minimal contribution of one country amounts to 1.5 m. EUR.

The list of projects financed by the BIDSF see in the table 9.

Table 9 Projects proposed to be financed by BIDSF during 2003 – 2010

	<b>Project title</b>	<b>in m. EUR</b>
A 4	Replenishment of the currently used decontamination devices with regard to decommissioning	2.53
B 6	Elaboration of documentation for the V – 1 NPP decommissioning	3.3
C7 -A	Processing and treatment of metal waste (re-casting line of metal RAW)	10.8
C7-B	Processing and final treatment of historic waste, highly-active sludges and sorbents through vitrification	4.37
C7-C	Processing and final treatment of historic waste, highly-active sludges and sorbents	11.8
C7-D	Means of transport of liquid historic RAW from the V-1 NPP to the existing processing prices	4.2
C8	Interim storage of RAW in the NPP Bohunice location	12.5
C9	Extention of the National Deposit in Mochovce	14.2
	<b>Total Nuclear Projects</b>	<b>63.7</b>

Table 10 Overview of costs for projects in frame of BIDSF for 2003 – 2010 (in m. EUR)

	TOTAL	2003	2004	2005	2006	2007	2008	2009	2010
<b>BIDSF</b>	115.81	1.08	5.98	11.95	18.66	16.14	23.03	19.18	19.27
<b>SFL</b>	21.97	0	0.81	0.23	1.99	3.07	5.2	5.54	5.13
<b>SE a.s.</b>	0.81	0.62	0.18	0	0	0	0	0	0

### 3.1.4 Presumed expenditures and incomes of the state-governed national fund

The presumed overall expenditures of the state-governed national until 2130 are shown in Table 11. The presumed incomes of the Fund are shown in Table 12. From the Fund-conducted modelling results it follows that with preserving the current state, it is not possible to secure enough resources for the full financial management of the back part of nuclear power.

A deeper analysis of the figures shows that, with preservation of current state in the Fund's creation, the financial resources would be spent to appr. 2039. The overall deficit of the Fund at the monitored period end would amount to appr. 2,4 b. EUR (88,68 b. Sk).

Table 11 Expenditures of the Fund during 2004 – 2130.

Decommissioning of nuclear facilities	1 672.41	m. EUR
Back part of fuel cycle	2 082.88	m. EUR
Processing and storage of RAW	135.84	m. EUR
Other costs	34.942	m. EUR
<b>TOTAL</b>	<b>3 926.07</b>	<b>m. EUR</b>

Table 12 Incomes of the Fund during 2004 – 2130\*.

Balance	295.02	m. EUR
NPP V -1 J. Bohunice	84.84	m. EUR
NPP V – 2 J. Bohunice	421.61	m. EUR
NPP Mochovce 1.2	727,75	m. EUR
<b>TOTAL</b>	<b>1 529.23</b>	<b>m. EUR</b>

\* Note the following specifications:

- adjustment of the payment sum from 10 % to 11% from the selling price of power generated in the NPP,
- 2.84% interest of resources over the inflation
- cancellation of contributions for municipalities within the NPP's vicinity – it is a kind of compensation of damages.

### 3.1.5 Possible increase of the National Fund's incomes

A realistic solution for sufficient cover of the back part of nuclear power costs in the Slovak Republic seems to lie in the preservation of payments to the Funds also after the NPP's operation end, what would require the amendments of the law No. 254/94 Z.z. on the State Fund for Elimination of Nuclear-power Facilities, in sense of later regulations. Currently the payments to the Fund are considered already in the final selling price of the consumed power pursuant to the valid regulations of the Authority for Regulation of Network Branches. So the new version of the law on the Fund will not mean additional increase of the final prices of power, but the period of the contributions payments will be extended according to the needs of the back part of nuclear power in the Slovak Republic. Thus, the overall deficit of the Fund will be covered in full extent.

In 2003, the payments to the Fund were 0.0034 EUR/kWh (0.127 Sk/kWh) from power consumed in the Slovak Republic (calculated from the electricity net consumption – i.e. without own consumption and canteens), representing the Fund's income 70.2 m. EUR (2.6 b. SK) in total. The proposed model presumes payments to the Fund amounting to 0.12 Sk/kWh with the validity from 2005 to 2030, and 0.06 % Sk/kWh during 2031 – 2058. The model used in the submitted material (which are internal confidential /secret/ documents of the State Fund for the Elimination of Nuclear Facilities) is based on the 2000 electricity consumption; its gradual growth by 1 % annually is presumed for the whole evaluated period.

### 3.1.6 Situation since July 1, 2006

#### 3.1.6.1 Creation of fund's resources pursuant to the newly passed law

On July 1, 2006, the Act on the National Nuclear Fund for Decommissioning of nuclear Facilities and for spent fuel and RAW management came into effect. According to the estimates of the State fund for elimination of nuclear-powered facilities, the Fund will be established as the state purpose fund, and the legal entity resident in Bratislava. The Nuclear Fund will be managed by the Ministry of Economy of the Slovak Republic.

The purpose of the establishment and activities of the National Nuclear Fund is to accumulate and manage, pursuant to the law regulations, the financial resources designed for the final part of the nuclear power in sufficient amount, in a transparent and non-discriminative way, to provide those resources to entities defined by law to spend inevitable costs for the nuclear facilities decommissioning and for RAW and spent fuel management.

The State fund for elimination of nuclear facilities that existed until the year 2006, virtually has been only renamed - changed its name for National nuclear fund, and will continue in its activities.

The National nuclear fund's resources are formed by financial resources that are obtained through:



- 1.) Contributions from bearers of permission for operation of nuclear facilities operation that generate power, for each megawatt of installed electric capacity, and from the selling price of electricity generated in the nuclear facility (hereafter „obligatory contributions“)
- 2.) Payments by the operator of the transmission system and by the operator of the distribution system (hereafter „systems operators“) that is designed to pay the debt that arose by creation of resources for covering the costs of the final part of nuclear power (hereafter „payment“); payment is part of the price of supplied electricity to the final consumers of electricity,
- 3.) Sanctions imposed by the authority according to special regulations,
- 4.) Interests (yields) from the nuclear fund's bank deposits
- 5.) Donations both from physical and legal entities,
- 6.) Subsidies and contributions from the EC Funds and other international organizations, financial institutions and funds aimed to cover the costs of the back part of nuclear power,
- 7.) State subsidies designed to cover the costs of management of the RAW and nuclear material, the origin of which is not known. The subsidies are provided in full amount of inevitable costs needed for the management and elimination of RAW and nuclear material, the origin of which is unknown. These subsidies will be paid from the budget of the authority; state subsidies are provided pursuant to law on the state budget,
- 8.) Subsidies from the state budget provided from reasons other than 7), according to the Government resolution on their provision; subsidies from the state budget are provided according to the law on state budget,
- 9.) Profits from the financial operations,
- 10.) Other resources, if defined by a special regulation or international agreement.

Pursuant to 1), the bearer of the permission for nuclear power-generating facility operation is obliged to pay to the nuclear fund the sum of 9 459.45 EUR annually per each megawatt of installed electric capacity generated by this nuclear facility, and the sum of 5.95 % of the selling price of electricity generated by the nuclear facility during the previous year. Details on the way of selection and payments for the obligatory contribution to the nuclear fund will be determined by the Governmental regulation.

#### 3.1.6.2 Responsibility for setting-up of financial resources

The Government of the Slovak Republic, that also manages the National Nuclear fund, took the responsibility for the setting up of the Fund's financial resources. Every four years, the Government may propose to change the amount of payments from the nuclear power plants' operators to the Fund, by the law amendments on national nuclear account. The change of financial resources set-up can be conducted only through the change of the law on the national nuclear fund that determines the

maximum payments from the V2 J. Bohunice and Mochovce NPPs operators, for years 2007 – 2011, directly in law on national nuclear law in § 13, article 3.), to 50 m. EUR (1.85 b. Sk).

### 3.1.6.3 Accruals and growth of the Fund.

Accruals, or the growth of the financial resources in the newly passed law was not set up in compliance with needs of the nuclear power facilities with the aim to accumulate the financial resources till the individual NPPs decommissioning start-up, but it was set up according to needs of the privatizing company – the ENEL company – so that it would not resign from the privatization contract.

The collection of the financial resources from operators for decommissioning will be carried out as follows:

NPP A1: It was not carried out at all, and there are no liabilities of the currently operating NPP operators with regard to NPP A1. Therefore, all costs regarding NPP A1 have to be covered differently.

NPP V1: funds have been collected from the operators from June 1, 1996 until the date of its presumed shut down on December 1, 2006, or December 1, 2007.

NPP V2: funds have been collected from the operators from June 1, 1996 until today.

NPP Mochovce 1, 2: funds have been collected from the operators since the NPP's start until today.

This means that a deficit must have been created in the national nuclear fund, as the financial resources from the operator since the NPP's operation start, started to be accumulated only in the Mochovce 1,2 NPP.

The financial resources paid by the nuclear facility operator to the Fund, were not kept separately per each nuclear facility, but they were kept in one account altogether. Only the expenditures of the Fund were kept separately per each nuclear facility. Pursuant to the new law, the Fund's sub-accounts will have to be kept according to the following scheme:

- a) Sub-account for nuclear facilities decommissioning, including RAW management from this decommissioning, operated in the Jaslovske Bohunice location in structure of the following analytical accounts :
- b) NPP A 1,
- c) NPP V 1,
- d) NPP V 2,
- e) Sub-account for the NPP's decommissioning, including RAW management made through this decommissioning, operated in the Mochovce location,

- f) Sub-account for the nuclear facilities decommissioning including RAW management from this decommissioning, that will start their operation after this law comes into force,
- g) Sub-account for management with the nuclear materials and RAW, origin of which is unknown,
- h) Sub-account for seeking the locations, geological survey, preparation, designing, construction, starting operation, operation and closure of spent nuclear fuel deposits including monitoring after closure of those deposits and including related research and development,
- i) Sub-account for institutional control of deposits,
- j) Sub-account for storage of spent fuel in independent nuclear facilities,
- k) Sub-account for covering of expenditures spent for the nuclear fund's management and expenditures related with the nuclear fund's management.

Sub-accounts according to article a) – g) are managed by the sub-accounts' managers of the state who are responsible for the division of the nuclear fund's resources into individual sub-accounts and individual analytical accounts, as well as for the effective and economic use of those resources from sub-accounts. Individual sub-accounts according to letter a) to g) have the following managers:

- a) Manager of sub-account for decommissioning of nuclear facilities operated in the Jaslovské Bohunice location ( letter a)),
- b) Manager of sub-account for NPP decommissioning operated in the Mochovce location (article 1 letter b)) and sub-account letter c),
- c) Manager of sub-accounts for purposes as defined in letters d) and g),
- d) Manager of sub-accounts for purposes as defined in letters e) and f).

Funds are available continuously as they financed and still finance also the reconstruction of the crashed A1 NPP. They finance also the research and development aimed at the deep deposit and RAW processing. The access to the National nuclear fund's means is granted to each physical and legal entity which fulfills conditions as defined by the law on the National nuclear fund, article 10. The procedure for getting access to the fund is based on the application that has to fulfill all conditions defined by the law on the National nuclear fund.

The applicant who fulfills the conditions for granting the means of the National nuclear fund pursuant to conditions defined by this law, has the legal claim to conclude a contract on the means granted from the National nuclear fund, in amount approved by the Board of Trustees.

The systems' operators are obliged by law to make the payments to nuclear fund account, together with possible yields that will arise during the relevant period of time. The amount of the annual payment, chosen by the article, that may be included in the electricity price, will be determined by the Government according to its quantification by

the law, and according to a strategy approved by the directives. The Authority for Regulation of Network Branches, by general obligatory legal ordinance issued pursuant to a special directive, will adjust the details of inclusion of this payment into the supplied electricity price.

Details of the method for the payment's selection according to its book-keeping in the systems operators, and details of methods and deadlines for this payment to the nuclear fund account to be made by the systems' operators, will be determined by the Government of the Slovak Republic's ordinance following the nuclear fund's proposal.

Until today, there were neither procedures determined in the book-keeping for setting-up of the fund's accruals and growth, nor the discount rates of the fund growth. It is not known what legal requirements or international standards have been applied in the accounting methodology during setting-up of the set-aside funds.

In case of the change of decommissioning estimations, the contributions to the fund can change only through the change of the law on nuclear fund. It is not secured whether the law on the amounts of contributions will be changed.

The newly passed law on the national nuclear account defined the setting-up of sub-accounts for individual NPPs decommissioning and activities as follows:

The proposal for division of nuclear fund's resources into individual sub-accounts and to individual analytical accounts, as well as expenditures of the nuclear fund's means pursuant to the approved strategy, will be submitted by the Board of Trustees to the Supervisory Board for approval, for the first time after the law coming to effect, until November 30, and then annually to November 15 of current year on the following year.

Until today, the National nuclear fund has not yet elaborated the plan for the division of financial means for concrete nuclear facilities for the future; it has not yet precisely calculated deficit of means in the Fund pursuant the criteria defined by the newly adopted law on the National nuclear fund.

#### 3.1.6.4 Transfer of financial means to the Fund

Financial means are transferred by payments to the Fund's account directly from the nuclear facilities' operators ; and from other contributors defined by the law.

#### 3.1.6.5 Legal requirements and standards applied in the methodology of setting-up the Funds

The National Fund was set-up pursuant to law No. 523/2004 Z.z. of the Slovak Republic on the budgetary regulations of public administration. Set-up of the Fund has to abide by this law and by the law on the national nuclear account.

### 3.1.6.6 Setting-up the accruals of the Fund

The basis for setting-up the accruals of the Fund were the undiscounted decommissioning costs. According to the adopted law on national nuclear account, the Nuclear fund must submit to the Ministry the following :

- updated conceptual plan of NPP A1 decommissioning including updated financial plan of decommissioning - till September 30, 2006,
- updated conceptual plan of NPP V1 decommissioning including updated financial plan of decommissioning - till September 30, 2006,
- updated quantified sum of debt related to the period of the NPPs' operations prior to establishment of the State Fund for Elimination of Nuclear Power-Generating Facilities and RAW and Spent Fuel Management – till December 31, 2006,
- complex proposal of strategy for decommissioning of all nuclear facilities in the Slovak Republic (including V2 and Mochovce 1, 2 NPPs) - till June 30, 2007.

Financial means of the Fund accounts (i.e. of the State Fund for Elimination of Nuclear-Power Facilities and RAW...) are transferred, to the date of law on national nuclear account coming in force, to the Nuclear Fund, and its individual sub-accounts and analytical accounts in such shares that are corresponding with the shares of generated electricity in individual NPPs in the overall electricity generated in all NPPs during 1978 - 2005.

Within three months from the date this law coming in effect, the Nuclear fund's director will provide:

- elaboration of financial statement of the Fund verified by an auditor,
- elaboration of annual report on the economic management and activities of the Fund,
- deletion of the Fund from the register of organizations kept by the Statistical Office of Slovak Republic,
- registration of the Nuclear Fund in the register of organizations kept by the Statistical Office of Slovak Republic.

Nuclear Fund will submit the proposal for its 2006 budget by means of the Fund's manager, to the Government of Slovak Republic for approval - till August 31, 2006.

### 3.1.6.7 Securing the contributions in case of change of costs estimates

Change of the amount of contributions can be defined only by the law. In case of change of cost estimates, each five years the amount of contributions to Fund can also change by law. There is no security that they will really change and how they will change, as only the National Committee of Slovak Republic deputies (Members of Parliament) can decide on the change.

## 3.2 Management of the Fund

### 3.2.1 Overview

The national nuclear fund is a legal entity under the public law and resident in Bratislava. The fund's content of activities include accumulation and management of financial means designed for the back part of nuclear power in the Slovak Republic in sufficient amount, and through transparent and non-discriminative way, to provide those means to the entities quoted in law, to pay the inevitable costs spent for decommissioning purposes.

The Nuclear fund management is carried out by the Ministry of Economy of Slovak Republic; i.e. it is not managed publicly, it is managed by the Government of the Slovak Republic. Up to now, all data on the fund's management were confidential confidential, and the public had not access to them. Pursuant to the adopted law on the National Nuclear Fund, the national fund consists of the Board of Trustees and Director of the Fund.

### 3.2.2 Board of Trustees

Board of Trustees of the Fund:

- The members of the Board of Trustees of the Fund will be designated by the Ministry of Economy on the basis of the selective procedure. The conditions for membership include the university degree of second level, ten years minimum experience in the field of work related with the nuclear facilities' decommissioning, or in field of elaboration of technical-economical concepts, or in field of financing, calculation, economic analyses, designing and implementation of constructions, civil engineering, or mechanical investment engineering.
- The Board negotiates/discusses the proposal for the nuclear fund's budget for the relevant calendar year with presumed development of incomes and expenditures for at least five years period, negotiates the view of the supervisory board to this proposal,
- submits the proposal for the budget together with the view of the Supervisory Board and the Nuclear Supervising Authority of Slovak Republic (hereafter „authority“) to take a stand on the Ministry until March 31 of the current year, if the Ministry does not define another deadline, and following the negotiation with the Ministry, to the Government of Slovak Republic for Approval in the deadline defined for submission of proposals for budgets of the public administration bodies,
- the Board elaborates the proposal for strategy of the back part of nuclear power in cooperation with the bearers of permissions or agreements issued by the authority, and with experts in field of the nuclear facilities' decommissioning and

RAW / spent fuel management, as well as of investments, nuclear power, economy and law (hereafter „strategy“). It consists of :

- a) material and time plan of activities related to the final part of nuclear power, at minimum in extent corresponding with the content requirements of the conceptual plan of decommissioning,
- b) technical and technological methodology of activities related with the final part of nuclear power,
- c) proposal for a strategy-providing financial plan that is divided in one-year and five-year periods of the strategy implementation, including proportionality between the individual sub-accounts by § 8,
- d) presumed impacts of contributions on prices of electricity and other goods and services, on the economic and social development of the country for each year of the strategy implementation,
- e) impact of proposed strategy on the balance / proportionality, safety and operational reliability of the energy system of Slovak Republic and EC,
- f) proposal of the financial plan for provision of costs of the nuclear fund's management for the whole strategy period,
- g) opinions of the health care bodies concerning the radiation protection and health protection of employees, in relation to the proposed strategy according to a special regulations; and the opinion of the Ministry of Environment of Slovak Republic concerning the impacts of the strategy implementation on the environment,

### 3.2.3 Supervisory Board

The Supervisory Board is the supervisory body of the Fund has the following tasks:

- It controls the management of the Fund's financial means designed for the management of the National nuclear fund
- It controls the coherence of the law on the National nuclear fund and other general law ordinances related with the coherence of the management of the nuclear fund
- It controls the purposefulness and effectiveness of the National nuclear fund means use granted in compliance with the regulations of the National nuclear fund, coherence of the rules and terms of the contract for granting of the National nuclear fund's means; it has the right to stop/block the execution of the decisions of the Board of Trustees made on the granting the Fund's means, or to stop the negotiation of the proposal for the contract on the Nuclear fund's means granting – until the decision made by the Minister of Economy.
- It negotiates the proposal for the intermediate-term and long-term financial plan for strategy of decommissioning, proposal for budget with expected

development of income and expenditures for at least five years, proposal for financial statement, annual report and financial report of the National nuclear fund

- It negotiates the proposals for granting the means from the National nuclear fund
- and other activities

The Supervisory Board has five members. The chairman to the Supervisory Board is the Secretary of the State of Ministry of Finance designated by the Minister of Finance. Other members include: the Secretary of the State of Ministry of Economy designated by the Minister of Economy, deputy of the Authority for Nuclear Supervision, representative of the Ministry of Environment designated by the Minister of Environment, and the representative of the Ministry of Health designated by the Minister of Health.

The Fund's Director is the executive body of the nuclear fund. The Director acts on behalf of the nuclear fund within the scope as defined in the nuclear fund statutes, and he/she is in charge of his/her activities /subordinated/ to the Board of Trustees. The Director takes part at the Board of Trustees meetings with the advisory vote.

#### **3.2.4 Director of the fund**

The Director is designated and dismissed by the Minister at the proposal of the Board of Trustees. Requirements on education, expert skills, qualification for legal acts, integrity and permanent residence, are similar to the members of the Board of Trustees. The Director is the head employee of the nuclear fund, and his/her selection is conducted through the selective procedure /tendering/ according to special regulations.

The director's duties are as follows :

- a) Fulfill the decisions made by the Board of Trustees,
- b) Provide the proper accounting / book-keeping of the nuclear fund,
- c) Contracting on the provision of the nuclear fund's means with the beneficiaries of those means, in compliance with the Board of Trustees decisions,
- d) Observe the fulfillment of the contracting conditions during the contracting period on the provision of nuclear fund means, and to penalize (payments and penalties) beneficiaries of those nuclear fund financial means in case of breaching the contract on provision of the nuclear fund financial means, or in case of those financial means use for purposes other than defined in the contract, or in case of other unauthorized or uneconomic use of those financial means or in case of stopping of the provided financial means,
- e) Extort contributions from the permission bearers for nuclear facilities operation, to extort sanctions and other financial claims of nuclear fund,



- f) Provide elaboration of an annual financial statement of the nuclear fund and submit it to the Board of Trustees and Supervising Board till February 15 the following calendar year,
- g) Provide elaboration of the annual report on financial management and activities of the fund, and to submit it to the Board of Trustees and Supervising Board till March 1, the following calendar year,
- h) Provide elaboration of the financial report of the nuclear fund on a quarterly basis, and to submit it to the Board of Trustees and Supervisory Board till the tenth day of the month following the calendarly quarter-of-the-year end,
- i) Take steps to eliminate shortcomings in the economy and activities of the nuclear fund, found by the Supervisory Board, Ministry, nuclear fund's main inspector and by the control and supervisory bodies of the state,
- j) Fulfill other tasks defined by the Board of Trustees or by Ministry,
- k) Organize selective procedures for positions of nuclear fund's managers carried out in compliance with special regulations, and to submit the proposal to the Board of Trustees, in order to designate the nuclear fund's managers for workplaces selected on the basis of the selective procedure, except for selective procedure and proposal for designation of the main inspector.

The Director submits to the Board of Trustees and Supervisory Board the following:

- proposal for the nuclear fund budget for the relevant calendarly year, including presumed development of nuclear fund's incomes and expenditures for at least five years period,
- proposal for both organizational order and work order of the nuclear fund, including proposals for other inner regulations of nuclear fund,
- proposal for the nuclear fund statute.

The fund is managed internally.

### **3.2.5 Access to the funds**

Access to the funds is defined by the law on nuclear fund as follows:

Financial means of nuclear fund can be used for purposes of justified /substantiated costs that were spent for activities related with the final part of nuclear power, namely for :

- a) End of the nuclear facility's operation due to decommissioning,
- b) Decommissioning of nuclear facilities that generated power by their operation, including RAW management generated during this decommissioning, and including preparatory activities following the nuclear reactor's shut down, with the aim to end the operation and to the decommissioning,

- c) Spent fuel management after the nuclear facility's operation end,
- d) Nuclear materials and RAW management, the origin of which is unknown, including RAW and nuclear materials resulting from random catchments or from criminal acts, the originator of which is unknown, according to the Police Force or Ministry of Health of Slovak Republic investigations,
- e) Purchase of property grounds to place the site for the deposit of spent nuclear fuel and RAW from the nuclear facilities' decommissioning,
- f) Seeking the sites, geological survey, preparation, designing, construction, start-up operation, operation and closure of the spent fuel and RAW deposits from decommissioning, including institutional control of deposits, and including related research and development,
- g) For management and activities related with the nuclear fund's management up to 1 % of the nuclear fund's annual incomes.

### **3.2.6 Restrictions with regard to the use of financial means**

The nuclear fund's means cannot be used for the following purposes:

- a) Business, start-up of other legal entities or physical entities, or as a share / stake to properties of other legal or physical entities, payment for purchase or other transfer of shares of stocks in the business organizations' properties,
- b) Financial operations at the financial market including purchase of public funds / commercial documents, apart from such investments of the nuclear fund's financial means, decisions on which are within the Ministry of Finance's competence,
- c) Provision of credits, loans or subsidies to the nuclear facilities' operators for their nuclear facilities operation, for financial provisions to insure the nuclear facility operator's responsibility, for damages caused by a nuclear event / accident, or for other nuclear damages,
- d) For payment of costs of the permission bearers for operating RAW management,
- e) Contributions for protection of life and health of citizens in zones endangered by nuclear facilities,
- f) Disposal of the state debt or as the state guarantee,
- g) Handling of work-legal, civil-legal and business-legal commitments developed in relation with the nuclear fund management above the limits as defined in article 1 letter g).
- h) The scope of the justified costs for the purposes of decommissioning, will be defined by the generally obliged ordinance issued by an authority.

### 3.2.7 Conditions of provision of the nuclear fund's means

The nuclear fund's means may be provided to a legal or to a physical entity – to a businessman, who fulfills the following conditions:

- He/she is the permission bearer for the nuclear facility operation end concerning decommissioning, for the stage of the nuclear facility's decommissioning, for closure of deposit and for institutional control, for RAW management, or for spent fuel management,
- has payed obligatory contributions – in case the contractor is the operator of the power-generating nuclear facility,
- payed the penalties within the terms according to special regulations,
- no unjustified or uneconomic management with the provided financial means from the nuclear fund were found in this entity, nor retainment of the nuclear fund's means, or use of the nuclear fund's means for purposes other than they were provided for,
- nuclear fund does not keep files on any debts againts this contractor, and no legal proceedings nor arbitration proceedings are lead against this contractor because of extortion of the nuclear fund's debts,
- contractor will show that during the five years time prior to application form submission, he/she properly fulfilled all tax and payment committments, and that the tax authorities, social insurance company, health-care insurance companies, Customs directorate do not register any debts against the contractor ; however, this does not refer to a nuclear facility operator who received the permission for nuclear facility operation in period shorter than five years prior to this law came in force ; in such a case, the contractor will show the fulfillment of the mentioned obligations during period since the nuclear facilities' operation start-up,
- application form submitted for provision of financial means from the nuclear fund with its annexs fulfill all matters defined by the law.

The condition for the financial means provision from the nuclear fund is that the activities relating with the final part of nuclear power, on which the financial means are applied for, are in compliance with the strategy, and that those activities will not cause imbalance in the energy system of Slovak Republic, or threat to or worsening of the environment and health state of inhabitants.

The Board of Trustees of the Fund makes decisions on the financial means investments; the Board has seven members. One of them is the Board's chairman, two are vice-chairmen, and four of them are the sub-accounts managers.

The control of the nuclear fund's economy is carried out by the Ministry of Finance, and the control of the management of the nuclear fund's means is carried out by the main

controller of the nuclear fund as well as other control authorities such as the Highest control authority of Slovak Republic.

The Board of Trustees of the Fund makes decisions on the financial means investments; those decisions are approved by the Government of Slovak Republic.

### **3.2.8 Requirements on the liquidity of the Fund**

There are no requirements on the Fund by law. The law determines only one clause that the financial means on individual sub-accounts and on individual analytical accounts, cannot have passive balance. Záporná zostatok. However, deficit of appr. 756 m. EUR (28 b. Sk) is currently found in the Fund for the A1 and V1 J. Bohunice decommissioning solely.

### **3.2.9 Internal control systems of the Fund**

The Supervisory body of the Fund is the Supervisory Board. The Supervisory Board has the following duties. It

- a) controls the nuclear fund's economy as for the management of financial means designed for the nuclear fund's management,
- b) controls the observance of this law and other generally obliged legal ordinance related with the observance of the nuclear fund economy,
- c) controls the efficiency and purposefulness of the nuclear fund's means use, as well as the observance of the regulations and contracting conditions of providing the nuclear fund's means, and – in justified cases – it has the right to stop the execution of the Board of Trustees decision about providing the means from the nuclear fund, or to stop the negotiation of the proposal for contract on the provision of means from the nuclear fund up to the Minister's decision, or to demand the termination of contract on provision of means from the nuclear fund, or resignation of the nuclear fund from this contract, if the beneficiary does not observe the conditions, in which the nuclear fund's means were provided, or he/she does not use them on purpose they were demanded,
- d) negotiates on the proposal for decommissioning strategy, proposal for intermediate and long-term financial plans to provide decommissioning strategy, proposal of the budget with presumed development of incomes and expenditures for at least five years period, proposal for financial statement, annual report and financial report of the nuclear fund.
- e) negotiates on the proposals for contracts on the nuclear fund's means provisions,
- f) in justified cases, it proposes to call the Board of Trustees, especially if shortcomings are found in activities, economy or in the use of nuclear fund's means; in such case, chairman (vicechairman) of the Board of Trustees is

- obliged to call to Board of Trustees within seven days from the date of delivery of the supervisory board's application for calling the Board of Trustees,
- g) orders duty to the Board of Trustees to take steps for elimination of shortcomings found during the control,
  - h) approves the payments and other functional benefits to the members of the Board of Trustees at the proposal of the Board of Trustees' chairman; Board of Trustees chairman's payments and benefits are approved by the Minister,
  - i) elaborates and submits to the Minister the report on the activities; part of the report are also the shortcomings found by the Supervisory Board in the Board of Trustees activities and in financial management of the nuclear fund during the previous calendary year, including steps taken to eliminate those shortcomings; this report is part of financial statement /accounts/ and annual report on the nuclear fund activities,
  - j) approves the rules of procedure of supervisory board.

The Supervisory board has five members. Chairman to the supervisory board is the Secretary of State of Ministry of Finance designated by the Minister of finance; other supervisory board members include the Secretary of State of the Ministry designated by the Minister, vice-chairman to the authority, a representative of the Ministry of Environment designated by the Minister of Environment of Slovak Republic, and a representative of the Ministry of Health Slovak Republic (hereafter „ministry of Health“) designated by Minister of Health of Slovak Republic.

The Chairman (vice-chairman) of the Board of Trustees and the main controller / inspector are obliged, by request, to take part in the supervisory board's meeting; other persons, that are invited to the meeting by the supervisory board's chairman may also take part in the supervisory board meeting.

The Members of the supervisory board are authorized to look into the documents and records related with the financial management, activities, providing and purposefulness of providing of the nuclear fund's means ; they can ask to submit the needed documents and ask for the necessary explanations by the board of trustees' members, nuclear fund employees and beneficiaries of nuclear fund financial means.

### **3.2.10 Role of the state**

The state has kept the full control over the Fund. The Government of the Slovak Republic approves the Fund's budget and the Ministry of Finance executes the control of financial management of the nuclear fund.

The nuclear fund will submit the proposal for its budget for 2006 by means of the fund's manager for approval to the Government of Slovak Republic till August 31, 2006.

### **3.2.11 Independent control of the Fund**

The law on the national nuclear fund assigned all control mechanisms to the internal bodies of the fund and to the Ministry of Finance. There is no external, let alone public and independent control of the fund.

### **3.2.12 Protection of Funds**

Protection of the fund is secured by their deposit in the National Bank of Slovakia accounts. We are missing information about the insurance of the funds and financial risks.

## **3.3 Special cases**

In case of early closure of the nuclear facility, it is the state budget of the Slovak Republic that by law takes the responsibility for financial provision. In such a case it is the GovCo (renamed to JAVIS from June 2006) stock company with 100 % of the state shares, which is then responsible for decommissioning. This is the definition as approved by the law and by the Government of the Slovak Republic. In case of the ownership transfer, the state takes the responsibility for the funds, even for the still running NPPs. As the funds are managed by the state, in case of the state's insolvency, there is no legal protection. In case of insolvency of the facility's operator, there is no protection of funds by law neither. The National nuclear fund has been, is, and will be state-governed and state-managed, and the contributions from contributors will always be on the National nuclear fund's sub-accounts. The means will still remain on the account also in case of insolvency of the operator. There is possibility left in the law to make contributions from the state budget, as a protection against all unpredictable impacts.

Table 13 Base for decommissioning funds required in Slovakia

Short name of nuclear facility	Kind of facility	Decommissioning funds are based on overnight / undiscounted decommissioning costs	Decommissioning funds are based on net present value / discounted decommissioning costs	Discount rate used for discounting, if any	Reference date used for discounting	Remarks
A1 J.Bohunice	NPP	yes	no	0	-	+ There is only one fund and one account for decommissioning. Under newly passed law, each nuclear facility will have to establish sub-accounts. Sub-accounts will be established by the National nuclear fund from January 1, 2007.
V1 J. Bohunice	NPP	+	+	+	+	
V2 J. Bohunice	NPP	+	+	+	+	
JE Mochovce 1,2	NPP	+	+	+	+	

Table 14 Decommissioning funds accumulated in relation to expected total costs of future decommissioning of nuclear installations in Slovakia (in prices of 2005)

Short name of nuclear facility	Kind of facility:	Total decommissioning costs estimated [Mio. Euro]	Provisions accumulated by 31-12-2004 [Mio. Euro]	Provisions accumulated in relation to expected costs [%]	Years of operation until 31-12-2004 in relation to total expected lifetime [%]	Remarks
A1 J. Bohunice	NPP	378	Total means accumulated on the Fund for all 4 NPPs amount to 380 m. EUR	appr. 6 % =324/(378+1884+1620+1620)	5 years, 25%	+not known, as the means are accumulated in one fund
V1 J. Bohunice	NPP	1 884			28 years, 75%	Overall cost estimates are without costs of operation of deep deposit after its closure. Costs of deep deposit operation are incalculable, eternal debt. Considered interest rates 3 - 4%
V2 J. Bohunice	NPP	1 620			28 years, 75%	
JE Mochovce 1,2	NPP	1 620			5 years, 14%	

Table 15 Management of decommissioning funds in Slovakia

Short name of nuclear facility	Kind of facility	Provisions accumulated by 31-12-2004 [Mio. Euro]	... of which has been accumulated within the own assets of the operator of the facility or its mother company [Mio. Euro]	... of which has been accumulated by the operator of the facility or its mother company within a separated account / segregated fund [Mio. Euro]	... of which has been accumulated in an external fund under public control [Mio. Euro]	... of which has been accumulated in an external fund under mixed private-public control [Mio. Euro]	Share of funds the operator of the facility can access for other activities until the funds are needed for their original decommissioning purpose [%]	Remarks
A1 J. Bohunice	NPP	324+	?	?	?	?	?	+ Only accumulated value is known. ? Till now data is confidential
V1 J. Bohunice	NPP		?	?		?		
V2 J. Bohunice	NPP		?	?		?		
JE Mochovce 1,2	NPP		?	?		?		



Table 16 Investment of decommissioning funds until they are used for their original purpose in Slovakia

Short name of nuclear facility	Kind of facility	Provisions accumulated by 31-12-2004 [Mio. Euro]	... of which have been invested in secure state bonds [Mio. Euro]	... of which have been invested in other assets with fixed interest rates [Mio. Euro]	... of which have been lent to associated or joined companies or to third parties [Mio. Euro]	... of which have been invested in other means (shares, mergers & acquisitions, etc.) [Mio. Euro]	Interest on invested financial means from decommissioning funds in 2004 [%]	Interest on invested financial means from decommissioning funds in period 2000-2004 [%]	Remarks
Nuclear power plant	NPP	324+	?	?	?	?	?	?	+ only accumulated value is known ? – data is confidential -

Overall costs of decommissioning of NPPs V2 and Mochovce 1,2 have been defined by the cost estimates of the Slovak Energy company Bratislava for decommissioning of the NPP V1 J. Bohunice, with the 2005 price level.

## 4 Transparency

### 4.1 Transparency of decommissioning strategies towards the public

There is no transparency of the decommissioning strategies for the public made ahead. The public may get information on the strategies only during the EIA process („Environmental Impacts Assessment“, i.e. process of assessment of the decommissioning impacts on the environment.) This process starts immediately prior to the shut down of the NPP's operation. However, the public can take part actively in the process only as an NGO /civil association registered at the Ministry of Internal Affairs. Also the affected municipalities can take part actively. The following information is available on the NPPs decommissioning during the EIA process:

- Characteristics of the activity.
- Place of the activities' implementation.
- Brief description of technological solution.
- Substantiation of the activity's need.
- Overall costs.
- List of the affected municipalities.
- Name of the affected body.
- Name of the authority giving permission.
- Impacts of the intention exceeding the state borderlines.

Only the person who is knowing of the matter and has the access to Internet can learn about this process. The EIA process is announced by no other public-service means but Internet. However, from this process the public cannot learn anything about the payments to the fund or about the fund management.

### 4.2 The degree of transparency of guarantee and financing for decommissioning towards the public

There is no degree of transparency of guarantee for decommissioning towards the public. Any information on the guarantee for the NPPs decommissioning is confidential. Confidential is also information on financing of the decommissioning, on the funds and on the management of funds designed for decommissioning of NPPs.

The situation will not change even after the law coming in force on the national nuclear fund, with effect from July 1, 2006, as it bears no regulations defined for transparency in financing and guarantee for the NPP's decommissioning. Such an approach of the Slovak Government is a leftover from the former socialist system that kept strictly in secret any information on the nuclear power as a strategical branch, mainly due to

orientation of Slovak nuclear power to Soviet Union, where such information was also classified.

There are reports (though probably not regular) from the A1 NPP operator on the progression of works on bringing the NPP into its radiation-safe conditions. However, there are no reports available neither on financing of those works, nor overviews on what kind of work were the money was spent for.

For the Government, there are probably only summaries for some period of time reporting on the amount of financial means spent for works on bringing the A1 NPP J. Bohunice into the radiation-safe conditions.

No information on financing any decommissioning activities, neither on activities related with the bringing the A1 NPP J. Bohunice into radiation-safe conditions, are not accessible to the public, and are confidential. They form even part of the state secret.

The manager of the Fund is not obliged to provide any information to the public, and will not do so in the future, as the informativeness and transparency of financing of the nuclear facilities decommissioning is not defined in the newly adopted law on the national nuclear fund.

The public has, by law, no possibility to participate in the decommissioning process. All activities connected with the nuclear facilities' decommissioning including decommissioning activities, are carried out without the presence of the public.

So the public is excluded from the decision-making process on the decommissioning, apart from the EIA process, when the public is positioned in fact accompli, and their comments have no weight in this process. Finally it is the Ministry of Environment, which will eventually decide on the EIA process by its view that in almost all cases ignores the views and opinions of NGOs, municipalities and affected individuals, e.g. the properties owners.

## 5 Stakeholder analysis

The main stakeholders are:

- a) The stakeholders having pushed the newly passed law on the National nuclear fund included the Government of the Slovak Republic represented by the Ministry of Economy, and indirectly the ENEL company and the Slovak Energy joint-stock company, Bratislava.
- b) The stakeholders having tried to change the proposals for the new law already during the legislation process included the anti-nuclear NGOs in the Slovak Republic (CEPA – Center for the Support of Local Activism, GREENPEACE, Za Matku Zem – For Mother Earth, Energy 2000, Energy of the Third Millennium and others.) These NGOs have been active also to push the change of the law even after the law being passed.
- c) By adoption of the new law on the National nuclear fund, the Government met the requirements of the ENEL company to guarantee the maximum amount of payments to the National nuclear fund. The guarantee of the maximum payments to the National nuclear fund from the NPPs operators directly in the law will result in further increase of deficit of the Fund. This deficit will have to be paid from the state budget. The ENEL company, Slovak Energy joint-stock company and most of the Slovak Parliament deputies are satisfied with this law. The anti-nuclear NGOs, however, do not agree with certain regulations / articles of the National nuclear fund law, and they expressed their disagreement with the newly passed National nuclear fund law not only through the Slovak media, but also by written opinions addressed to the Prime Minister and to the Minister of Economy of the Slovak Republic.
- d) The Government and the Parliament of the Slovak Republic, and the nuclear industry think that the legislation of the Slovak Republic in field of the NPPs decommissioning is harmonized on the EU level. The NGOs however, agree with this opinion only partially, as the low payments to the National nuclear fund by the NPPs operators will cause deepening of deficit in the National Nuclear fund. Therefore, they are active to push the amendments of the law so that the payments made by the NPPs operators to the National nuclear fund to be increased to such an extent that they cover fully the decommissioning costs of all NPPs in the Slovak Republic.

## 6 Conclusions and recommendations

The most important problem of the nuclear power financing in Slovakia as a whole is the fact that there are no EC obligatory regulations that would be obliged for all EC countries, for all stages of decommissioning. Therefore, each EC country defines its own rules of financing decommissioning, and in Slovakia, these rules were heavily influenced by the nuclear industry.

It is specific for Slovakia that following the NPP V1 J. Bohunice shut down, only two NPPs will be in operation after 2008. These – with the currently defined payments from operators according to the newly adopted law on the National Nuclear Fund – will not be able even to cover their back part, including deposit of the spent nuclear fuel that they will be produced during their operation period. There are absolutely no financial means that would have been paid to the fund from the electricity generation in the A1 NPP J. Bohunice. Already today, the fund is in high deficit compared to the decommissioning costs expected for A-1 and V1, and the deficit will be increasing for the future, as the law defined the contributions from the NPPs operators to be comparably low.

The biggest shortcoming of the existing law is that the payments by the NPPs' operators were set too low so that they will cover only about 20 – 30 % of the costs of the back part of nuclear power during their operational period. Moreover, the existing means have to be reallocated to the sub-accounts formed within the new funds so that they correspond with the amount of electricity generated in nuclear facilities during 1978 – 2005. This means that Mochovce 1, 2 NPP will financially rehabilitate deficit at other NPPs – V1 and V2 j. Bohunice. This is a kind of cross-subsidy inside the Fund.

Therefore we propose :

At the national level :

1.) To amend the law on national nuclear fund so that :

- the payments by NPPs operators would be increased to such level that these during the operational period could, at their sub-accounts, accumulate as much financial means so they could cover all costs of their decommissioning, and financial means for their decommissioning could not be rehabilitated from the state budget.
- The highest level of transparency of decommissioning strategies, responsibility for guarantee for decommissioning activities and financing of decommissioning would be defined by law,
- The cross-subsidies at the fund's sub-accounts would be eliminated,
- The fund's manager would be designed the duty to elaborate and once a year to submit report on the fund management that would include:
  - a) all incomes of the fund,
  - b) all expenditures of the fund

- c) list of selective procedures /tenders/ and their results,
- d) balance sheet in full extent, state of all sub-accounts for profit and loss, summarized cash flow statement,
- duty would be set to inform the public on decommissioning strategies and their risks,
- independent institution would be set-up for public control of the fund's management.

2.) We propose that the following principles – concerning informativeness of the public during the NPPs decommissioning process and during the deep deposit construction – to be included in the relevant legislation of the Slovak Republic:

- Principle of survey of the public opinion before implementation of the intention.
- Early involvement of the public in the decision-making process.
- Include the public opinions into the resolutions / decisions.
- Open process of adoption of resolutions.
- Assessment of various alternatives prior to adopting the resolutions.
- Principle of accessibility of all information by form, which is acceptable for all target groups of inhabitants.
- Give the local communities the real task in the decision-making process, including setting-up of liaison/contact committees and the right for refusal of the location.
- Set up an institute for independent assessment, monitoring all activities related with the decommissioning process, including the back fuel cycle.

3.) At the EC level, to adopt legal regulations that would comprise :

- compulsory for all EC countries, precise principles of calculation of estimates for back part of nuclear power, separately for nuclear facilities dismantling, decontamination and demolition, and separately for the back fuel cycle.
- compulsory for all EC countries, principles of set-up of the fund for nuclear power-generating facilities decommissioning, as quoted in item 1.)
- principles of transparency of decommissioning process towards the public, as quoted in item 2.).

## 7 References

Polonec, L. et al. (2005): Skutocné náklady jadrovej energetiky na Slovensku, report of Energia 2000, Bratislava.