

Annual Report 2003



Developments and activities in 2003

Organisation of Nagra

Year-end closure—annual accounts for 2003



Impressum

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**Cover picture: Around 70 people
are currently employed by Nagra.**

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Nagra

Hans Issler.

“As an established national competence centre and an internationally recognised partner in the field of nuclear waste management, our aims are:

- **to construct safe deep repositories for all categories of radioactive waste arising in Switzerland, without delay and at reasonable cost;**
- **to promote international collaboration in the area of research and development.”**

Foreword

The year 2003 saw the clarification of the legal boundary conditions that will apply to Nagra's work in the future. In March, the two chambers of the Swiss Parliament – the National Council and the Council of States – passed the new Nuclear Energy Law. The Law calls for monitored deep geological disposal for all categories of radioactive waste, defines responsibilities in the area of nuclear waste management and regulates licensing procedures. A new requirement is that the organisations responsible for waste management (the waste producers) have to submit a waste management programme outlining repository implementation to the Federal Council for review and approval.

Responsibility towards man and the environment demands that radioactive waste that already exists should be disposed of in a safe and timely manner. For this reason, the waste producers aim to implement geological disposal efficiently and without undue delay. Once siting issues have been clarified, applications for a general licence, as specified in the new Nuclear Energy Law, will be submitted to the Federal Council.

The “Entsorgungsnachweis” (demonstration of disposal feasibility) for high-level waste, submitted to the government at the end of 2002, is currently being reviewed by the federal authorities. During 2003, experts from the OECD/NEA also carried out a review of the Entsorgungsnachweis safety analysis. The report of these nine experts will be published in spring 2004.

Once again, we can look back on a busy year. Besides the efforts associated with the high-level waste project, GNW

(Cooperative for Radioactive Waste Disposal, Wellenberg) was finally dissolved and responsibility for work on the low- and intermediate-level waste programme returned to Nagra. The Grimsel Test Site is approaching 20 years of international collaborative experiments and activities there will continue as part of a new research phase. Nagra continues to be a partner in the international research project in the Opalinus Clay of Mont Terri (Canton Jura). The year also saw continued involvement of Nagra in the projects forming part of the new European Union research programme (Framework Programme).

The challenges to be faced in the coming years will include transparent presentation of technical results and projects, as well as supporting the political process leading to site selection. In addition to technical and safety aspects, the socio-economic impact of a repository on a siting region will continue to gain significance. Studies commissioned in April 2004 by the Federal Office of Energy and the Opalinus Working Group (consisting of representatives from the local communities of Benken, Marthalen and Trüllikon in the Zürcher Weinland) will provide an important decision-basis in this respect.

I would like to take this opportunity of thanking all those involved in our projects, and in particular the employees of Nagra, for their great efforts and high standard of work over the last year.

Hans Issler
President

Our mandate

Radioactive wastes have been arising in Switzerland for decades, from the operation (and future decommissioning) of the five nuclear power plants and from the use of radioactive materials in various areas of medicine, industry and research (MIR waste).

In terms of the Atomic Act of 1959, the waste producers are responsible – under the supervision of the federal authorities – for the permanent, safe management and disposal of all categories of radioactive waste. With a view to fulfilling this responsibility, the operators of the nuclear power plants and the Federal Government (responsible for MIR waste) set up Nagra in 1972.

Nuclear waste management strategy in Switzerland assumes deep geological disposal for all categories of waste. Currently, two types of repository are planned: one for low- and intermediate-level waste (L/ILW) and one for spent fuel, high-level and long-lived intermediate-level waste (SF/HLW/ILW).

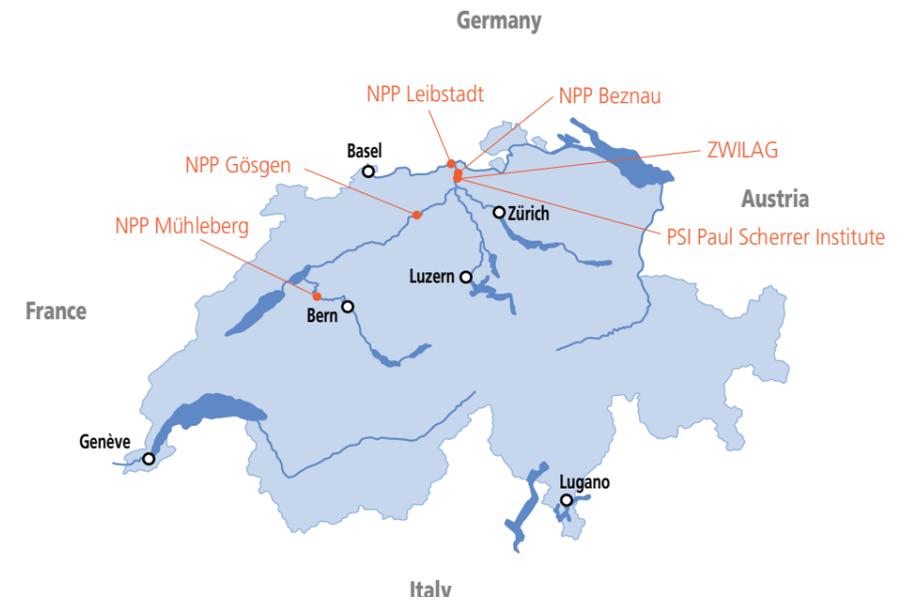
Nagra's task is to provide the scientific and technical basis for realising safe, long-term management of radioactive wastes. In particular, this involves making proposals regarding the waste management concept, assessing the suitability of potential repository sites and ensuring ongoing inventorying and conditioning of wastes into a form suitable for disposal. In order to meet these responsibilities, Nagra has been pursuing a broadly based research programme since the mid-seventies. The work is carried out in close collaboration with the Paul Scherrer Institute (PSI) in Würenlingen and various universities and scientific institutions, both in Switzerland and abroad.

Our work

- Waste characterisation and continuous updating of the radioactive waste inventory as a basis for planning disposal projects; checking waste specifications as part of official waste clearance procedures and as a service to the Members of the Nagra Cooperative.
- Acquisition of the field data required for site selection, safety assessment and disposal projects.
- Project studies that provide input for designing repository installations and engineered barriers, and for planning operating procedures.
- Ongoing analysis of information and data within the context of performance assessment and evaluation of this information with a view to licensing procedure requirements.
- Development of databases and fine-tuning of the methods used for analysing disposal system behaviour; verification and validation of the data and models used in performance assessment.
- Active participation in international collaborative projects with a view to coordinating and optimising planning and development efforts.
- Meeting responsibilities in terms of communication and information.
- Providing expert services to third parties.



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Developments in 2003

Energy policy, legislation, authorities

Legal framework

Following detailed deliberations, Parliament finally passed the Nuclear Energy Law (KEG) in its March 2003 session; the period for calling for a referendum on the new Law expired, without being made use of, in September of the same year. The extensive work involved in preparing the body of ordinances that will support the new legislation has already been initiated and it is foreseen that the Law will enter into force at the beginning of 2005. The new Law defines responsibilities in the area of nuclear waste management, calls for monitored deep geological disposal for all wastes and concentrates the licensing procedure at a federal level. One new aspect is that the general licence for a repository will be subject to an optional referendum. The Federal Government also has increased responsibility, in that it has to evaluate and approve a waste management programme prepared and submitted by the waste producers.

As part of a response to a series of parliamentary questions, the Federal Government also took a clear position on future procedure to be followed in the waste management programme.

At the beginning of May, the Federal Department of the Environment, Transport, Energy and Communications (DETEC) published the first Swiss report within the framework of the joint convention of the International Atomic Energy Agency (IAEA) on radioactive waste management (Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management). DETEC came to the conclusion that, in practice, Switzerland is meeting the terms of the convention.

In a nationwide referendum held on 18th May, the Swiss people clearly rejected two anti-nuclear initiatives: "Strom ohne Atom" (energy without nuclear) and "Moratorium Plus" (further moratorium on the construction of new nuclear power plants).

The Federal Government also decided to dissolve the Expert Group on Disposal Concepts for Radioactive Waste (EKRA). Against the background of activities surrounding the new Nuclear Energy Law, the Group published reports in 2000 and 2002 on waste management concepts and strategies.

Waste management and decommissioning funds

The two funds were established to cover the costs of managing radioactive waste and spent fuel and the decommissioning of the nuclear power plants at the end of their operating lifetime. Accumulation of funds, from contributions made by the nuclear power plant operators, is proceeding according to plan. At the end of 2003, the accumulated capital was 1771 million CHF (waste management fund) and 971 million CHF (decommissioning fund).

Radioactive materials

Final work on the Opalinus Clay Project

The reference report for the Opalinus Clay Project, NTB 01-01 (Model Radioactive Waste Inventory for Reprocessing Waste and Spent Fuel), has now been finalised and published. This key report provides an overview of the model inventories for spent fuel, long-lived intermediate-level waste and high-level waste, including all the parameters required for planning facilities and operations and for the safety analysis of the deep geological repository.

Services and contract work

The centralised inventory of waste produced to date continued to be maintained as a key service to the waste producers; the inventory currently includes around 21,000 waste packages. In particular, the methods used for calculating activated reactor components were developed further. The correlation factors for other wastes were updated on the basis of radiological measurements carried out by the TÜV in Germany. Data obtained from checking of waste products at the Paul Scherrer Institute (PSI) were also integrated.

The centralised inventory of existing wastes forms the basis for the "Model Inventory of Radioactive Materials" (MIRAM), of which a complete revision has been initiated. This model inventory of existing and future waste arisings forms the basis for planning the management strategy for L/ILW, ILW and HLW. By the end of 2003, data processing for the new module had been largely completed and information on the operational and decommissioning wastes for the nuclear power plants had been updated.

Contract work included preparing waste specifications for PSI and ZWILAG. Several projects were initiated with the CERN research centre with a view to management of the wastes arising there. A version of the "Information System for Radioactive Materials" (ISRAM), adapted to meet the particular needs of CERN, was completed and will be installed in 2004. Various waste certification procedures (ELFB) were also carried out. Activities performed as part of various working groups included compilation of an IAEA databank with world-wide waste data and preparation of a system for classifying Swiss radioactive wastes.

Wellenberg in Canton Nidwalden (centre of photograph) was proposed by Nagra as a site for a deep geological repository for low- and intermediate-level waste. The site had to be abandoned for political reasons.



Comet



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During 2003, the measurement systems were removed from the exploratory boreholes at Wellenberg and the boreholes were then filled with cement. The picture above shows the site of borehole SB4 – immediately to the right of the road – after re-cultivation.

Low- and intermediate-level waste (L/ILW)

Wellenberg abandoned for political reasons

Following the decision of the voters of Canton Nidwalden in autumn 2002 to refuse a concession for an exploratory drift at Wellenberg, the site has now been abandoned for political reasons. The Wellenberg foundation was dissolved in a decision of 24th October 2003. At an extraordinary general meeting held on 31st July 2003, the decision was made to dissolve the Cooperative for Radioactive Waste Disposal, Wellenberg (GNW); publication of the decision in the Swiss trade magazine followed on 22nd August 2003 and the entry for GNW in the companies register was duly deleted.

With the dissolution of GNW, responsibility for management of L/ILW returns to Nagra. What remains clear is that the programme for disposal of this category of waste should proceed as rapidly as possible. Switzer-

land presently has sufficient interim storage capacity for safe storage of all radioactive waste but, compared to other countries, is somewhat behind in terms of implementing deep disposal of L/ILW.

Termination of long-term monitoring and filling of boreholes

In autumn 2002, the long-term monitoring of springs and deep groundwaters at Wellenberg was brought to a close. Removal of the measurement systems from the six exploratory boreholes began in spring 2003 and the boreholes were then filled with special cement. This work was supervised by HSK and the responsible cantonal authorities. The drill-sites were re-cultivated before the end of the year and returned to their owners. The final reports will be submitted to the authorities by the middle of 2004.

New programme for all categories of radioactive waste

Preparation of a waste management programme

The new Nuclear Energy Law now obliges the waste producers to submit a waste management programme for all waste categories to the Federal Council for approval. The programme has to cover general procedure, milestones in the timetable and the individual steps to be taken on the way to solving this important national issue. The Federal Council and Parliament have created the legal boundary conditions that will make realisation of the necessary facilities possible in practice. The sound technical-scientific knowledge base that already exists ensures that the technical challenges of the programme can be met. At the request of the utilities, Nagra began in 2003 with preparatory work on various technical aspects and the scientific background for the programme.

Framework to be provided by the Federal Government

Nagra does not, however, control the time plan for submitting a waste management programme, in the sense that future procedure has to be specified by the authorities. According to a statement by the Federal Council, as soon as the legal boundary conditions have been defined in the Nuclear Energy Law, the waste management strategy, existing structures and current allocation of waste management responsibilities will be reviewed, as will the involvement of politicians and the public in the implementation process.

Until the Federal Government has laid down these boundary conditions, Nagra's work on the L/ILW programme will focus on technical aspects (background, criteria, technical aspects of a criteria-related site selection procedure).



A view of part of the Zürcher Weinland, looking towards the south. A layer of Opalinus Clay lies at a depth of 600 to 900 metres below the valley floor. The suitability of this formation as a host rock for a high-level waste repository has been investigated as part of the Opalinus Clay Project.

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The Federal Office of Energy (BFE) and the Office for Waste, Water, Energy and Air (AWEL) of Canton Zürich hosted a public information event on high-level waste disposal in Trüllikon (Zürcher Weinland) on 25th October 2003. On this occasion, Nagra was invited to present the results of its research.



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Spent fuel (SF), high-level waste (HLW) and long-lived intermediate-level waste (ILW)

Entsorgungsnachweis

At the end of 2002, Nagra submitted the Entsorgungsnachweis (demonstration of disposal feasibility based on Opalinus Clay) for SF/HLW/ILW to the Federal Council for review. In the project reports, Nagra comes to the conclusion that safe disposal of these wastes in a deep geological repository in the Opalinus Clay of the Zürcher Weinland region is feasible. Based on the results of the Opalinus Clay Project and the systematic site selection procedure followed, Nagra has requested the Federal Council

- to acknowledge that the conditions laid down by the Federal Council in its evaluation of Project Gewähr 1985 of 3rd June 1988 have been fulfilled and that the feasibility of disposal has been successfully demonstrated
- to agree to the focusing of future investigations associated with disposal of SF/HLW/ILW in Switzerland on the Opalinus Clay in the potential siting region in the Zürcher Weinland.

The results of the Entsorgungsnachweis are documented in three Nagra Technical Reports: NTB 02-02 on facilities and operation, NTB 02-03 on geology and NTB 02-05 on performance assessment. These reports are now available directly on the internet (www.nagra.ch).

A series of supporting reference reports provides extensive geological, geophysical, hydrogeological, rock mechanical, engineering and safety data, analyses and models. All these reports were available by the middle of 2003.

Review of the Entsorgungsnachweis documentation by the authorities

Submission of the Entsorgungsnachweis project and the publication of the associated reports triggered a strong reaction on the part of the press, radio and television, on both the Swiss and German sides of the river Rhine. Besides the usual critical comments, the high level of understanding of the potential host rock in the Zürcher Weinland and of its suitability for accommodating a deep geological repository was also acknowledged.

According to the federal authorities, the detailed technical review of the Opalinus Clay Project documentation will take around two years. Once this review is complete, it is planned – presumably in 2005 – to present the project documentation together with the reviews and comments of HSK, KSA and AGNEB to the general public. This should ensure transparency and provide the Cantons, local communities and interested parties with an opportunity to express their views on

the project and the future procedure to be followed. The Federal Council is expected to reach a decision on future procedure in 2006.

Transparency and dialogue

With regard to the review of the Entsorgungsnachweis project, the Federal Office of Energy (BFE) attaches great importance to providing timely and comprehensive information, particularly to the Cantons of Zürich, Aargau, Thurgau and Schaffhausen and to the neighbouring State of Baden-Württemberg in Germany. In order to ensure that the German and Swiss authorities are involved in the process, the BFE set up an Information and Communication Working Group and a Technical Forum in 2003.

The Working Group, under the leadership of the BFE, coordinates information and communication activities associated with the Entsorgungsnachweis and ensures early information of the politically interested Swiss and German authorities. The Group

was responsible for initiating and organising the information events held for regional and local authorities on both sides of the Rhine (in Marthalen on 6th June 2003) and for the public (in Trüllikon on 25th October 2003).

The Technical Forum under HSK (see www.technischesforum.ch) answers questions from the public through the Swiss authorities.

For the promised committee of government representatives, the mandate and composition were still under discussion at the end of the year.

Discussion partner for the public

In February 2003, the three local communities of Benken, Marthalen and Trüllikon joined forces with the "Planning Group Zürcher Weinland" to form the "Forum Opalinus Clay". The Forum is intended to represent the interests of the region and to serve as a contact-point for questions from the public. The Forum has announced its intention to commis-



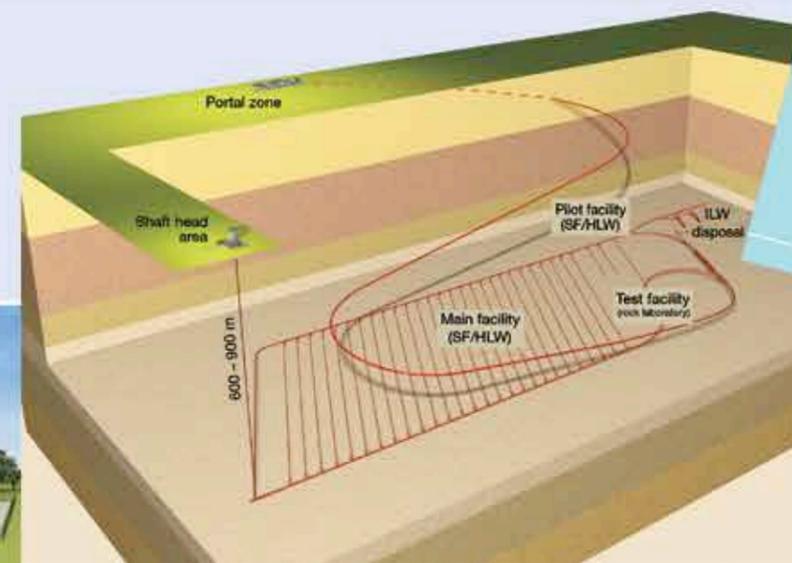
Components of a geological repository for spent fuel (SF), high-level waste (HLW) and long-lived intermediate-level waste (ILW), presented in model form.

Shaft head area

- 1 Shaft head frame with exhaust air vents
- 2 Construction office, recreation areas, work-shop, transformer installations etc.
- 3 Excavated material depot
- 4 Equipment/materials hall

Portal zone

- 1 Administration building
- 2 Operations centre
- 3 Ventilation building
- 4 Equipment transition area
- 5 Conditioning and packaging plant for SF/HLW
- 6 Rail access
- 7 Road access
- 8 Access tunnel, ramp (sub-surface)



The three main reports of the Entsorgungsnachweis (Opalinus Clay Project).

sion a study on the socio-economic impact of a repository on the Weinland.

Review of safety by international experts

The Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD) was requested by the Swiss safety authorities to appoint an international team of experts to carry out a review of the Entsorgungsnachweis safety assessment. The NEA asked nine experts from different countries to carry out this work. During the course of the review, Nagra provided answers to around 400 questions from the experts. The task was completed with a one-week workshop in November, which was also attended by representatives of HSK, KSA and KNE. The final report will be published in English and German in spring 2004 and will be made available to the public.

Uncertainty generated by the defective study by the Oekoinstitut

At the request of the local anti-nuclear associations Bedenken and IGEL (which have joined together in the meantime to form "KLAR! Switzerland"), the Oekoinstitut Darmstadt e. V. (Germany) carried out a study on the Entsorgungsnachweis and presented its results in February 2003. Although the study came to the conclusion that there were no apparent reasons to consider the Zürcher Weinland as being unsuitable as a potential disposal area, a series of serious errors in the study led to accusations being raised against Nagra; this in turn resulted in strong media attention and considerable uncertainty on the part of the public. The true facts were subsequently established by the Swiss safety authorities (HSK), commissions (KNE) and their experts. During two discussion sessions with the report authors organised by HSK, the technical errors in the study were

highlighted and publicised in a series of press releases. The accusations against Nagra proved to be groundless. As a result, the Oekoinstitut initially planned to rework its study but, in view of the clarity of the situation, finally withdrew it completely in January 2004.

Further options

Nagra's work to date has allowed reserve siting areas to be identified for the priority host rock option Opalinus Clay and for the reserve option Lower Freshwater Molasse. The possibilities for disposal in the crystalline basement were documented in 1994 and the evaluation of this work by HSK will soon be completed.

Response of German experts to the selection of the Zürcher Weinland

The potential siting area in the Zürcher Weinland lies close to the border with Germany. An independent evaluation of the selection of the Zürcher Weinland by German experts was thus commissioned by German communities in the area. The German-Swiss Commission for the Safety of Nuclear Installations (DSK) entrusted this review to AkEnd (German working group on repository site selection procedures). In its report published in March 2003, the group came to the conclusion that, considered overall, the Swiss selection procedure met with international requirements placed on such procedures. The selection of the Zürcher Weinland as the preferred option for a HLW/ILW repository based on considerations of safety was considered to be justified. The accusation that the proximity of the Weinland to the German border was a driving force behind the selection was rejected.



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Nagra works closely with the Paul Scherrer Institute, in particular with the Waste Management Laboratory.

As part of the FEBEX experiment being carried out in a tunnel at the Grimsel Test Site, the safety barrier system for a geological repository for high-level waste is being investigated. After six years, the system was partly excavated and more than 1000 material samples were collected. The samples are being analysed in the laboratories of the 23 partners in the FEBEX project. The photograph shows the bentonite blocks used as a tunnel backfill.



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Technical background

The focus in 2003 was on investigations specifically for the HLW programme. Most of the work described was carried out together with the Waste Management Laboratory (LES) at PSI, with Nagra bearing 50 percent of the research costs. Some of the projects are also carried out as part of the European Union's Fifth Framework Research Programme. A series of reference reports prepared by PSI as part of the Entsorgungsnachweis project was also completed. The long-standing collaboration with PSI again delivered valuable results in 2003 and thanks are extended to those involved in the research for their important contributions.

Modelling radionuclide transport

As part of studies extending beyond the scope of the Entsorgungsnachweis, data from various diffusion experiments on Opalinus Clay were analysed and values derived for diffusion constants and sorption. The values used for the Entsorgungsnachweis safety analysis were also confirmed. For some tracers, a more detailed evaluation of the data indicated two different transport-relevant

porosities. Modelling studies were therefore initiated to investigate the influence of a possible heterogeneity of clay on the mm-scale on the diffusive transport of radionuclides.

A computer program developed at PSI was used to model diffusion through cement in the initial degradation phase. The evolution with time of the cement as a sorbing solid phase and of its porewater chemistry and sorption kinetics were taken into account. The results confirmed earlier results obtained using a simple model.

Laboratory studies, geochemical models and datasets

During the course of 2003, the key geochemical background reports for the Entsorgungsnachweis safety assessment were published (sorption and solubility values in cement, bentonite and Opalinus Clay). The NEA "Thermochemical Database" project continued, with the involvement of PSI.

Measurements of radionuclide sorption onto clay minerals continued. This work was again complemented

by X-ray absorption spectroscopy (XAS) measurements, which allow detailed information to be obtained on the immediate surroundings of the nuclide under investigation. This makes an important contribution to understanding sorption mechanisms. Modelling of radionuclide sorption in clays and bentonite is a focus of work at PSI and further participation in an NEA project on this topic is foreseen. Sorption measurements on cement and cement minerals and co-precipitation experiments are also being carried out. This work contributes to further developing the understanding of the retention properties of cement barriers for radionuclides in the context of the geological disposal of ILW and L/ILW.

Experiments on the degradation of cellulose (contained mainly in L/ILW) in a cementitious environment are being conducted, with financial contributions from Nirex (UK) and SKB (Sweden). The experiments look at the extent to which degradation products can increase the mobility of radionuclides in such an environment.

Engineered barriers

Practically all the work on the engineered barriers has been carried out as part of EU projects extending over several years and has related to the following: engineered barriers in the Opalinus Clay (EU project EB, see Table on page 20) and in granite (FEBEX), bentonite (BENIPA), gas release (GASNET), long-term behaviour of spent fuel (SFS) and vitrified high-level waste (GLASTAB) and the effects of highly alkaline waters from cementitious repositories (high-pH plume) on clay barriers (ECOCLAY).

Analogue studies

The focus of the analogue studies was again on the Maqarin project in Jordan. Besides Nagra, Andra (France), Nirex (UK), SKB (Sweden) and JNC (Japan) are involved in this study. The project is looking at the influence of naturally occurring highly alkaline waters on fractured clayey limestones, as an analogue for the effects of cement porewaters on the host rock surrounding a L/ILW or ILW repository. Compared with short-term laboratory experiments, the processes being studied at Maqarin have been occurring over thousands of

years. Field work continued in 2003, with a view to obtaining more samples. The analyses are now complete and the results will be documented in a final technical report which will be published in 2004.



In its rock laboratory in the Grimsel region, Nagra is working with a number of Swiss and foreign partner organisations. The experiments in the laboratory are focused on the behaviour of the engineered safety barriers and the transport of radionuclides in rock.



Nagra is involved in many of the experiments being carried out in the Mont Terri Rock Laboratory in Canton Jura. Here, important information is being obtained on the Opalinus Clay formation, which is being considered as a host rock for a high-level waste repository (see page 10).

Rock laboratories

Grimsel Test Site (GTS)

Nagra has been operating an underground rock laboratory in the crystalline rock of the Grimsel region since 1984. Seventeen partner organisations from ten different countries are now participating in the research programme at the GTS. Also involved in the programme are numerous universities and research institutes from Switzerland and abroad, the European Union and the Swiss Federal Office for Education and Science (BBW). The duration of the projects is now five to seven years and laboratory studies and modelling form an important component of each programme. However, shorter-duration experiments are also carried out at the GTS, for example testing of new methods, tools and equipment.

Phase V projects (1997–2003)

Almost all the experiments in Phase V (see Table) were completed in 2003. Documentation in the form of Nagra Technical Reports (NTBs) ensures that the results are accessible to all interested parties. At the meeting of the International Steering Committee (ISCO) in spring, results were presented to technical representatives of

Phase V projects at the Grimsel Test Site

CRR	Retardation of colloids and radionuclides
CTN	Synthesis of results for the tunnel near-field
EFP	Effective parameters
FEBEX	1:1 demonstration of the emplacement concept for high-level waste
FOM	Use of fibre-optic systems
GAM	Gas migration in shear zones
GMT	Gas migration through engineered barriers and surrounding rock
HPF	High-pH plume in fractured rock

Phase VI projects

CFM	Formation and transport of colloids with radionuclides under realistic conditions
FEBEX	1:1 demonstration of the emplacement concept for high-level waste
GMT	Gas migration through engineered barriers and surrounding rock
GTT	Testing of new seismic sources
LCS	Long-term interactions between cement (solutions) and porewaters and rock
LTD	Long-term diffusion of radionuclides
NF-PRO	1:1 demonstration of the disposal concept for high-level waste (continuation of FEBEX project)
PSG	Determination of pore space geometry in the matrix
RH	Demonstration and testing of concepts for emplacement of SF/HLW under realistic conditions (remote handling)

organisations from Switzerland and abroad and the work programme for completion of Phase V was approved.

Phase VI (2003–2013)

Following a decision by Nagra to continue with experiments at the GTS until at least 2013, it became possible to plan a series of new projects. Representatives from seventeen organisations attended the planning meet-

ing. The focus will be on long-term experiments aimed at demonstrating the emplacement of radioactive waste. These experiments – which will be carried out on a 1:1 scale – are concerned mainly with the practical implementation of emplacement concepts under conditions similar to those in a repository. The FEBEX and GMT projects will continue to address technical questions relating to the long-term evolution of the engineered barrier system. A further focal point will be in situ experiments on the transport of radionuclides. Building on more than 15 years of experience with such studies, three new projects are currently being planned for the GTS (CFM, LTD and LCS, see Table). All these projects have in common that the boundary conditions for the experiments are as close as possible to the situation in a deep geological repository, allowing results to be obtained that are relevant for the later safety assessment of the disposal facility.

An overview of the investigations at the Grimsel Test Site, including a compilation of key documentation published in recent years, can be found at www.grimsel.com.

Mont Terri Rock Laboratory (FMT)

Underground exploration of the Opalinus Clay has been ongoing for around eight years as part of the international Mont Terri research project (St-Ursanne, Canton Jura). The work is carried out in a tunnel running parallel to the security gallery of the Mont Terri motorway tunnel. Since the middle of 2001, the project has been managed by the Federal Office for Water and Geology (FOWG); the FOWG also has responsibility for operation of the Rock Laboratory. Twelve organisations from six different countries are presently involved in the research activities at the FMT.

For Nagra, which is involved in a number of experiments in the Laboratory, the FMT represents an important source of data for deepening its understanding of the Opalinus Clay. Experiments in which Nagra is involved include long-term diffusion experiments, analysis and modelling of rock samples from drillcores, a large-scale engineered barrier experiment (led by the EU), an experiment investigating the effects of heat on the engineered barriers and the

host rock, a ventilation test, hydrogeological experiments on two-phase water and gas flow, geochemical modelling and rock mechanical studies on the long-term stability of underground structures.

In the first half of 2003, the work programme of Phase 8 was completed as planned. The projects planned for Phase 9 (July 2003 to June 2004) have been brought together in the form of a longer-term research programme and participation of the different partner organisations has been defined. Work on these experiments began from the middle of the year, after the necessary permits had been obtained. Planning of Phase 10 began before the close of the year. This involved determining the space requirements for future experiments and assessing the need and timing for a large-scale expansion of the laboratory facilities.

An overview of the experiments at the Rock Laboratory can be found at www.mont-terri.ch.



The Gas Migration Test (GMT) is being carried out at the Grimsel Test Site; lead organisation is the Radioactive Waste Management Funding and Research Center (RWMC) of Japan.



Comet

The data from the ongoing test phase can be accessed on-line by project partners world-wide.



Comet

Expert services

International services and projects

Nagra's 30 years of experience in the field of waste management has proved to be valuable for other national waste management programmes and for technical applications outside the nuclear area. Services are provided in the areas of strategic programme planning, specification of waste inventories, site selection and characterisation, development of disposal concepts, safety analysis and communication. The Grimsel Test Site serves as a focal point for international project studies (see page 16).

The majority of contract work in 2003 came again from Japan, with many projects being carried out together with Nagra's partner organisation Obayashi Corporation, or as part of bilateral collaboration agreements with Criepi, JNC, JNFL, Numo and RWMC (see page 43 for abbreviations).

The Japanese waste management programme is currently in a very active phase. Numo has openly approached all municipalities in Japan to ask if they are interested in volun-

teering as a potential host community for a HLW repository and is currently preparing for responses to their inquiries. Nagra is making an important contribution in the form of development of repository concepts for potential siting environments, use of multi-attribute analysis for site/design comparison and organisation of a series of international tectonics meetings.

For intermediate-level waste, JNFL is running the L1 project for an intermediate-depth geological disposal facility at the Rokkasho site. Construction of an access tunnel for the facility has already begun. Technical support for various aspects of repository implementation is being provided by the Nagra-Obayashi consortium.

Also important is the support provided to JNC for its rock laboratory programme, which foresees simultaneous development of two laboratories (Mizunami in crystalline rock and Horonobe in sediments). Other projects are also being carried out for JNC, including preparation of waste inventories and analogue studies in Maqarin and Tono. The focus in 2003 was on preparation for, and review of,

the second JNC report on disposal of long-lived intermediate-level waste (TRU).

Other projects included the production of information and synthesis reports on specific topics. Translation and editing services are being offered increasingly; in addition to German, English, French and Italian, technical translations into and from Japanese are also possible.

Contract work for Members of the Cooperative

After a period of almost three years, the PEGASOS seismic hazard study for the Swiss NPP sites is now nearing completion. In the final phase, the experts' models of sources, attenuation and site effects have been prepared in parameterised form for input to the hazard calculations. The complexity of the models and the large number of alternatives has led to an unanticipated large calculation effort which, despite modern software, has taken months to complete. Once the ongoing quality assurance controls and checks have been carried out, the results will be handed over to "swissnuclear". The final report will be

available as planned, by the middle of 2004. This will be followed by a review of the results and documentation by the safety authorities; this is expected to last several months, after which the report will be finalised and published.

Review of disposal costs

To secure the costs of waste management, financial reserves are paid into two funds (waste management and decommissioning) by the NPP operators. The payments are subject to Federal Government supervision. The amount of the payments is derived from the estimated waste management costs. The cost estimate was last reviewed in 2001 and, in 2003, HSK carried out a review of the 2001 estimate at the request of the cost committee of the waste management fund. The result was that some of the positions for deep disposal had to be looked at again by Nagra and some additions made. The revised cost estimate, with some small changes to other positions, was submitted by the power plant operators (swissnuclear) to the cost committee of the waste management fund for approval.

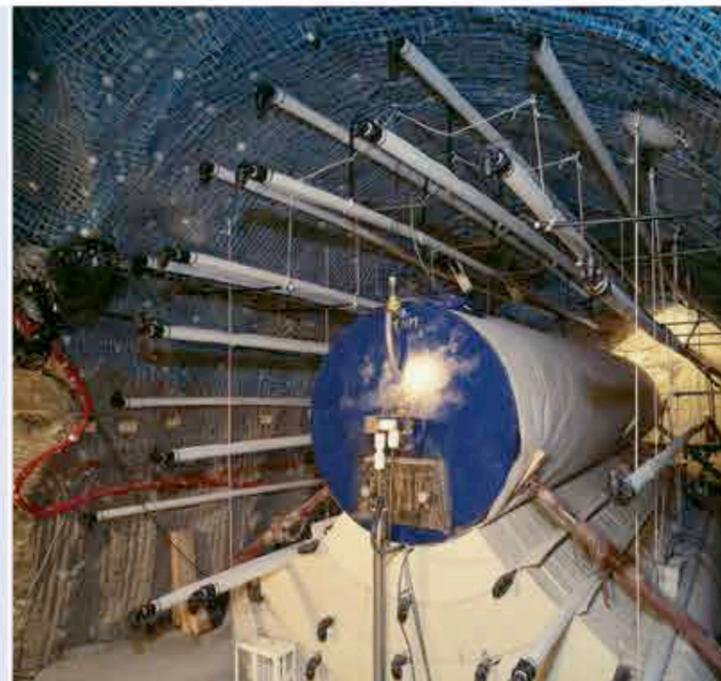
Nagra participation in European Union research projects

Fifth Framework

BENIPA	Bentonite Barriers in Integrated Performance Assessment
COMPAS	Comparison of Alternative Waste Management Strategies for Long-lived Radioactive Wastes
CROP	Cluster Repository Project – A Basis for Evaluating and Developing Concepts for Final Repositories for High-level Radioactive Waste
EB	Engineered Barrier Emplacement Experiment in Opalinus Clay
ECOCLAY-II	Effects of Cement on Clay Barrier Performance – Phase II
FEBEX-II	Full-scale Engineered Barrier Experiment in Crystalline Host Rock – Phase II
GASNET	Gas Issues in Performance Assessment of Deep Repositories for Nuclear Waste
GLASTAB	Long-term Behaviour of Glass: Improving the Glass Source Term and Substantiating the Basic Hypotheses
HE	Heater Experiment: Rock and Bentonite Thermo-hydro-mechanical (THM) Processes in the Near Field
MODEX-REP	Elaboration of Hydromechanical Coupled Models by Interpretation of the Disturbances Observed During the Sinking of the Main Shaft of an Underground Laboratory in Eastern France
NET.EXCEL	Network of Excellence in Nuclear Waste Management
RETROCK	Treatment of Geosphere Retention Phenomena in Safety Assessments
SELFRAC	Fractures and Self-healing Within the Excavation Disturbed Zone in Clays
SFS	Spent Fuel Stability under Repository Conditions
SPIN	Testing of Safety and Performance Indicators
TN on Monitoring	Thematic Network on the Role of Monitoring in a Phased Approach to Disposal
VE	Ventilation Experiment in Opalinus Clay

Sixth Framework

CETRAD	Co-ordinated Action on Education and Training in Radiation Protection and Radioactive Waste Management
ESDRED	Engineering Studies and Demonstrations of Repository Designs
NF-PRO	Understanding and Physical and Numerical Modelling of the Key Processes in the Near-field, and their Coupling, for Different Host Rocks and Repository Strategies
SAPIERR	Support Action: Pilot Initiative for European Regional Repositories (support role only)



A system of engineered safety barriers in Opalinus Clay is being investigated as part of the EB project at the Mont Terri Rock Laboratory. The project is part of the Fifth Framework Programme of the EU. The photograph on the left shows the test configuration during installation in 2002.



International collaboration

A regular exchange of information takes place as part of the different formal bilateral agreements between Nagra and its foreign partner organisations. Joint projects are also carried out with many partners; these are either multilateral (e.g. as part of rock laboratory projects) or conducted together with international organisations (particularly the NEA and EU).

In 2003, joint research work continued in the Grimsel and Mont Terri rock laboratories in Switzerland and in Äspö in Sweden. Nagra staff also continued to be involved in the activities at the Bure rock laboratory in France. Research efforts were also supported by a series of joint laboratory projects (e.g. the GAMBIT project on gas migration through bentonite) and model development studies. This includes the projects carried out under the auspices of NEA on sorption and the thermo-chemical databank. Participation in the EU Framework Programmes has evolved to become an important component of the research and development activities carried out by Nagra.

Beyond these diverse specific joint projects, Nagra continues to be represented in various working groups of the OECD/NEA.

Participation in the European Union Framework Programmes

With its Research Framework Programmes, the European Union (EU) promotes research and technological development within Europe. Bilateral agreements between Switzerland and the EU allow Swiss researchers to participate in European projects. Up to and including the Fifth Framework Programme, Swiss scientists were supported financially by the Swiss Federal Office for Education and Science (BBW). However, the Sixth Framework Programme foresees co-financing with EU funds from Brussels; Switzerland makes the corresponding funds available to the EU.

Nagra's interest in European research projects on safe disposal of radioactive waste in deep geological formations is focused in the following areas:

- Conceptual and strategic studies on safe handling and disposal of radioactive waste
- Experiments on the behaviour of the engineered barriers and the

host rock over long time spans

- Laboratory studies aimed at building up the necessary databases for performing safety assessments
- Work in rock laboratories for developing new instrumentation and investigation techniques, for characterising rock properties, on the influence of the engineered barriers on the surrounding rock and demonstration experiments on the practical feasibility of deep geological disposal.

Fifth Framework Programme (1998 – 2002)

Around half of the total of seventeen projects (see Table on this page) were completed successfully within the planned time period or were in the final phase of reporting by the end of the year. The final scientific and financial reports have been submitted to the Swiss Federal Office for Education and Science.

Sixth Framework Programme (2002 – 2006)

The Sixth Framework Programme is the key instrument of the EU for creating a European Research Area (ERA). The aim is to mobilise a critical mass of resources and to re-structure the European research landscape. With this in mind, the aim is to involve larger inter-disciplinary teams in the new programme. Two new types of project will be used to back up this development: the so-called "Networks of Excellence" and "Integrated Projects". In addition, the traditional style of project, which is smaller in terms of scope and number of partners, will also continue.

In terms of Nagra's participation in the projects of the Sixth Framework Programme, a contract for the Integrated Project NF-PRO was signed in 2003. Signing of contracts for the projects ESDRED and CETRAD is foreseen for the beginning of 2004.



Merz



Merz



Nagra was on the road again in 2003 with its information campaign, aimed at promoting dialogue with the public.

Public relations

Dialogue with the public is a central aspect of Nagra's activities. Following the submission of the Entsorgungsnachweis for high-level waste at the end of 2002, the call for information in Northern Switzerland was particularly high in 2003. There were also numerous questions regarding the referendum on 18th May on the two anti-nuclear initiatives; the "unsolved" waste management problem is continually raised as an argument for phasing out nuclear energy.

Information campaign 2003 and exhibitions

In June/July 2003, Nagra visited the towns of Schaffhausen, Aarau, Zürich, Lucerne and Solothurn with its information campaign. The mobile containers were set up for three days in busy public places at each location. An opening event for politicians, representatives of the energy sector, officials and the media was also held in each town. During the 15 days of the tour, around 12,000 people visited the stand. In addition Nagra was also present at the Schaffhausen autumn trade fair and, for the first time, at the Winterthur trade fair,

to discuss issues with interested visitors.

Guided tours and visits

Guided tours of the rock laboratories are very important as they provide an opportunity to show, at first hand, how technical know-how is being translated into actual research and demonstration projects. In 2003, 1300 people visited the Grimsel Test Site and 455 visited the Mont Terri Rock Laboratory.

In September and October of 2003, two information trips were held for politicians and officials, to Sweden and Finland. These visits to foreign waste management facilities that have been in operation for several years contribute significantly to understanding of waste management issues and the feasibility of geological disposal.

Information service, teaching materials

In 2003, Nagra produced eight media releases on current topics. Around 30 advertisements were placed in technical journals and daily and weekly

newspapers, sometimes in combination with technical articles. An important aspect of communication is dealing with general questions from the public and distribution of information materials. Nagra receives requests for materials for teaching, lectures and presentations more or less on a daily basis. Four experiment boxes, containing educational materials for schools, and around 40 Geiger-Müller counters can also be borrowed.

Publications and electronic media

2003 saw the publication of a colourful annual report, one issue in the series "nagra Focus", three issues of "nagra News" and a range of brochures. Seven existing publications went into reprint (mostly for updating). A DVD was also produced entitled "Deep geological repository in Opalinus Clay – concept for repository facilities and operation". An information sheet providing an overview of all these materials is also available.

A comprehensive archive of all media releases on waste management issues

has been set up on the website www.nagra.ch and the amount of information that can be downloaded has been greatly expanded. Work began at the end of 2003 on the complete redesign of the website.

Documentation centre and translation service

Nagra maintains a documentation centre (Info-Centre), which works together with a number of external libraries and organisations. The most important tasks of the Info-Centre include managing a technical library, compiling and archiving project documentation and conducting literature research. Maintenance of an intranet ensures flow of information within the company.

Numerous translations were carried out during the year for Nagra's in-house publications (periodicals, brochures, electronic media, etc.). Translations were also carried out, mainly for Japanese organisations and, as part of external services, reports were prepared and documents proof-read.



The Nagra Management Team: (from left to right) M. Fritschi, P. Zuidema, H. Issler, I. McKinley, H. Maxeiner.

Organisation

Management and headquarters

Management

The ordinary general meeting of the Nagra Cooperative took place in Bern on 4th June 2003. The Members approved the annual report and accounts for 2002. Total expenditure amounted to 34.5 million CHF, which can be divided as follows: 2.4 million CHF was borne by GNW, 4.8 million CHF through contracts for third parties and 4.3 million CHF through services for individual Members of the Cooperative. Taking into account other operational yields, this resulted in a net expenditure for the Members of the Cooperative of 22.2 million CHF for the financial year 2002.

On the occasion of the ordinary general meeting, Hans Fuchs (KKG) and Hans Achermann (KKL) announced their resignation. Peter Hirt was elected as the new KKG representative and Mario Schönenberger as the KKL representative. Hans Fuchs was elected to the Board of Management in 1992; he was also Chairman of the Technical Committee and of the Commission for Information. Hans Achermann had been a member of the Board of Management since the year 2000. Both gentlemen were thanked for their active contribution

to the progress of work over the years and their support of Nagra's activities. The remaining members of the Board were confirmed for a period of office up to 2006; Hans Issler was also confirmed as President.

To meet with a change in the management structure of Nagra, the general meeting also approved an amendment to the company regulations. Top-level management of Nagra is now by a three-person Executive Board, with an extended Management Team with a further five persons (including support positions). The Executive Board consists of Hans Issler (President), Dr. Markus Fritschi (Division Head Repository Projects) and Dr. Piet Zuidema (Division Head Science and Technology).

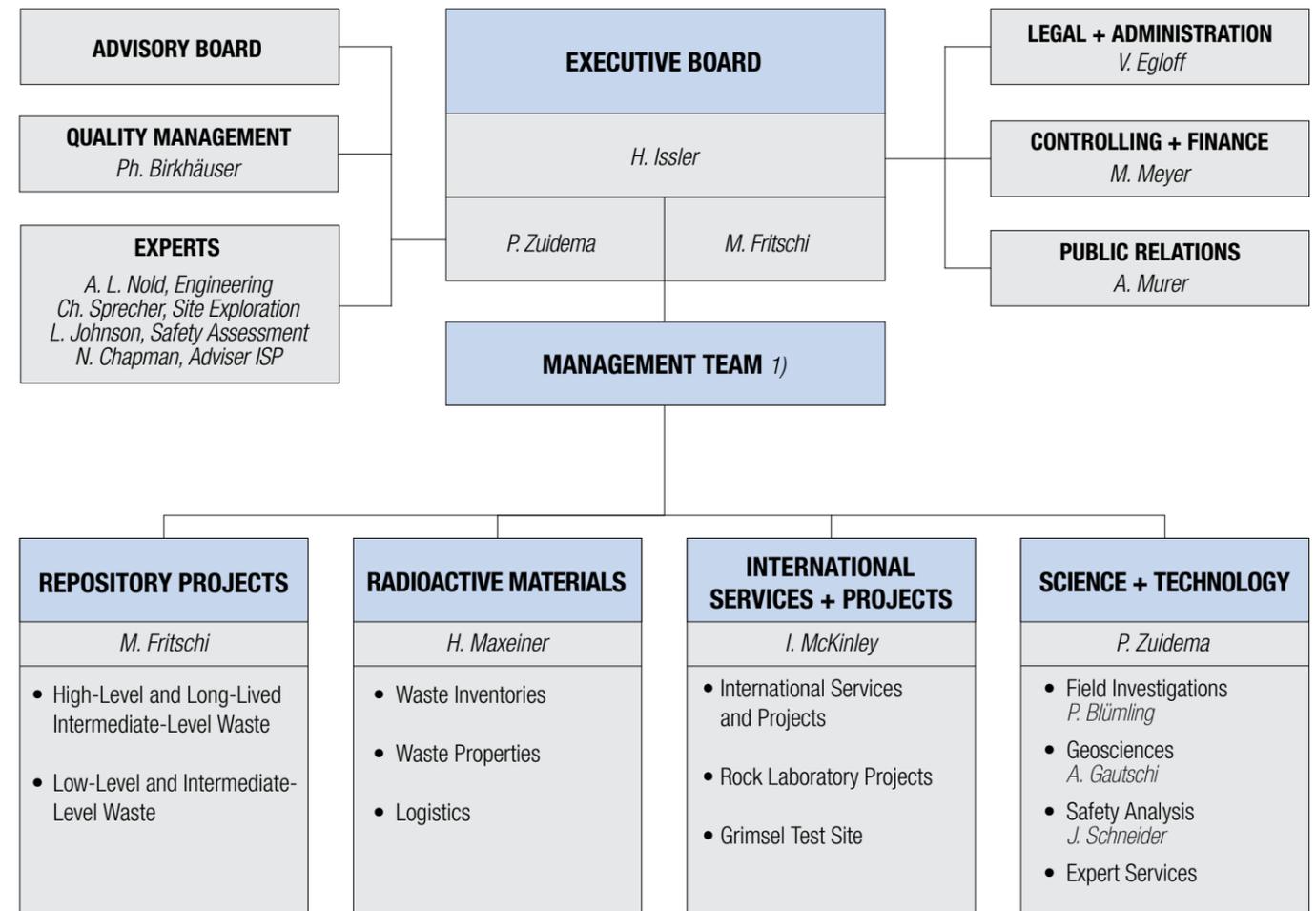
At a meeting held on 3rd December 2003, the Board of Management authorised an outline credit of 27.9 million CHF for research and project work in the year 2004. Four meetings of the Board of Management were held to deal with ongoing business. Discussions on important issues were held by the different commissions (Technical Committee, Commission

for Legal Issues, Finance Commission and Commission for Information).

Headquarters

At the end of 2003, 69 people were employed at the Nagra headquarters in Wettingen, corresponding to 63.2 full-time positions (63.3 in the previous year). In addition, 16 people (corresponding to 7.7 full-time positions; 8 in the previous year) were employed as advisers, part-time employees, support staff and students. A significant proportion of Nagra's work is carried out in collaboration with research institutes, technical colleges and geological and engineering consultants, as well as with the Members of the Cooperative.

Organigram



1) Management Team: H. Issler, P. Zuidema, M. Fritschi, H. Maxeiner, I. McKinley



TheMembersoftheNagraCooperative.

Members of the Cooperative, Board of Management and Technical Committee

Members of the Cooperative

Swiss Federal Government
Bern

BKW FMB Energie AG
Bern

Kernkraftwerk Gösgen-Däniken AG
Däniken

Kernkraftwerk Leibstadt AG
Leibstadt

Nordostschweizerische Kraftwerke
Baden

Energie Ouest Suisse
Lausanne

Board of Management (period of office 2003–2006)

Hans Issler
President
Nagra

Hans Rudolf Gubser
Vice-president
Nordostschweizerische Kraftwerke

Hermann Ineichen
BKW FMB Energie AG

Dr. Hans Fuchs
Kernkraftwerk Gösgen-Däniken AG
(until 4th June 2003)

Dr. Bernard Michaud
Government representative,
Federal Office of Health
(until 3rd December 2003)

Hans Achermann
Kernkraftwerk Leibstadt AG
(until 4th June 2003)

Jean-Louis Pfaeffli
Energie Ouest Suisse

Peter Hirt
Kernkraftwerk Gösgen-Däniken AG
(from 4th June 2003)

Mario Schönenberger
Kernkraftwerk Leibstadt AG
(from 4th June 2003)

Martin Jermann
Paul Scherrer Institute
(from 1st January 2004)

Technical Committee (31st December 2003)

Mario Schönenberger
Chairman
Kernkraftwerk Leibstadt AG

Dr. Jörg Hadermann
Paul Scherrer Institute

Dr. Marcel Lips
Kernkraftwerk Gösgen-Däniken AG

Jean-Louis Pfaeffli
Energie Ouest Suisse

Dr. Anton von Gunten
BKW FMB Energie AG

Herbert Bay
Nordostschweizerische Kraftwerke

Dr. Piet Zuidema
Nagra

Finance Commission (31st December 2003)

Thomas Schärer
Chairman
Nordostschweizerische Kraftwerke

Kurt Bachmann
Kernkraftwerk Gösgen-Däniken AG

Erich Keller
Federal Office of Energy

Thomas Gysel
Kernkraftwerk Leibstadt AG

Christian Sahli
BKW FMB Energie AG

Marc Meyer
Nagra

Commission for Legal Issues (31st December 2003)

Dr. Jürg Marti
Chairman
Kernkraftwerk Leibstadt AG

Peter Dubach
BKW FMB Energie AG

Franco Gaffuri
Kernkraftwerk Gösgen-Däniken AG

Dr. Olivier Robert
Nordostschweizerische Kraftwerke

Martin de Techtermann
Energie Ouest Suisse

Valentin Egloff
Nagra

Commission for Information (31st December 2003)

Peter Hirt
Chairman
Kernkraftwerk Gösgen-Däniken AG

Dr. Jean-François Dupont
Energie Ouest Suisse

Leo Erne
Kernkraftwerk Leibstadt AG

Urs Peter Stebler
BKW FMB Energie AG

Rolf Schmid
Kernkraftwerk Gösgen-Däniken AG

Verena Martignier
Axpo und Nordostschweizerische
Kraftwerke

Armin Murer
Nagra

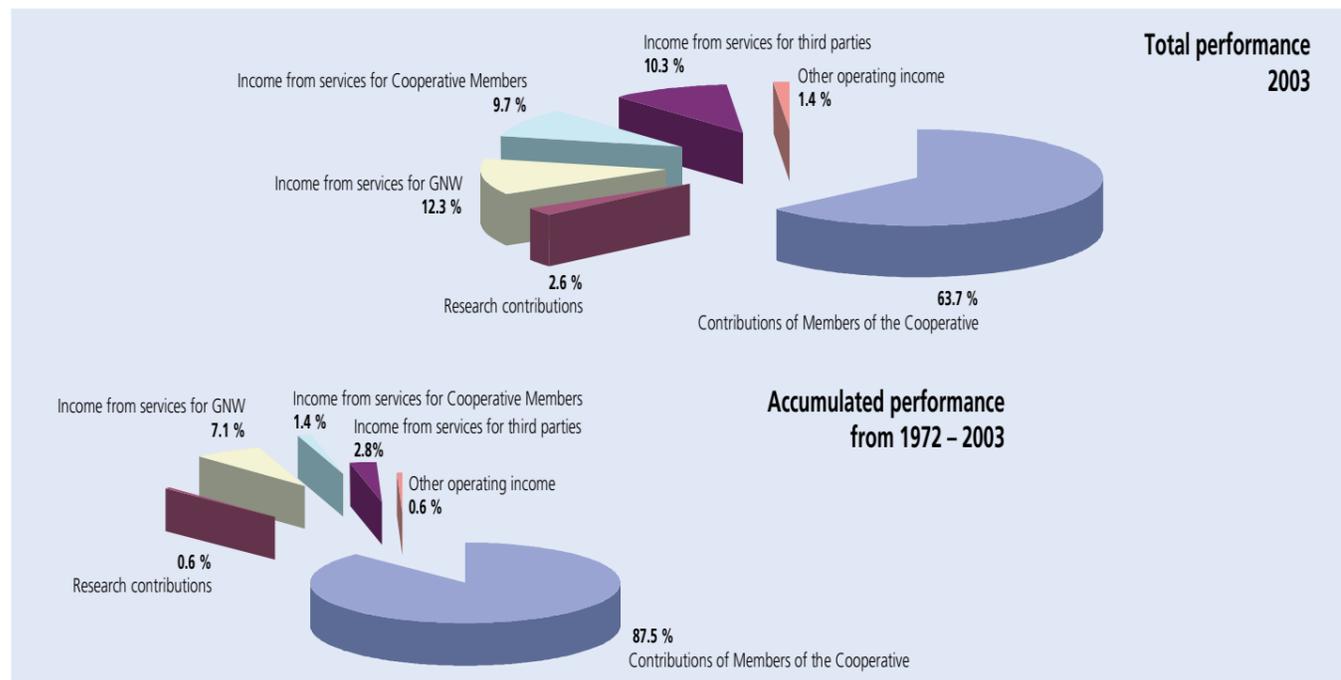
Commissions

Auditors

PricewaterhouseCoopersAG, Zürich

Year-end closure – annual accounts 2003





Comments on the annual accounts

In 2003, the gross result was 34.2 million CHF, a decrease of 0.2 million CHF compared to the previous year. The contributions of the Members of the Cooperative dropped by 0.3 million CHF to 21.9 million CHF.

Other operating income decreased by 0.1 million CHF to 0.5 million CHF.

Taking into account ongoing contracts, income from deliveries and services increased by 0.2 million CHF to 11.9 million CHF. This increase is due mainly to the following:

- Research and partner contributions increased by 0.1 million CHF to 0.9 million CHF, compared to the previous year.
- Payments by GNW increased by 1.8 million CHF to 4.2 million CHF.
- Direct contracts for services to Members of the Cooperative decreased by 1.0 million CHF. Of a total of 3.3 million CHF, 2.7 million were due to the PEGASOS project alone.
- Taking into account ongoing contracts, services to other third parties decreased by 0.7 million CHF to 3.5 million CHF, compared to the previous year.

Total expenditure was reduced by a total of around 0.2 million CHF. Documented external expenditure decreased by 0.6 million CHF to 15.3 million CHF. Compared with the previous year, personnel costs increased by around 0.4 million CHF or 3.6%.

Further information on selected positions can be found in the appendix to the annual accounts.

Wettingen, 8th April 2004

Hans Issler, President

Balance sheet as per 31st December 2003

(p. m. = pro memoria)

	2003 CHF	2002 CHF	Number in Appendix
Assets			
Liquid assets	3 374 187	2 559 554	1
Trade receivables	4 398 104	4 984 429	2
Other receivables	6 397	17 664	
Ongoing contracts	1 986 718	2 158 231	3
Active accruals and deferrals	–	15 104	
Total current assets	9 765 406	9 734 982	
Office furnishings – headquarters	13 000	38 000	
Office furnishings – field offices	p.m.	p.m.	
Vehicles	25 900	46 000	
Drillsite installations	p.m.	p.m.	
Land and buildings	2 683 379	2 727 772	
Total capital assets	2 722 279	2 811 772	4
Total assets	12 487 685	12 546 754	
Liabilities			
Trade payables	2 670 490	4 554 917	5
Prepayments	1 881 357	893 836	3
Other liabilities	442 308	406 640	
Passive accruals and deferrals	987 660	4 997 435	6
Provisional reserves	6 385 870	1 573 926	7
Total loan capital	12 367 685	12 426 754	
Cooperative capital	120 000	120 000	
Total equity capital	120 000	120 000	
Total liabilities	12 487 685	12 546 754	

Operating accounts 2003

	2003 CHF	2002 CHF	Number in Appendix
Total performance			
Contributions to administration costs	600 000	600 000	
Contributions for project expenditure	22 046 324	26 331 386	
Balancing of income/expenditure excess	-783 712	-4 765 413	
Contributions of Cooperative Members	21 862 612	22 165 973	8
Research contributions	883 406	788 575	
Income from services for GNW	4 200 425	2 399 123	
Income from other services for Cooperative Members	3 309 925	4 256 341	
Income from services for third parties	3 699 214	4 808 530	
Income from deliveries and services	12 092 970	12 252 569	9
Adjustment in balance sheet for ongoing contracts	-171 513	-547 320	3
Other operating income	462 594	579 866	10
Total performance	34 246 663	34 451 088	
Operating expenditure			
External expenditure	15 294 414	15 893 880	11
Personnel costs	11 341 224	10 952 499	
Depreciation of assets	89 493	41 232	
Other operating expenditure	7 270 040	7 417 170	12
Operating expenditure	33 995 171	34 304 781	
Operating profit before interest and taxes	251 492	146 307	
Financial income	24 722	47 745	
Financial expenditure	-79 204	-92 839	
Taxes	-197 010	-101 213	
Total operating expenditure	34 246 663	34 451 088	

Cash flow statement 2003

	2003 CHF	2002 CHF	Number in Appendix
Change in liquid assets			
Research contributions	883 406	788 575	
Income from services for GNW	4 200 425	2 399 123	
Income from other services for Cooperative Members	3 309 925	4 256 341	
Income from services for third parties	3 699 214	4 808 530	
Adjustment in balance sheet for ongoing contracts	-171 513	-547 320	
Income from third parties including adjustment for ongoing contracts	11 921 457	11 705 249	9
Other operating income	462 594	579 866	10
Total income	12 384 051	12 285 115	
Contributions of Cooperative Members	21 862 612	22 165 973	8
Total performance	34 246 663	34 451 088	
External expenditure	-15 294 414	-15 893 880	11
Personnel expenditure	-11 341 224	-10 952 499	
Other operating expenditure	-7 270 040	-7 417 170	12
Result, neutral result, taxes	-251 492	-146 307	
Total expenditure (without depreciation)	-34 157 170	-34 409 856	
Cash flow	89 493	41 232	4
Change in receivables	597 591	-524 055	2
Change in ongoing contracts	171 513	547 320	3
Change in active accruals and deferrals	15 104	-15 104	
Change in liabilities	-861 238	1 466 582	5, 3
Change in short-term bank loans	-	-	
Change in passive accruals and deferrals	-4 009 774	-123 944	6
Change in reserves	55 266	210 229	7
Cash flow from company activities	-3 942 045	1 602 260	
Investments in tangible assets	-	-1 874 625	4
Cash flow from investments	-	-1 874 625	
Change in Cooperative capital	-	-	
Reserve GNW	4 756 678	-	7
Cash flow from financing activities	4 756 678	-	
Change in liquid assets	814 633	-272 365	1

Accumulated accounts

(Contributions of the Cooperative Members and their application since the founding of Nagra in 1972)

	Status 31.12.2002 CHF	Increase 2003 CHF	Status 31.12.2003 CHF	Number in Appendix
Total performance				
Contributions for administration costs	80 720 000	600 000	81 320 000	
Swiss Confederation	22 100 165	593 596	22 693 761	
BKW FMB Energie AG	75 309 386	1 833 775	77 143 161	
Kernkraftwerk Gösgen-Däniken AG	213 687 769	5 018 251	218 706 020	
Kernkraftwerk Leibstadt AG	230 939 025	6 057 399	236 996 424	
Nordostschweizerische Kraftwerke AG	166 602 585	3 777 890	170 380 475	
Contributions to project expenditure	708 638 930	17 280 911	725 919 841	
Project expenditure still to be covered by Members of Cooperative	–	–	–	
Prepayments of Members of Cooperative for project expenditure	-4 765 413	3 981 701	-783 712	
Balancing of income/expenditure excess	-4 765 413	3 981 701	-783 712	
Contributions of Members of Cooperative	784 593 517	21 862 612	806 456 129	13
Research contributions	4 812 206	883 406	5 695 612	
Income from services for GNW	61 060 299	4 200 425	65 260 724	
Income from other services for Cooperative Members	9 205 722	3 309 925	12 515 647	
Income from services for third parties	19 701 660	3 699 214	23 400 874	
Income from deliveries and services	94 779 887	12 092 970	106 872 857	14
Adjustment in balance sheet for ongoing contracts	2 158 230	-171 513	1 986 717	1
Other operating income	4 705 629	462 594	5 168 223	16
Total performance of accumulated accounts	886 237 263	34 246 663	920 483 926	

	Status 31.12.2002 CHF	Increase 2003 CHF	Status 31.12.2003 CHF	Number in Appendix
Total expenditure				
Administration costs	70 913 378	600 000	71 513 378	
General project expenditure, contributions	9 806 622	–	9 806 622	
Administration and general project expenditure	80 720 000	600 000	81 320 000	
Generic studies	164 498 788	7 620 111	172 118 899	
Planning of facilities (repository concepts)	18 416 450	4 007 106	22 423 556	
Geological investigations for site selection	402 212 612	5 502 758	407 715 370	
Experimental programmes (rock labs)	70 145 282	1 987 643	72 132 925	
Public relations, documentation	55 983 138	4 191 817	60 174 955	
Project-related expenditure	711 256 270	23 309 435	734 565 705	17
Total administration, general and project-related expenditure	791 976 270	23 909 435	815 885 705	
Project expenditure for GNW	60 658 756	2 106 374	62 765 130	
Project expenditure for Cooperative Members	9 468 415	3 545 939	13 014 354	
Project expenditure for third parties	24 133 822	4 684 915	28 818 737	
Project-related expenditure from deliveries and services	94 260 993	10 337 228	104 598 221	18
Total expenditure for accumulated accounts	886 237 263	34 246 663	920 483 926	
Expenditure according to repository project				
Low- and intermediate-level waste project	265 284 578	6 835 047	272 119 625	
High-level waste project	445 971 692	16 474 388	462 446 080	
Wellenberg project	60 658 756	2 106 374	62 765 130	
Expenditure in accumulated accounts according to repository project	771 915 026	25 415 809	797 330 835	19



Notes on the annual accounts

1 Liquid assets

Liquid assets increased by 0.8 million CHF compared to the previous year. As of 31st December 2003, there were no fixed-term deposits.

2 Receivables from deliveries and services

Receivables from deliveries and services decreased by a total of 0.6 million CHF to 4.4 million CHF.

Receivables from deliveries and services with respect to third parties decreased by 1.0 million CHF to 0.8 million CHF. The largest single debtor is ZWILAG, with 0.1 million CHF. Also included in this position are claims against the Members of the Cooperative in the amount of 3.6 million CHF (3.2 million CHF in the previous year). The largest claim relates to Kernkraftwerk Leibstadt AG, with 1.7 million CHF.

3 Ongoing contracts

Ongoing contracts for third parties decreased compared to the previous year by 0.2 million CHF to 2.0 million CHF.

Passive prepayments for ongoing contracts increased by 1.0 million CHF and now amount to 1.9 million CHF.

Activated ongoing contracts result exclusively from work performed for third parties.

4 Fixed assets

At the end of 2002, a suitable property was obtained in Mellingen for 1.8 million CHF as a replacement for the existing storage hall.

No fixed assets were activated during 2003. Small acquisitions are contained in other operating expenditure. Depreciation is documented separately. The income from sale of fixed

assets is contained in other operating income; in 2003 it amounted to 0.17 million CHF.

The facilities at headquarters and the Grimsel Test Site are insured against fire damage for a total of 7.5 million CHF (same amount as in the previous year). The fire insurance value of the storage hall and contents in Mellingen is 3.7 million CHF.

5 Payables from deliveries and services

Payables from deliveries and services decreased during 2003 by around 1.9 million CHF to 2.7 million CHF.

The position contains liabilities towards Members of the Cooperative in the amount of 0.2 million CHF (0.1 in the previous year).

6 Passive accruals and deferrals

Passive accruals and deferrals decreased in 2003 by around 4.0 million CHF.

The balance shown contains liabilities towards Members of the Cooperative of around 0.8 million CHF (4.8 million CHF in the previous year) for claimed project costs that have not been applied.

Passive accruals and deferrals towards third parties amounted to 0.2 million CHF, as in the previous year.

7 Reserves

As before, reserves include amounts for vacation and overtime of employees, tax reserves and various items. As of 30th July 2003, Nagra took over responsibility for the Wellenberg site from the liquidated GNW for a one-off payment of 4.8 million CHF. For a period of ten years, this amount will

be used in particular for recultivation work, production of project documentation and final reports and payment of various charges.

8 Contributions of Members of the Cooperative

The contributions of Members of the Cooperative decreased during the year by around 0.3 million CHF and are made up as follows:

Administrative costs of 0.6 million CHF, passed-on taxes for nuclear facilities of HSK of 2.8 million CHF (1.7 million CHF in the previous year), contributions to project costs of 19.3 million CHF. At the end of the year, this amount was reduced by 0.8 million CHF (excess demand) to 18.5 million CHF (19.8 million CHF in the previous year).

9 Income from deliveries and services

Research contributions increased by 0.1 million CHF to 0.9 million CHF. Services to GNW increased by 1.8 million CHF to 4.2 million CHF.

Other services to Members of the Cooperative decreased by 0.9 million CHF to 3.3 million CHF; around 2.7 million CHF of this can be attributed to the PEGASOS project alone. The project is a seismic hazard study extending over 3 years that will generate services to the nuclear power plant operators in the total amount of 9 million CHF.

Income from deliveries and services to third parties decreased in 2003 by 1.1 million CHF to 3.7 million CHF. Taking into account the decrease in ongoing contracts (for third parties), services to third parties decreased by around 0.7 million CHF compared to the previous year.

10 Other operating income

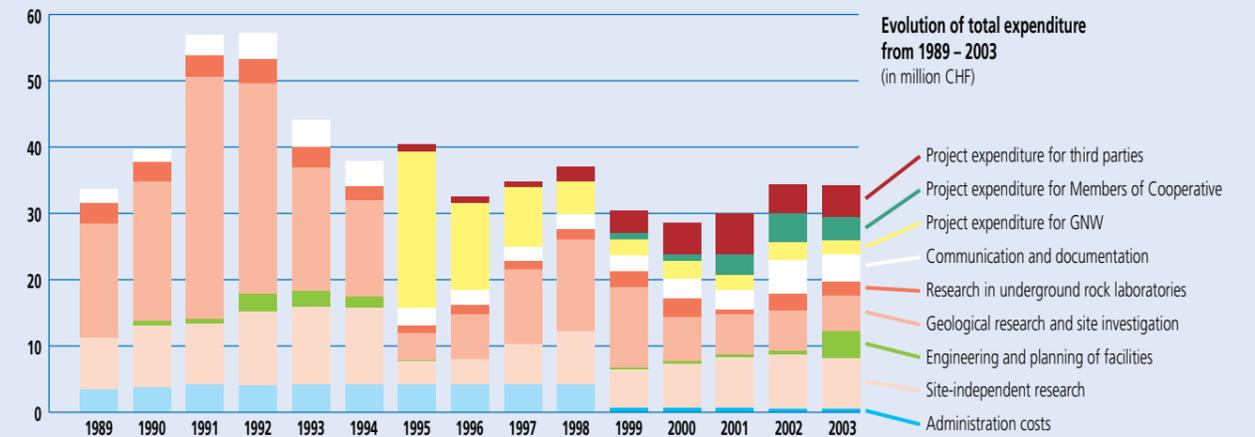
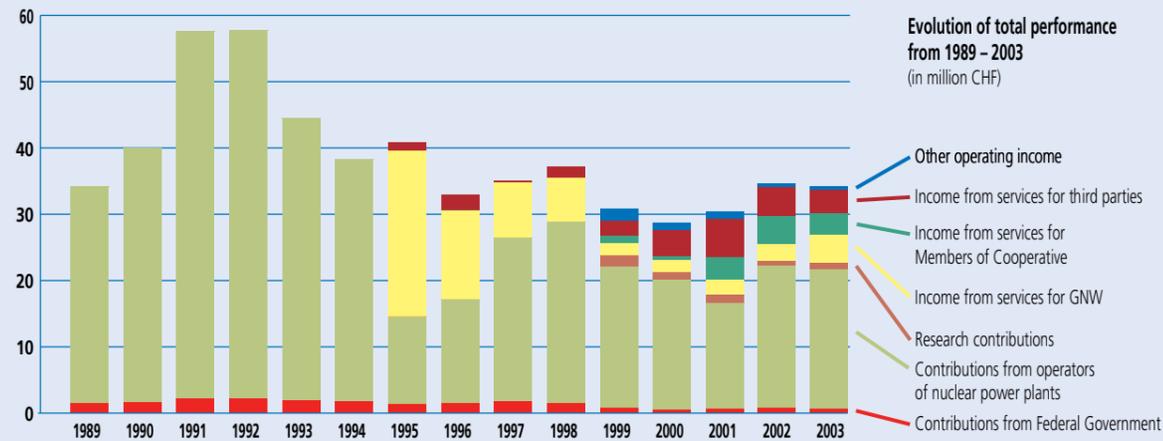
Other operating income decreased during 2003 by around 0.1 million CHF to 0.5 million CHF. The amount passed on to GNW for taxes on nuclear facilities of HSK decreased from 0.5 million CHF to 0.1 million CHF.

11 External expenditure

External expenditure decreased in 2003 by 0.6 million CHF.

12 Other operating expenditure

Other operating expenditure increased during the year by 0.1 million CHF.



Notes on the accumulated accounts

The accumulated presentation of the contributions from the Members of the Cooperative and the application of these contributions forms the basis for any adjustment payments between the Members. It also shows which work gives rise to project-related expenditure.

13 Contributions of Members of the Cooperative

The contributions of the Members of the Cooperative towards covering project costs are determined annually as a percentage, based on the thermal output of the individual power plants.

In 2003, the Members of the Cooperative made net payments to Nagra in the amount of 17.9 million CHF. Taking into account prepayments by Members of the Cooperative that have not yet been applied in the amount of 0.8 million CHF as well as the balance from the previous year of 4.8 million CHF, this results in contributions of the Members in the total amount of 21.9 million CHF (22.2 million CHF in the previous year).

Included in this is the contribution to administrative costs in the amount of 0.6 million CHF, as well as taxes passed on for nuclear facilities in the amount of 2.8 million CHF.

14 Income from deliveries and services

The entries for accumulated income from deliveries and services agree with the operating accounts and are explained there.

15 Adjustment for ongoing contracts

Adjustments to the status of initiated work agree with the operating accounts and are explained there.

16 Other operating income

The entries for other accumulated operating income agree with the operating accounts and are explained there.

17 Project-related expenditure

Project-related expenditure in 2003 amounted to around 23.3 million CHF. These monies were applied as follows:

a) Non-site-specific (generic) studies (7.6 million CHF)

Site-independent studies include proportional expenditure on documenting and inventorying radioactive wastes, development of disposal concepts, development of safety assessment methodologies and carrying out performance assessments. Also included are costs of the safety report for the Entsorgungsnachweis Project.

b) Planning of facilities (4.0 million CHF)

This includes expenditure on the project for a deep geological repository in the Opalinus Clay, documenting of this work in the Entsorgungsnachweis Project and conceptual studies for low- and intermediate-level waste.

c) Geological investigations for site selection (5.5 million CHF)

Geological investigations included studies in the investigation area of Northern Switzerland associated with disposal of high-level waste. Also included are the costs of the geosynthesis associated with the Entsorgungsnachweis Project.

d) Experimental work (2.0 million CHF)

This relates to research activities at the Grimsel Test Site and Mont Terri Rock Laboratory.

e) Public relations and documentation (4.2 million CHF)

This expenditure results mainly from editing, translating and producing information brochures, media activities and costs of exhibitions and information events.

18 Project-related expenditure from deliveries and services

This expenditure in the amount of 10.3 million CHF results from contracts included under income from deliveries and services and covers the following positions:

- Project expenditure for GNW of 2.1 million CHF,
- Project expenditure for Members of the Cooperative of 3.5 million CHF
- Project expenditure for third parties of 4.7 million CHF, which also contains some expenditure for research projects.

19 Expenditure according to repository project

The position “Expenditure according to repository project” allows – at the time of realisation of the repositories – the proportional emplacement quota per repository and Cooperative Member to be determined.

Of the around 23.3 million CHF for project-related expenditure, (see note 17), for the year 2003 6.8 million CHF can be assigned to the programme for low- and intermediate-level waste and 16.4 million CHF to the programme for high-level waste. Following the negative decision by Canton Nidwalden, the Wellenberg project was brought to a close in 2003 and will no longer be pursued.

Bericht der Revisionsstelle
an die Generalversammlung der
NAGRA Nationale Genossenschaft für die Lagerung radioaktiver Abfälle
Wettingen

Als Revisionsstelle haben wir die Buchführung, die Jahresrechnung (Bilanz, Betriebsrechnung, Mittelflussrechnung und Anhang), die auf den Seiten 31 bis 33 bzw. 36 und 37 abgebildet ist, sowie die Geschäftsführung der NAGRA Nationale Genossenschaft für die Lagerung radioaktiver Abfälle für das am 31. Dezember 2003 abgeschlossene Geschäftsjahr geprüft.

Für die Jahresrechnung und die Geschäftsführung ist die Verwaltung verantwortlich, während unsere Aufgabe darin besteht, die Jahresrechnung und die Geschäftsführung zu prüfen und zu beurteilen. Wir bestätigen, dass wir die Anforderungen hinsichtlich Befähigung und Unabhängigkeit erfüllen.

Unsere Prüfung erfolgte nach den Grundsätzen des schweizerischen Berufsstandes, wonach eine Prüfung so zu planen und durchzuführen ist, dass wesentliche Fehlaussagen in der Jahresrechnung mit angemessener Sicherheit erkannt werden. Wir prüften die Posten und Angaben der Jahresrechnung mittels Analysen und Erhebungen auf der Basis von Stichproben. Ferner beurteilten wir die Anwendung der massgebenden Rechnungslegungsgrundsätze, die wesentlichen Bewertungsentscheide sowie die Darstellung der Jahresrechnung als Ganzes. Bei der Prüfung der Geschäftsführung wird beurteilt, ob die Voraussetzungen für eine gesetzes- und statutenkonforme Geschäftsführung gegeben sind; dabei handelt es sich nicht um eine Zweckmässigkeitsprüfung. Wir sind der Auffassung, dass unsere Prüfung eine ausreichende Grundlage für unser Urteil bildet.

Gemäss unserer Beurteilung entsprechen die Buchführung, die Jahresrechnung und die Geschäftsführung dem schweizerischen Gesetz und den Statuten.

Wir empfehlen, die vorliegende Jahresrechnung zu genehmigen.

PricewaterhouseCoopers AG

A. Bantli

I. Bischofsberger

Zürich, 8. April 2004

Nagra Technical Reports (NTBs)

A complete list of all NTBs published to date, together with a pricelist, can be obtained from Nagra's headquarters in Wettingen or downloaded from the website.

NTB 99-08

"Geologische Entwicklung der Nord-schweiz, Neotektonik und Langzeit-szenarien Zürcher Weinland"; W.H. Müller, H. Naef and H.R. Graf; (December 2002, published 2003). Also available as CD-ROM (PDF format).

NTB 00-06

"Grimsel Test Site – Investigation Phase IV (1994-1996): The Nagra-JNC in situ study of safety relevant radionuclide retardation in fractured crystalline rock – II: The RRP project methodology development, field and laboratory tests"; W.R. Alexander, K. Ota and B. Frieg (Eds.); (July 2003). Also available as CD-ROM (PDF format).

NTB 00-08

"Grimsel Test Site – Investigation Phase IV (1994-1996): The Nagra-JNC in situ study of safety relevant radionuclide retardation in fractured crystalline rock – IV: The in situ study of matrix porosity in the vicinity of a water conducting fracture"; A. Möri, M. Mazurek, M. Adler, M. Schild, S. Siegesmund, A. Vollbrecht, K. Ota, T. Ando, W.R. Alexander, P.A. Smith, P. Haag and Ch. Bühler; (May 2003). Also available as CD-ROM (PDF format).

NTB 01-01

"Model Radioactive Waste Inventory for Reprocessing Waste and Spent Fuel"; D.F. McGinnes; (December 2002, published 2003).

NTB 02-06

"Project Opalinus Clay: Models, Codes and Data for Safety Assessment – Demonstration of disposal feasibility for spent fuel, vitrified high-level waste and long-lived intermediate-

level waste (Entsorgungsnachweis)"; (December 2003).

NTB 02-08

"The Uptake of Eu(III) and Th(IV) by Calcite under Hyperalkaline Conditions: The Influence of Gluconic and Isosaccharinic Acid"; J. Tits, M. Bradbury, P. Eckert, A. Schaible and E. Wieland, Paul Scherrer Institute, Villigen PSI; (December 2002, published 2003).

NTB 02-09

"Assessment of Porewater Chemistry in the Betonite Backfill for the Swiss SF/HLW Repository"; E. Curti and P. Wersin; (December 2002, published 2003). Also available as CD-ROM (PDF format).

NTB 02-11

"Canister Options for the Disposal of Spent Fuel"; L.H. Johnson and F. King; (April 2003). Also available as CD-ROM (PDF format).

NTB 02-12

"Application of the Nagra / PSI TDB 01/01 Solubility of Th, U, Np and Pu"; W. Hummel and U. Berner, Paul Scherrer Institute, Villigen PSI; (December 2002, published 2003).

NTB 02-13

"Redox Conditions in the Near Field of a Repository for SF/HLW and ILW in Opalinus Clay"; P. Wersin, L.H. Johnson, B. Schwyn, U. Berner and E. Curti; (March 2003). Also available as CD-ROM (PDF format).

NTB 02-14

"Stability and Mobility of Colloids in Opalinus Clay"; A. Voegelin and R. Kretzschmar, Institut für terrestrische Ökologie, ETH Zürich; (December 2002, published 2003). Also available as CD-ROM (PDF format).

NTB 02-15

"Diffusion of Tritiated Water (HTO) and ²²Na⁺-ions through Non-degraded Hardened Cement Pastes – II. Modelling Results". A. Jakob, Paul Scherrer Institute, Villigen PSI; (November 2002, published 2003).

NTB 02-17

"A Comparison of Apparent Diffusion Coefficients Measured in Compacted Kunigel V1 Bentonite with those calculated from Batch Sorption measurements and D_e (HTO) Data: A Case Study for Cs(I), Ni(II), Sm(III), Am(III), Zr(IV) and Np(V)"; M.H. Bradbury and B. Baeyens, Paul Scherrer Institute, Villigen PSI; (December 2002, published 2003).

NTB 02-18

"Near-Field Sorption Data Bases for Compacted MX-80 Bentonite for Performance Assessment of a High-Level Radioactive Waste Repository in Opalinus Clay Host Rock"; M.H. Bradbury and B. Baeyens, Paul Scherrer Institute, Villigen PSI; (March 2003).

NTB 02-19

"Far-Field Sorption Data Bases for Performance Assessment of a High-Level Radioactive Waste Repository in an Undisturbed Opalinus Clay Host Rock"; M.H. Bradbury and B. Baeyens, Paul Scherrer Institute, Villigen PSI; (March 2003).

NTB 02-20

"Cementitious Near-Field Sorption Data Base for Performance Assessment of an ILW Repository in Opalinus Clay"; E. Wieland and L.R. Van Loon, Paul Scherrer Institute, Villigen PSI; (December 2002, published 2003).

NTB 02-21

"Glass Dissolution Parameters: Update for Entsorgungsnachweis"; E. Curti, Paul Scherrer Institute, Villigen PSI; (June 2003).

NTB 02-22

"Project Opalinus Clay: Radionuclide Concentration Limits in the Cementitious Near-Field of an ILW Repository"; U. Berner, Paul Scherrer Institute, Villigen PSI; (February 2003). Also available as CD-ROM (PDF format).

NTB 02-23

"Project Opalinus Clay: FEP Manage-

ment for Safety Assessment – Demonstration of disposal feasibility for spent fuel, vitrified high-level waste and long-lived intermediate-level waste (Entsorgungsnachweis“; (December 2002, published 2003). Also available as CD-ROM (PDF format).

NTB 02-24

“SMA/WLB: Bohrlochversiegelung/-verfüllung SB4a/schräg“; (December 2002, published 2003). Also available as CD-ROM (PDF format).

Publications for a wider audience

The publications “nagra Bulletin”, “nagra Focus” and “nagra News” appear as required based on topics of current interest, rather than on a regular basis. They can be subscribed to free of charge and are also available in large numbers.

Three issues of “nagra News”, in German, French and Italian, appeared during the year:

- “nagra News 10” (April 2003) explains the next steps and the responsible bodies involved in the

review of the demonstration of disposal feasibility (“Entsorgungsnachweis“) for spent fuel (SF), high-level waste (HLW) and long-lived intermediate-level waste (ILW).

- “nagra News 11” (June 2003) reports on history behind the development of the Entsorgungsnachweis Project.

- “nagra News 12” (November 2003) presents the future stages in the SF/HLW/ILW programme and reports on the modernisation of the earthquake monitoring network in Northern Switzerland and the information event of the Federal Office of Energy and the “Amt für Abfall, Wasser, Energie und Luft“ of Canton Zürich held in Trüllikon.

In the “nagra Focus” series, which contains topical articles on nuclear waste management, one issue appeared in German and French:

- “nagra Focus 04” on disposal of high-level waste (October 2003). The journal contains four articles: Safety today: containment and interim storage; Safety for the future: geological disposal; The Opalinus Clay Project: a potential solution; The repository will be required in a few decades.

In early summer 2003, a brochure was published on information/dialogue/documentation as part of Nagra’s sediment programme (in German). In autumn, four leaflets were produced on the key experiments at the Grimsel Test Site.

Seven existing publications went into reprint.

A DVD was produced in German and English with the title “Deep geological repository in Opalinus Clay, concept for repository facilities and operations“. Models of the surface and underground facilities, the emplacement of waste, the realisation of the repository and its closure are presented in animated form.

Nagra’s range of information material can be found on the homepage www.nagra.ch. An overview sheet is also available.

Glossar

AGNEB – Federal Interagency Working Group on Nuclear Waste Management.

Andra – Agence nationale pour la gestion des déchets radioactifs, France.

Äspö – International research project in Sweden, based in an underground laboratory in crystalline rock.

BBW – Swiss Federal Office for Education and Science (Bundesamt für Bildung und Wissenschaft).

BFE – Swiss Federal Office of Energy, under DETEC.

CEA – Commissariat à l'énergie atomique, France.

CERN – European Organization for Nuclear Research.

Criepi – Central Research Institute of Electric Power Industry, Japan.

DETEC – Federal Department of the Environment, Transport, Energy and Communications.

DSK – German-Swiss Commission for the Safety of Nuclear Installations.

EDI – Federal Department of Home Affairs.

EKRA – Expert Group on Disposal Concepts for Radioactive Waste (dissolved at the beginning of 2003).

ELFB – Endlagerfähigkeitsbescheinigung (certification of suitability for disposal).

ETH – Swiss Federal Institute of Technology.

EU – European Union.

FMT – Mont Terri Rock Laboratory in Opalinus Clay, located near St-Ursanne, Canton Jura; project managed by FOWG.

FOWG – Swiss Federal Office for Water and Geology, under DETEC; management of the Mont Terri Project.

GNW – Cooperative for Radioactive Waste Disposal Wellenberg; domiciled in Wolfenschiessen, Canton Nidwalden (dissolved in 2003).

GTS – Grimsel Test Site; Nagra's underground laboratory in crystalline rock on the Grimsel pass, Canton Bern.

HLW – High-level waste; vitrified waste from reprocessing.

HSK – Swiss Federal Nuclear Safety Inspectorate, Villigen (under BFE).

IAEA – International Atomic Energy Agency.

ILW – Long-lived intermediate-level waste.

ISRAM – Information system for radioactive materials.

JNC – Japan Nuclear Cycle Development Institute.

JNFL – Japan Nuclear Fuel Limited.

KEG – Nuclear Energy Law.

KNE – Commission for Nuclear Waste Management.

KSA – Swiss Federal Commission for the Safety of Nuclear Installations.

LES – Waste Management Laboratory, PSI.

L/ILW – Low- and intermediate-level waste.

MIR – Radioactive wastes from medicine, industry and research.

MIRAM – Model inventory of radioactive materials.

NEA – Nuclear Energy Agency.

Nirex – United Kingdom Nuclear Industry Radioactive Waste Executive.

NPP – Nuclear power plant.

NTB – Nagra Technical Report. Series of technical-scientific publications.

Numo – Nuclear Waste Management Organization of Japan.

Obayashi – Obayashi Corporation, Japan.

OECD – Organisation for Economic Cooperation and Development.

PEGASOS – Seismic hazard study for the Swiss nuclear power plant sites.

PSI – Paul Scherrer Institute, Villigen, Canton Aargau.

RWMC – Radioactive Waste Management Funding and Research Center, Japan.

SF/HLW – Spent fuel/high-level waste.

SKB – Svensk Kärnbränslehantering AB, Sweden.

TRU – Transuranic waste.

TÜV – Technical Inspection Association, Germany.

ZWILAG – Zwischenlager Würenlingen AG; centralised interim storage facility of the Swiss utilities for all categories of radioactive waste.



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