

Annual Report 2002

nagra



Die Schweiz hat radioaktiven Abfall.
Wir kümmern uns darum.
NAGRA. Wer sonst.

Developments and activities in 2002

Organisation of Nagra

Year-end closure – annual accounts 2002

Impressum

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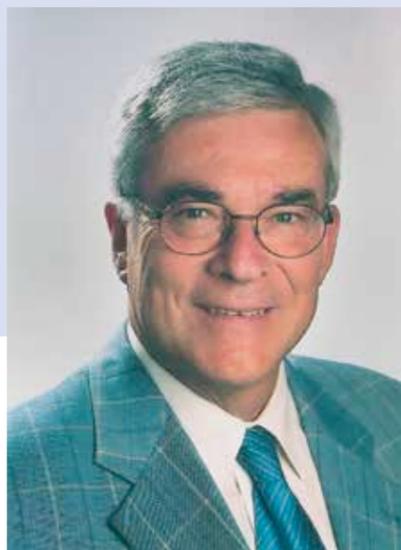
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Cover picture: In 2002, Nagra visited the cities of Berne, Zürich, Basel, St. Gallen, Winterthur, Lausanne and Geneva with a mobile exhibition.
(Photo: Nagra)

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Hans Issler, President.



Foreword

The most significant event of the year 2002 was the submission of the "Entsorgungsnachweis" Project (demonstration of disposal feasibility) for high-level waste. The extensive technical Project documentation was handed to the federal authorities on 20th December. The reports demonstrate how deep geological disposal could be implemented, which sedimentary layers in Northern Switzerland would come into question for construction of a repository and the extent to which reliable statements can be made today regarding long-term safety. The federal authorities will now review the reports; this will be followed by an opportunity for public inspection of the documentation (together with the reviews), with a decision by the Federal Council on future procedure expected some time in the year 2006. In the coming years, it is foreseen that there will be broad socio-political discussion on the status and realisation of waste management activities.

Following the negative result of the popular referendum in Canton Nidwalden, the concept for disposal of low- and intermediate-level waste will have to be re-thought and a new site selection procedure initiated. The technical background for this work already exists to a large extent, but procedural steps will have to be brought into line with the requirements set out in the new Nuclear Energy Law. Our aim is to propose a targeted waste management programme for all types of radioactive waste to the Federal Council by the year 2005.

International collaboration activities continued at Nagra's Grimsel Test Site; the experiment programmes in the rock laboratory have already been ongoing for more than 15 years and preparations are underway for a further

10-year research phase. Nagra is also a partner in the international research project at Mont Terri (Canton Jura). This work complements the investigations of the Opalinus Clay being carried out in the potential siting area in the Zürcher Weinland.

As a recognised competence centre, we have again provided a wide range of expert services to the Members of our Cooperative and to third parties, in addition to working on our national programme.

I would like to take this opportunity of thanking all those involved – particularly Nagra employees – for their committed efforts and outstanding performance over the last year.

- "As an established national competence centre and an internationally recognised partner in the field of nuclear waste management, our aims are:
- To construct, in Switzerland, a deep geological repository for the low- and intermediate-level waste produced by the Swiss nuclear power plants and the Federal Government. The associated planning, capital and operating costs, which are borne by the waste producers, are comparable with costs in foreign programmes.
- To demonstrate the technical feasibility of constructing a deep geological repository for high-level waste in Switzerland. Given that such a facility will be required only several decades from now, and that participation in international disposal solutions is conceivable, we are carrying out the necessary work and securing important know-how at reasonable cost."

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 the fields 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 Government – 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.

The 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/LLW).

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, for 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 provision of information.
- Providing expert services to third parties.



Developments in 2002

Energy policy, legislation, authorities

Legal background

The draft of a new Nuclear Energy Law was the subject of intense discussion in both the National Council and the Council of States. The Law provides the boundary conditions for long-term management of radioactive waste. At the end of the year, there were still important differences between the conclusions of the two chambers. With respect to radioactive waste management, however, the concept of geological disposal was undisputed. The respective areas of competence of the Federal Government and the Cantons was still a matter of disagreement.

The Expert Group on Disposal Concepts for Radioactive Waste (EKRA) published its second report on waste management strategy in autumn. The report concludes that improvement is necessary with respect to the legal, financial and organisational boundary conditions. Some of the Group's recommendations have been considered in the discussions surrounding the Nuclear Energy Law.

In a final vote on 14th December 2002, both chambers recommended rejecting the two popular initiatives

“Strom ohne Atom” (phasing out of nuclear energy) and “Moratorium plus” (further moratorium on construction of new nuclear power plants). The 18th of May 2003 has been set by the Federal Government as the date for the referendum on the initiatives.

Waste management and decommissioning funds

As confirmed by the annual accounts for the year 2001, accumulation of funds for waste management and for the decommissioning of the nuclear power plants is financially on course. The funds were established to cover the costs of managing radioactive waste and spent fuel and for decommissioning of nuclear facilities after their operating lifetime.

Popular initiative in Canton Zürich

The cantonal popular initiative entitled “Atomfragen vors Volk” (right of the people to vote on nuclear issues) was submitted to the authorities on 11th March 2002, with around 15,000 signatures. The initiative demands that cantonal concessions for underground disposal of radioactive waste and for associated preparatory mea-

asures requiring a licence should be subject to a popular referendum. An earlier private initiative with similar content was rejected by a large majority of the Cantonal Council in 2001.

International progress

While there are already a number of repositories in operation world-wide for low- and intermediate-level waste, recent years have also seen important policy decisions being made regarding construction of repositories for spent fuel and high-level waste. In July 2002, the American Parliament upheld the previous decision of the President, voted against a veto of the Federal State of Nevada and designated Yucca Mountain as the site for a geological repository for spent fuel and high-level waste. The next step, in 2004, will be to submit an application for a construction permit to the nuclear licensing authority. Construction is expected to start in 2005 at the earliest. In Finland, the Government and Parliament had already made a decision in 2001 regarding construction of a repository for spent fuel at Olkiluoto. In 2002, the Finnish Parliament also decided in favour of constructing a fifth nuclear reactor.



Radioactive materials

As a basis for the Opalinus Clay Project (see page 11), a detailed model waste inventory and a volume framework were generated for expected future waste arisings. The results are summarised in a reference report which will be published in 2003.

Services for the waste producers focused on maintaining and further developing the central waste data inventory, which currently includes around 20,000 waste packages originating from the Swiss nuclear power plants. The database also integrates the results of radiological inventory studies and checking of waste products carried out by TÜV (German technical inspection and services company) and the Paul Scherrer Institute (PSI). The program “Correlation Factors for Radioactive Waste”, which is continually being refined and developed, is used to calculate complete inventories for each waste package. The result is an overview of all wastes that is always up-to-date. One of the key projects in the coming years will be revising the “Model Inventory for Radioactive Materials” (MIRAM), which was last updated in 1994. One significant improvement will be the increased

incorporation of real data. The first calculation modules are already available. A start has been made on updating data on wastes arising from the decommissioning of the nuclear power plants; this work is based on decommissioning studies carried out in 2000/2001.

As part of a contract, a study was carried out on the consequences of different fuel burn-up scenarios in terms of resulting waste volumes and the associated costs of waste disposal. Further contract work related to preparation of waste specifications: for PSI this included documentation of wastes from the hot lab and from the PSI-West accelerator. For Zwiilag, a specification for the waste from the Lucens research reactor was prepared, as well as a comprehensive provisional specification for the incineration and melting plant; this is required for the official clearance for active test operation of the plant. Various waste disposability certification procedures and projects with foreign partner organisations were completed, for example work on setting up an IAEA databank that contains world-wide waste data.

All work and projects were again carried out in close collaboration with the Members of the Nagra Cooperative and various contractors, with particular emphasis being placed on quality assurance procedures.



Wellenberg in Canton Nidwalden. This site had to be abandoned for political reasons.

Comet



GNW

In the run-up to the referendum on the concession for the exploratory drift, the Cooperative for Radioactive Waste Disposal Wellenberg (GNW) provided information to the public at various locations in Canton Nidwalden.

Repository for low- and intermediate-level waste (L/ILW)



Concession for the exploratory drift at Wellenberg

The year of reporting saw a negative decision on the concession application by the Cooperative for Radioactive Waste Disposal Wellenberg (GNW) for construction of an exploratory drift at the Wellenberg site.

The “Kantonale Fachgruppe Wellenberg” (Wellenberg Technical Working Group; KFW) published its report on the site selection procedure on 23rd January 2002. Despite some criticism of the actual procedure itself, the overall result in terms of site selection was found to be appropriate. On 18th March, the administrative court of Canton Nidwalden reached a decision on the objections lodged against the concession for the exploratory drift granted by the Cantonal Council in 2001, rejecting the objections on all points. A report prepared by KFW on the waste inventory for disposal in the Wellenberg repository was submitted to the Canton in June 2002. The conclusion was that, for the purpose of granting the concession, all requirements in terms of waste inventory had been fulfilled. The safety authorities of the Federal

Government and all expert groups involved considered the Wellenberg site as being suitable from the viewpoint of long-term geological safety.

On 22nd September 2002, the people of Canton Nidwalden voted clearly against the concession previously granted by the Cantonal Government, by 57.5%. The application was rejected by all local communities in the Canton, with the exception of the siting community of Wolfenschiessen, which voted 55.6% in favour. The site has therefore been abandoned for political reasons.

Technical activities

In the lead-up to the referendum, technical activities were restricted to ongoing long-term monitoring at the Wellenberg site (groundwater, weather data, seismicity) and to providing input to the work being carried out by KFW.

At the request of KFW, additional work was carried out on the so-called optimisation study submitted by Nagra in June 2001 for particular waste types from the area of responsibility of the Federal Government

(MIR waste); allocation of these wastes to the Wellenberg inventory had been questioned by KFW. The uncertainty related primarily to what waste inventory data were necessary for the granting of the concession and how a process for ongoing optimisation of allocation of wastes to the L/ILW and SF/HLW/ILW repositories could be set up. A consensus was subsequently reached on these questions.

Following the refusal of the concession application, the long-term monitoring was halted and the results documented; preparations were also made for the necessary restoration work in the field and some work was carried out. The weather measurement station at Bettelrüti was completely dismantled by the end of 2002 and the surroundings recultivated. Work also began on removing instrumentation from the exploratory boreholes. Due to weather conditions, however, the majority of the work will only be carried out in spring/summer of 2003.

Continuation of work on the L/ILW project

Following the abandonment of the site-specific Wellenberg project, responsibility for work on the low-/intermediate-level waste project returned from GNW to Nagra. The first step was to initiate a strategic assessment of the situation. The aim now is to submit concrete proposals for future procedure to the Federal Government for their approval; these should be in line with the waste management programme foreseen by the new Nuclear Energy Law. It is planned to submit these proposals in the year 2005.

The necessary interim storage capacity for L/ILW is assured.



Comzet



The central and northern part of the Zürcher Weinland. Left: part of the village of Marthalen; Centre: Rudolfingen (below) and Benken (above).

Disposal of spent fuel (SF), high-level waste (HLW) and long-lived intermediate-level waste (ILW)

Entsorgungsnachweis Project submitted

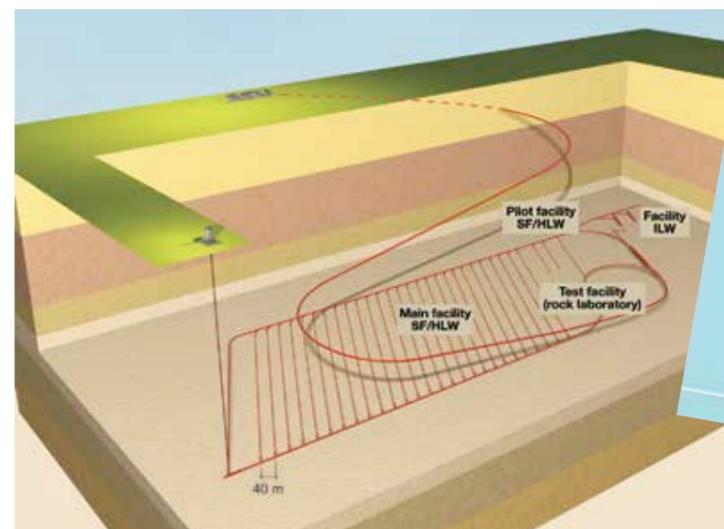
The most significant event of the year 2002 was the submission of the Entsorgungsnachweis Project to the Federal Government. On 20th December 2002, the documentation was delivered to the federal authorities and the public was informed of events by media releases issued by Nagra and the Federal Office of Energy. The Entsorgungsnachweis – or demonstration of feasibility of disposal – is based on the Opalinus Clay Project. A comprehensive overview of the Project has been published in the form of a brochure and can be found on Nagra's website (www.nagra.ch).

With submission of the Project documentation, Nagra has fulfilled a condition attached by the Federal Government to its decision on Project Gewähr in 1988, namely that

a demonstration of siting feasibility be provided for high-level waste disposal and that research be extended to cover sedimentary formations.

Focus on the safety of deep geological disposal

The aim of the Entsorgungsnachweis is to investigate and demonstrate the feasibility and safety of deep geological disposal of spent fuel, vitrified high-level waste and long-lived intermediate-level waste (SF/HLW/ILW) in Switzerland. In this sense, it serves as a foundation on which the Federal Government will base its decision on the future of the programme. In addition, the Project provides the necessary background for planning future waste management activities, including estimating the costs to be covered by the waste management fund. Not least, it provides the framework for in-depth social dialogue on waste management issues.



Schematic illustration of the deep geological repository for SF/HLW/ILW in Opalinus Clay.



The three main reports of the Entsorgungsnachweis Project.

Transparent approach

Following the decision of the Federal Government that sediments should be considered as potential host rocks, and following a broadly based, stepwise evaluation procedure in which the number of potential sites and host rocks was successively narrowed down, the Opalinus Clay was finally identified in 1994 as the priority sedimentary host rock option and the Zürcher Weinland as the first priority investigation area. The selection was based on safety considerations and proceeded in close cooperation with, and with the agreement of, the federal authorities and their technical experts. The public was regularly informed of the planned investigations and all results, including the justification behind the narrowing-down procedure, were published openly. The Swiss licensing procedure for "preparatory measures", which stipulates two occasions for publishing the application documentation together with the associated opinion of the authorities, also provided interested parties with the opportunity to bring their views formally into the procedure.

The potential siting area in the Zürcher Weinland lies close to the border with Germany. For understandable reasons, German communities and districts in the vicinity called for an independent review, by German experts, of the Swiss selection procedure. One question to be looked at in particular was whether proximity to the border could actually have been a ground for selecting the region in the Zürcher Weinland. The "German-Swiss Commission for the Safety of Nuclear Installations" (DSK) requested the group AkEnd (German working group on selection procedures for disposal sites) to carry out the review. This group of experts, with a wide spectrum of political backgrounds, was commissioned by the Federal Ministry of the Environment in Berlin to develop a systematic site selection procedure for Germany. Its report on the Swiss procedure should be published at the beginning of 2003.

Further options

As part of the selection procedure, reserve areas were identified for the Opalinus Clay host rock option and for the reserve sediment option Lower

Freshwater Molasse. The potential for deep disposal in the crystalline basement of Northern Switzerland was documented in 1996 and the evaluation of this project by the federal authorities is almost complete.

Opalinus Clay Project

After 1994, the Opalinus Clay host rock and the investigation area in the Zürcher Weinland were characterised in detail using seismic measurements and a deep borehole; these activities were complemented by investigations conducted as part of the international research programme in the Mont Terri Rock Laboratory (Canton Jura).

The Opalinus Clay Project is based on the results of these investigations, as well as on other materials compiled by Nagra during the course of the last 20 years. The Project documentation comprises a synthesis of the geological investigations (geosynthesis), an engineering study and a safety assessment report. The disposal concept formulated for the potential siting area in the Zürcher Weinland is used as a basis for showing that the safe, long-term disposal of SF/HLW/ILW in a deep repository is feasible.

Evaluation of the suitability of the Opalinus Clay in the Zürcher Weinland is based on data from the Benken borehole, seismic measurement campaigns and experiments in the Mont Terri Rock Laboratory (also located in Opalinus Clay).



Based on the results of the Opalinus Clay Project and the systematic site selection procedure, Nagra is requesting the Federal Government

- to acknowledge fulfilment of the conditions attached to the findings on Project Gewähr of 3rd June 1988 and to confirm that feasibility of disposal has been demonstrated,
- to agree to focusing future investigations on the disposal of spent fuel, vitrified high-level waste and long-lived intermediate-level waste in Switzerland on the Opalinus Clay and the potential siting area in the Zürcher Weinland.

Review by the safety authorities and international experts

According to an estimate by the federal authorities, the detailed technical review of the Project documentation by the authorities and their experts will take around two years. A review by international experts of the NEA/OECD is foreseen for 2003.

Decision by the Federal Government

Following the technical reviews, it is planned to publish the Project doc-

umentation, together with the evaluation of the Swiss Federal Nuclear Safety Inspectorate (HSK) and the opinion of the Federal Commission for the Safety of Nuclear Installations (KSA). This will provide the Cantons, local communities and interested parties with an opportunity to express their views on the Entsorgungsnachweis and on future procedure. A decision by the Federal Government is expected from the year 2006.

Timetable

At several meetings held during the course of 2002, the Federal Inter-agency Working Group on Nuclear Waste Management (AGNEB) considered the technical aspects of the time plan for disposal of SF/HLW/ILW. The key step for realising such a project in Switzerland would be the granting of a general licence by the Federal Council, which then has to be ratified by Parliament. Such a decision, which would also specify the selected site, is not expected before the year 2020. Based on technical and economic considerations, the start of operation of a deep repository from the middle of the century would seem to be reasonable.

Scientific and technical activities

Scientific and technical work in 2002 focused on preparing the three reports that make up the documentation of the Opalinus Clay Project (geosynthesis, safety report, engineering study). The reports will be made available to the public in the first quarter of 2003.

Geosynthesis

As part of a close interdisciplinary collaboration, the geological datasets for the safety assessment and for the engineering studies were finalised. A technical review of key aspects of the properties of the Opalinus Clay was carried out, with participation of international experts.

Safety assessment

Over the course of the years, the safety analysis methodology has been refined based on state-of-the-art scientific and technical progress and all calculation tools, models, geochemical databanks, waste data, etc. have been continuously updated. In 2002, these materials were once again subject to external review and calculations were carried out using

definitive datasets. The results and conclusions of the analyses are documented in a comprehensive safety report.

Engineering study

The report on the facilities and operation concept was reviewed and subsequently revised. Although realisation of a repository for SF/HLW/ILW in Switzerland still lies several decades in the future, the engineering feasibility of the underground facilities is presented, as well as aspects of operational safety. The surface facilities are also described.

As a scientific-technical competence centre, Nagra has demonstrated with the Entsorgungsnachweis Project for a deep geological repository in the Opalinus Clay of the Zürcher Weinland that

- a high standard of safety can be assured (safety demonstration)
- construction, operation and closure of the repository can be realised in a reliable manner (demonstration of engineering feasibility) and
- the host rock in the potential siting area has a sufficient extent (siting demonstration).

These conclusions do not rule out the possibility that a safe repository can be constructed in other areas, be it in Opalinus Clay in another area or in another host rock.

The arguments leading to the proposal to focus future activities on the Opalinus Clay in the potential siting area in the Zürcher Weinland are justified.

Nagra has worked closely with the Paul Scherrer Institute (PSI) for many years. In the foreground are the facilities of PSI-East, which are linked by a bridge over the River Aare with PSI-West.



Comet

Technical background

In 2002, the focus once again was on project-specific studies for the HLW programme. Most of the work described in the following paragraphs was carried out as part of the long-standing and successful collaboration with the Waste Management Laboratory (LES) of PSI, as part of which Nagra bears 50 percent of the costs of research. Some of the work is being carried out as joint projects as part of the European Union's Fifth Framework Research Programme (see page 19). Once again, the collaboration with PSI delivered many important results in 2002 and this opportunity is taken of thanking those involved in the research for their valuable cooperation.

Radionuclide transport modelling at PSI

Transport calculations were carried out as part of the safety analyses of the Entsorgungsnachweis for SF/HLW/ILW. The potential impact of future glaciation events on radionuclide transport in the Opalinus Clay was investigated and modelled. The isotope distributions (profiles) measured in water samples collected in the Benken borehole were also

analysed in more detail and the pore structure and condition of the pore-water were investigated. The results of field experiments at Mont Terri and laboratory measurements on drill-cores provided a new understanding of diffusion in different types of pore spaces. A program developed at PSI was used to analyse the results of the experiment "Hyperalkaline Plume in Fractured Rocks" (HPF), which was carried out at the Grimsel Test Site.

Laboratory studies, geochemical models and databases (work at PSI)

As a basis for the Entsorgungsnachweis safety analysis, the geochemical databases for thermodynamics and sorption and solubility values in cement, bentonite and Opalinus Clay were checked for consistency and then completed and documented. An extensive series of measurements and build-up of valuable know-how have led to an end-result in the form of a high-quality basis for calculating key chemical processes occurring in geological repositories.

The technical know-how that has been built up is also applied interna-

tionally through PSI's participation in the NEA "Thermochemical Database" project; under PSI's leadership, a book is being prepared on organic ligands. Sorption measurements for radionuclides such as caesium and uranium on clay minerals were continued and complemented using spectroscopic methods such as X-ray absorption. Modelling of radionuclide sorption on clays and bentonite represents an important area of work and PSI continues to be involved in an associated NEA project. In the laboratory, diffusion measurements were carried out on Opalinus Clay samples both parallel and perpendicular to the bedding. Associated field experiments are being carried out at the Mont Terri Rock Laboratory. Besides the sorption measurements mentioned above, it is also important to understand diffusion, in order to evaluate radionuclide transport through the Opalinus Clay. Further sorption measurements were carried out for cement and cement minerals and co-precipitation phenomena were investigated. These studies serve mainly to clarify the retention properties of the cement barrier for radionuclides in geological repositories for ILW and L/ILW.



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The Maqarin natural analogue in Jordan. Here, the effects of naturally highly alkaline groundwaters on the rock are being investigated.

Analogue studies

The safety of geological disposal has to be assured over very long timescales. This long-term safety has to be confirmed by safety analyses. The basis for these analyses is a sufficient understanding of the behaviour of disposal systems, which is obtained inter alia by analogue studies. These studies are based on the fact that, in nature, processes occur that are similar to those in a deep geological repository. Compared with short-term laboratory experiments, processes can be studied that have occurred over thousands of years.

The experiments on degradation of cellulose in a cementitious environment are continuing with the financial support of Nirex (UK) and SKB (Sweden).

Engineered barriers

Practically all the work on the engineered barriers has continued as part of EU projects (see list on page 21), with the following themes: Engineered barriers in the Opalinus Clay (EU project EB) and in granite (EU project FEBEX), bentonite (EU project BENIPA), gas release (EU project GASNET), long-term behaviour of spent fuel elements (EU project SFS) and vitrified high-level waste (EU project GLASTAB) and the effect of hyperalkaline waters (high-pH plumes) on clay barriers (EU project ECOCLAY).

Analogue studies

The focus of analogue studies was once again on the Maqarin project in Jordan, in which – besides Nagra – Andra (France), Nirex (UK), the CEA (France), SKB (Sweden) and JNC (Japan) participate. The project is looking at the influence of natural, highly alkaline waters on fractured

clayey limestones and is an analogue for the effects of cement porewaters on the host rock in the vicinity of a L/ILW or ILW repository.

Work on ongoing projects at the Grimsel Test Site and the Mont Terri Rock Laboratory.



Phase V projects at the Grimsel Test Site

CRR	Colloid and Radionuclide Retardation
CTN	Conclusions on the Tunnel Near-Field (desk study)
EFP	Effective Parameters
FEBEX	Full-scale Engineered Barrier Experiment
FOM	Fibre-Optic Sensing Systems Operational Safety Monitoring
GAM	Gas Migration in Shear Zones
GMT	Gas Migration Test in the EBS and Geosphere
HPF	Hyperalkaline Plume in Fractured Rock

Rock laboratories

Grimsel Test Site (GTS)

For more than 15 years, the rock laboratory operated by Nagra in the crystalline rock of the Grimsel area has been a centre for international collaboration on research into the safe disposal of radioactive waste. A total of 18 partner organisations from 10 countries, as well as numerous universities and research institutes from Switzerland and abroad, are involved in the ongoing experiment programmes. The European Union (EU) and the Federal Office for Education and Science (BBW) support the FEBEX project.

Phase V projects (1997 – 2004)

During the course of 2002, significant milestones were reached in the Phase V investigation programme. The background and objectives of all the projects are presented on the website www.grimsel.com. Seven of the projects extend over several years and, besides the actual field investigations, include extensive laboratory and modelling studies.

In the CRR project (see box on next page for explanation of abbreviations), a range of individual field and

laboratory experiments were carried out to determine the effects of colloids on the transport of radionuclides through the geological barrier. The field work was completed with a major experiment in summer 2002. The HPF project is looking at the migration of cement waters from a geological repository, the reactions of these waters with the host rock and the influence on retention of radionuclides. Following a monitored heating and saturation phase extending over 6 years, partial excavation began in the large-scale FEBEX waste emplacement experiment. The excavation will provide a direct view into the engineered barrier system. The large-scale GMT experiment aims primarily to measure and interpret gas transport through the engineered barriers. The actual gas migration tests began in December and will extend over a period of around eight months. In the EFP experiment, fracture systems in existing boreholes were investigated using a range of hydraulic and geophysical methods, to provide further input for upscaling hydrogeological model calculations. The field experiments were completed in summer. The GAM

project applied a range of novel and innovative measurement techniques to characterise the flow-paths of water and gas in fractured rock. New technologies to be used for long-term monitoring in geological repositories are being optimised as part of a number of projects. Specifically aimed at further development and testing of new methods in this area is the FOM project, in which fibre-optic systems are used as an alternative to conventional sensors.

Phase VI (2003-2013)

Although some of the Phase V projects will continue into 2004, intensive efforts are already underway on preparing for the new investigation phase. In May 2002, an international workshop was held with representatives from 11 countries; on this occasion the new concept and the planned direction of the research for Phase VI were discussed. During the course of the year, some ideas for projects were developed further – in collaboration with partner organisations – into concrete proposals. Phase VI will focus on projects that increase the understanding of the barrier systems of geological repos-

itories. The opportunity will also be taken to investigate the transport behaviour of radionuclides directly using in situ experiments at the GTS.

Mont Terri Rock Laboratory (FMT)

The research programme at the international Mont Terri Rock Laboratory at St-Ursanne (Canton Jura) has been running for seven years. The project is managed by the Federal Office for Water and Geology (FOWG), which is also responsible for the operation of the Laboratory. Canton Jura supports the project through its "Commission de Suivi". A total of 11 organisations from six countries (Belgium, Germany, France, Japan, Switzerland and Spain) participate in the wide-ranging research programme; the European Union and the Swiss Federal Office for Education and Science (BBW) also co-finance some projects.

In 2002, Nagra was involved in 13 out of a total of 22 experiments, four of which were conducted as part of the EU Fifth Framework Programme (Engineered Barrier Emplacement Experiment, Heater Experiment, Self-Sealing Experiment and Venti-

lation Experiment). The application by FOWG for a licence for Phase 8 was granted by the authorities of Canton Jura on the basis of existing contractual agreements. The terms of the licence include the possibility to use radioactive tracers (radiotracers) in long-term diffusion experiments in the Opalinus Clay. The focus of Nagra's work at Mont Terri was on synthesis studies in the areas of geochemistry, hydrogeology (including material transport) and rock mechanics. This work complements Nagra's investigations on Opalinus Clay in the potential siting area in the Zürcher Weinland.

In parallel with the ongoing work, steps were taken at the end of the year by FOWG in collaboration with the project partners and other interested parties towards setting up a long-term research programme extending over five to ten years. Of the several dozen proposals that were submitted, the project partners will identify the geoscientific issues that are relevant for them during 2003 and will draw up experiment programmes for future project phases.

An overview of ongoing work can be found at www.mont-terri.ch.



Comet

On behalf of the Japanese organisation RWMC (Radioactive Waste Management Funding and Research Center), Nagra is carrying out the Gas Migration Test (GMT) at the Grimsel Test Site.

Expert services

International services and projects

Nagra's 30 years of experience in the waste management field has proved to be valuable for other national waste management programmes, as well as for technical applications outside the nuclear area. This gives Nagra the opportunity to advise various foreign organisations (mainly in the Far East) and to support them through targeted research and development work. Partners in the Swiss network, for example the Paul Scherrer Institute (PSI) and the University of Bern, are also involved in this work. The Grimsel Test Site serves as a focal point for international projects.

The majority of direct contract work in 2002 came from Japan, with many projects being carried out together with Nagra's partner organisation Obayashi Corporation. These activities are complemented by joint projects carried out as part of the various bilateral agreements with Criepi, JNC, JNFL, Numo and RWMC (for abbreviations see page 42). The themes of workshops held during the year included information management in the area of site characterisation,

development of concepts for HLW repositories, the use of multi-attribute analysis (MAA) in site comparison exercises and characterisation and prediction of tectonic processes. Projects are also being conducted on the current status of work in specific topical areas, for example the application of natural analogues.

The search for volunteer sites for a HLW repository initiated by Numo involves particular technical challenges, which can perhaps best be addressed by modification of existing repository designs or development of alternative repository concepts. Nagra's results and experience are in great demand in this area. A further project involves evaluating the practicability and safety of remote handling procedures; in these studies the emphasis is on quality assurance during installation of the engineered barrier system.

An important aspect of general research activities is the support provided to JNC in its rock laboratory programme, which foresees parallel development of two underground facilities (Mizunami in crystalline rock

and Horonobe in sediments). Other projects with JNC are also being continued, for example preparation of waste inventories, natural analogue studies in Tono and Maqarin, studies on disposal of long-lived intermediate-level waste and joint development of geochemical databases.

Within Europe, Nagra has carried out a range of small projects for nuclear waste management organisations in Germany, Italy, Sweden, the UK and the Slovak Republic. Support was provided in the area of documentation to the Association for Regional and International Underground Storage (ARIUS) that was set up in February 2002. Nagra's geoscientific know-how was also applied in non-nuclear projects in Austria and Switzerland.

Work for Members of the Cooperative

The PEGASOS seismic hazard study for the Swiss NPP sites continued according to plan. The methodological approach used in PSHA (Probabilistic Seismic Hazard Analysis) involves provision of input data by experts and expert groups who have the task of integrating the entire

spectrum of opinion of the technical community. In 2002, models were prepared of seismic sources, attenuation (decrease in seismic energy with distance from source) and site-specific effects (strengthening or weakening as a result of near-surface geology). The associated uncertainties are determined quantitatively by parameter distributions or multiple alternatives. Workshops were held to prepare the experts for their task, before they started to prepare a first version of their models; this work is carried out in a stepwise manner, based on an extensive project databank and numerous relevant studies. The first sensitivity calculations at the beginning of 2003 will show to what extent the individual modelling assumptions have an impact on the estimated seismic hazard at the four NPP sites. Following a final possibility for revision, the definitive input data for the hazard calculations will be released.

Review of disposal costs

To secure the financing of waste management activities, the NPP operators set aside financial reserves, the amount of which is derived

from estimated disposal costs. The estimate of waste disposal costs was last reviewed and updated in 2001. Following the abandonment of Wellenberg as a potential site for a L/ILW repository, the costs will require to be re-evaluated once a new waste management plan has been formulated. A first assessment of the situation has led to the conclusion that, for the case of a new disposal site, greater reserves would not require to be set aside. The early phases of the selection procedure for L/ILW sites are now more than two decades in the past. For the new beginning that will now be necessary, it will not be possible to simply fall back on the procedure from before; new information acquired in the meantime will have to be assimilated. There is a potential for optimisation through targeted application of technical information and experience acquired in the interim, whereby the same high requirements in terms of safety still apply.

In 2002, HSK began a review of the 2001 cost estimate at the request of the "Cost Committee of the waste management fund". Nagra has made the necessary supporting information available.

Excavation of the first heater as part of the large-scale FEBEX experiment at the Grimsel Test Site. This experiment is being run as an EU project and is managed by Enresa of Spain.



Comet

Titles of the different European Union projects

BENIPA	Bentonite Barriers in Integrated Performance Assessments
COMPAS	Comparison of Alternative Waste Management Strategies for Long-lived Radioactive Wastes
CROP	Cluster Repository Project – A Basis for Evaluating and Developing Concepts of 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
ESDRED	Development and Testing of Disposal Concepts and Technologies in Underground Research Laboratories
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
GEODISNET	Sustainable Integration of European Research in the Geological Disposal of Radioactive Waste
GLASTAB	Long-Term Behavior 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
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
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



International collaboration

A regular exchange of information takes place within the framework of various bilateral agreements between Nagra and foreign waste management organisations. Joint projects are also carried out with some partners. These are either multilateral (e.g. as part of rock laboratory programmes), or are carried out together with international organisations (particularly the NEA and the EU). In 2002, joint research work continued in the Grimsel and Mont Terri rock laboratories in Switzerland and in Äspö in Sweden. Nagra staff were also involved in work at Andra's Bure facility. Joint laboratory projects (e.g. GAMBIT on gas migration through bentonite) and model development studies also continued, as did projects carried out within the NEA on sorption and thermodynamic databanks. Nagra's participation in the EU's research programmes has now become an important aspect of its research and development activities.

Beyond the wide range of specific joint activities, Nagra is also represented in various working groups of the international organisation NEA/OECD.

Nagra is also a member of EDRAM (International Association for Environmentally Safe Disposal of Radioactive Materials). The Association was formed by organisations responsible for waste management from the USA, Canada, the UK, Sweden, Finland, France, Belgium, Germany, Spain and Japan. The aim is to exchange information and experience among the members.

As in previous years, Nagra staff also attended key meetings on the topic of waste management and Nagra representatives were invited to make presentations on a range of topics.

Nagra also participated in 2002 in the annual meeting of Working Group 4 of the German-Swiss Commission for the Safety of Nuclear Installations (DSK); the meeting was held in Switzerland.

Participation in the Framework Programmes of the European Union (Euratom/nuclear fission)

Participation in the Framework Research Programmes of the EU allows Nagra to further build on its technical know-how and to have an active influence on important developments in the field. This international collaboration is also important from a public relations point of view, as it shows that the research being carried out in Switzerland is in line with work being carried out in other countries and thus corresponds to the state-of-the-art in science and technology.

The contractual provisions that apply between Switzerland and the EU specify that Swiss project partners will receive their financial contributions towards research via the Swiss Federal Office for Education and Science (BBW), rather than through the European Commission.

Fifth Framework Programme (1998 – 2002)

The first project with Nagra participation in the Fifth Framework Programme – the SPIN project (Testing

of Safety and Performance Indicators) – was completed according to schedule at the end of October 2002, with submission of the final project report to the EU Commission. The contractual dealings between the project partners (including Nagra) and the EU Commission for the last project to be submitted (NET.EXCEL, Network of Excellence in Nuclear Waste Management) have been completed successfully.

Sixth Framework Programme (2002 – 2006)

Based on the announcement and work programme for 2003, European waste management organisations – including Nagra – have decided to develop the following "Expressions of Interest" into concrete project proposals and to submit them to the EU Commission:

- GEODISNET, "Sustainable Integration of European Research in the Geological Disposal of Radioactive Waste" (Network of Excellence, coordinator SKB, Sweden).
- 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" (Integrated Project, coordinator SCK•CEN, Belgium).

- ESDRED, "Development and Testing of Disposal Concepts and Technologies in Underground Research Laboratories" (Integrated Project, coordinator Andra, France).

The planning and preparation of the project proposals by the involved organisations began at the end of 2002, under the guidance of the designated coordinator in each case.

A concept for setting up a European training centre in Switzerland in the field of radioactive waste management was discussed with various partners. It is planned to establish a responsible organisation in 2003.



Comet

Group tours of the Grimsel Test Site are offered between June and October. A total of 1800 people visited the facility in 2002.



Important steps on the way to safe management of radioactive waste have already been achieved. This was the message of Nagra's 2002 information tour which visited several Swiss cities.

Public relations

In 2002, great significance was attached once again to informing the general public and conducting dialogue with involved organisations and affected population groups.

Information tour 2002

In 2002, Nagra visited the cities of Berne, Zürich, Basel, St. Gallen, Winterthur, Lausanne and Geneva with a mobile information exhibition. Simple messages were used to communicate the fact that key steps on the way to safe management of radioactive waste have already been realised. Media interest was awakened through press conferences, at which politicians and representatives of the energy branch and the authorities were present.

Visits to facilities, exhibitions

Nagra presented its activities and projects at trade fairs in Schaffhausen and Rheinau. Nagra staff were also involved in the campaign leading up to the vote in Nidwalden and conducted tours of the Grimsel Test Site held at the invitation of GNW. Rock laboratories are useful tools for demonstrating the high level of technical understanding in the field of

safe waste management to schools, associations, authorities and journalists. A total of 1800 people visited the Grimsel Test Site in 2002. Around 200 visitors were also welcomed by Nagra at the Mont Terri Rock Laboratory.

In April and May 2002, two information trips to Sweden and Finland were held for politicians and members of the authorities. Repositories for radioactive waste have been operating successfully in these two countries for many years.

Information service, teaching materials

In 2002, a series of media releases accompanied important events. Articles, advertisements and brochures were placed in technical journals covering the areas of the environment, engineering and education. Nagra staff were again available for technical courses at colleges and for questions from journalists, as well as for presentations to interested associations and schools.

Nagra receives inquiries on a daily basis for information materials and

measuring equipment for school lessons, presentations and project studies. The measuring equipment, which includes four "experiment boxes" and around 40 hand-held Geiger-Müller counters, was continuously on loan. The equipment is provided together with instructions and extensive picture material.

Information publications and electronic media (see page 41)

2002 saw the publication of two issues of "nagra News". One "nagra Bulletin" – the series that is more technically orientated – appeared on the subject of rock laboratories. The submission of the Entsorgungsnachweis Project in December 2002 was marked by publication of a 24-page summary overview of the Opalinus Clay Project.

The video on natural analogues – "Traces of the Future" – was produced as a DVD (presently in German only). A DVD is also being produced on the facilities and operation concept for a geological repository constructed in Opalinus Clay; this will be available at the beginning of 2003.

Nagra's website (www.nagra.ch) was also reworked in 2002 and additional topics included. The site was translated into French at the end of the year and is now available in three languages (French, German and English).

Documentation centre and translation service

Nagra has a documentation centre (Info-Centre) that works together with many external libraries and organisations. The main tasks of the Info-Centre are to maintain an in-house technical library, to archive project documentation and to carry out literature searches. Smooth information flow within Nagra is ensured by an Intranet that is maintained and operated by the documentation centre.

During 2002, translations were made of many of Nagra's own publications (periodicals, brochures, website, etc.). In addition, proof-reading and editing of external documentation was carried out, mainly as contract work for Japanese organisations.

Organisation



The Management Team with (from left) Markus Fritschi, Harald Maxeiner, Ian McKinley, Piet Zuidema and Hans Issler.

Management and headquarters

Management

The ordinary general meeting of the Nagra Cooperative took place in Olten on 20th June 2002. The Members approved the annual report and accounts for 2001. Total expenditure amounted to 30 million CHF, which can be divided as follows: 2.3 million CHF was borne by GNW, 6.2 million CHF by contracts for third parties and 3.1 million CHF by services for individual Members of the Cooperative. This resulted in a net expenditure for the Members of the Cooperative of 18.4 million CHF for the financial year 2001.

On the occasion of the ordinary general meeting, Gisbert Straub (BKW FMB Energie AG) announced his resignation and Hermann Ineichen was elected as the new BKW representative. Mr Straub was elected onto the Board of Management in 1997 and he was thanked for his active contribution to the progress of work over the years.

The Members of the Cooperative approved an amendment to the cost distribution formula. This new distribution is effective from 1st

January 2003 and takes into account the change in thermal output of the Leibstadt power plant.

A storage hall for core material, drilling equipment and exhibition material was purchased in Mellingen (AG).

At a meeting held on 4th December 2002, the Board of Management authorised an outline credit of 19.8 million CHF for research and project work in the year 2003.

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

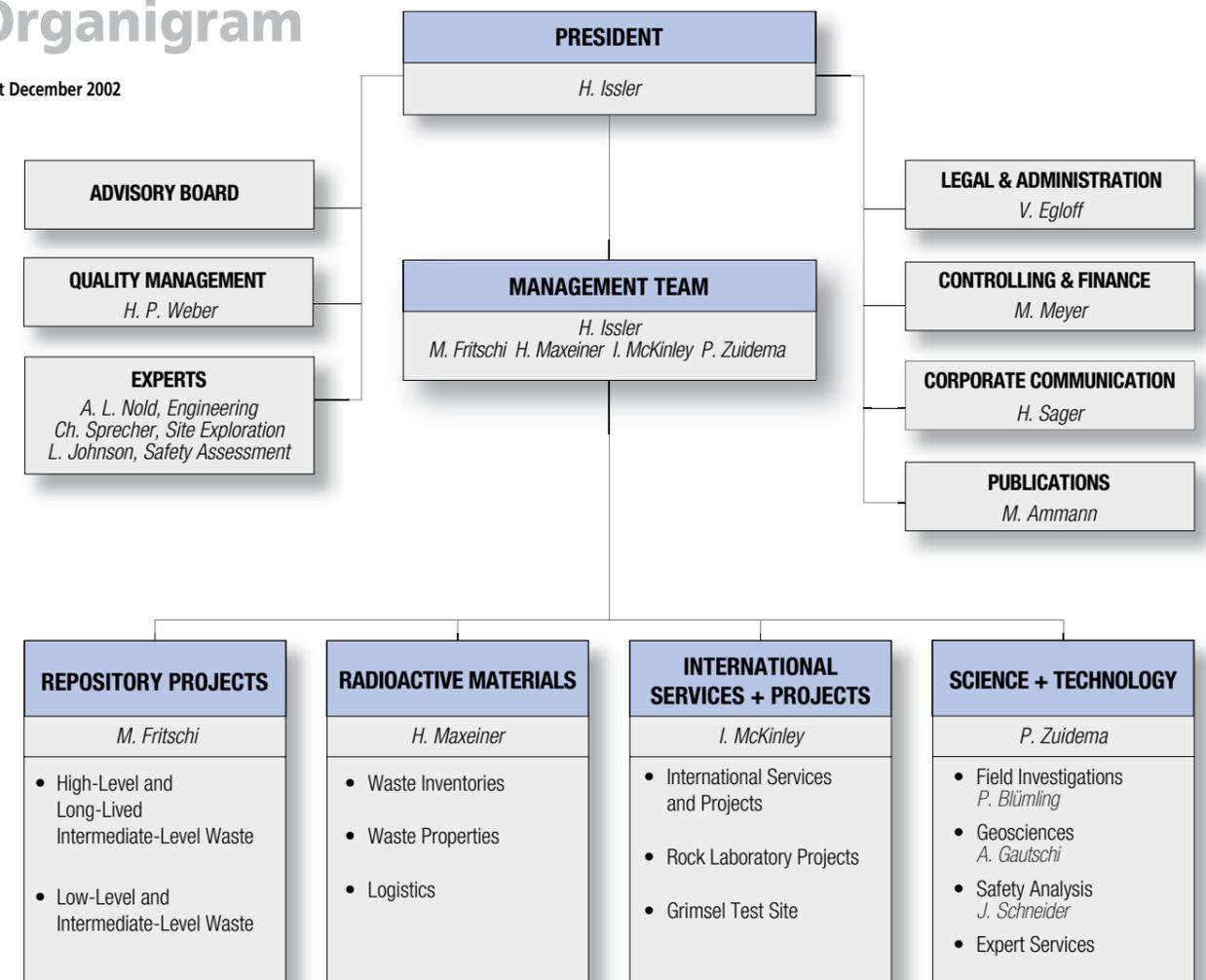
Headquarters

At the end of 2002, 69 people were employed at the Nagra headquarters in Wettingen, corresponding to 63.1 full-time positions (62 in the previous year). In addition, 17 people (corresponding to 8 full-time positions as in the previous year) were employed as advisers, part-time employees, support staff and students. Three people are currently delegated to the GNW project team. 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.

Dr. Emil Kowalski retired at the end of the year. He is thanked for his valuable services in the field of nuclear waste management.

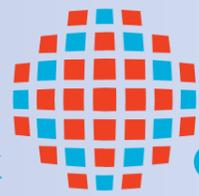
Organigram

31st December 2002

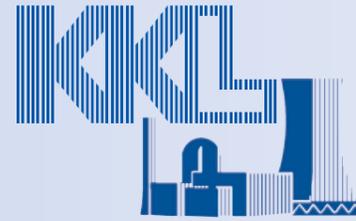




Kernkraftwerk



Gösgen



NOK



The Members of the Nagra Cooperative.



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 2000–2003)

Hans Issler
President
Nagra

Hans Rudolf Gubser
Vice-President,
Nordostschweizerische Kraftwerke

Gisbert Straub
BKW FMB Energie AG
(until 20th June 2002)

Hermann Ineichen
BKW FMB Energie AG
(from 20th June 2002)

Dr. Hans Fuchs
Kernkraftwerk Gösgen-Däniken AG

Dr. Bernard Michaud
Government representative,
Federal Office of Health

Hans Achermann
Kernkraftwerk Leibstadt AG

Jean-Louis Pfaeffli
Energie Ouest Suisse

Technical Committee

Dr. Hans Fuchs
Chairman
Kernkraftwerk Gösgen-Däniken AG

Dr. Jörg Hadermann
Paul Scherrer Institute

Dr. Heinrich Patak
Kernkraftwerk Leibstadt AG

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

Commissions

Finance Commission

Peter Enderli
Chairman
Nordostschweizerische Kraftwerke
(until 20th June 2002)

Thomas Schärer
Chairman
Nordostschweizerische Kraftwerke
(from 20th June 2002)

Kurt Bachmann
Kernkraftwerk Gösgen-Däniken AG

Erich Keller
Bundesamt für Energie

Thomas Gysel
Kernkraftwerk Leibstadt AG

Christian Sahl
BKW FMB Energie AG

Marc Meyer
Nagra

Commission for Legal Issues

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

Dr. Hans Fuchs
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 and Nordostschweizerische
Kraftwerke

Heinz Sager
Nagra

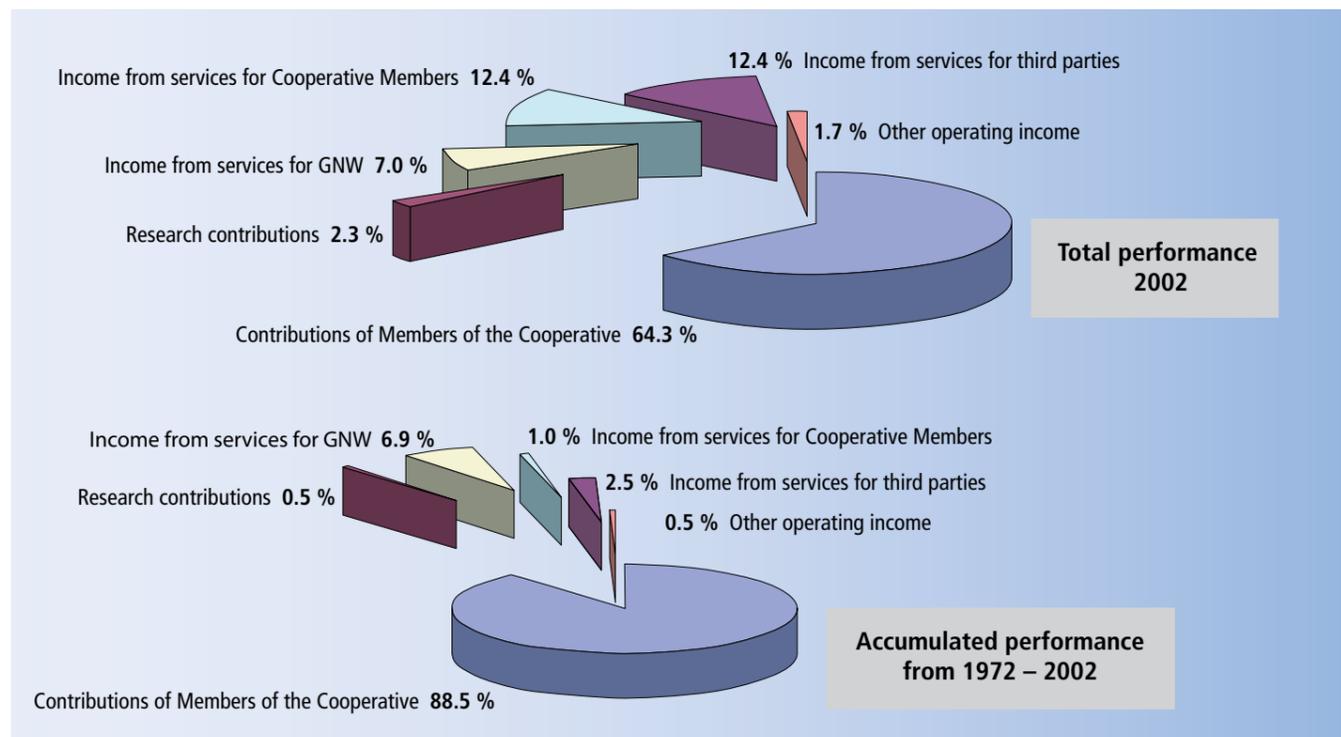
31st December 2002

Auditors

PricewaterhouseCoopers AG, Zürich

Year-end closure – annual accounts 2002





Comments on the annual accounts

In 2002, the gross result was 34.5 million CHF, an increase of 2.6 million CHF compared to the previous year. The contributions of the Members of the Cooperative rose by 5.8 million CHF to 22.2 million CHF.

Other operating income decreased by 2.5 million CHF to 0.6 million CHF. This decrease can be explained by a one-of incoming payment in the previous year of 1.9 million CHF arising from a legal claim.

Taking into account ongoing contracts, income from deliveries and services decreased by 0.8 million CHF to 11.7 million CHF. This reduction is due mainly to the following:

- Research and partner contributions decreased by 0.5 million CHF to 0.8 million CHF, compared to the previous year.
- Services to GNW increased by 0.2 million CHF to 2.4 million CHF.
- Direct contracts for services to Members of the Cooperative increased by 0.9 million CHF. Of a total of 4.3 million CHF, 3.5 million are due to the PEGASOS project alone.

- Taking into account ongoing contracts, services to other third parties decreased by 1.3 million CHF to 4.3 million CHF, compared to the previous year.

Total expenditure increased by a total of around 2.6 million CHF. Documented external expenditure increased by 0.2 million CHF to 15.9 million CHF. Compared with the previous year, personnel costs increased by around 0.5 million CHF or 4 per cent.

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

Wettingen, 14th April 2003

Hans Issler, President

Balance sheet as per 31st December 2002

(p. m. = pro memoria)

	2002 CHF	2001 CHF	Number in Appendix
Assets			
Liquid assets	2 559 554	2 831 919	1
Trade receivables	4 984 429	4 194 526	2
Other receivables	17 664	283 512	
Ongoing contracts	2 158 231	2 705 551	3
Active accruals and deferrals	15 104	–	
Total current assets	9 734 982	10 015 508	
Office furnishings – headquarters	38 000	63 000	
Office furnishings – field offices	p.m.	p.m.	
Vehicles	46 000	12 000	
Drillsite installations	p.m.	p.m.	
Land and buildings	2 727 772	903 379	
Total capital assets	2 811 772	978 379	4
Total assets	12 546 754	10 993 887	
Liabilities			
Trade payables	4 928 315	3 834 392	5
Prepayments	893 836	467 241	3
Other liabilities	33 242	87 178	
Passive accruals and deferrals	4 997 435	5 121 379	6
Provisional reserves	1 573 926	1 363 697	
Total loan capital	12 426 754	10 873 887	
Cooperative capital	120 000	120 000	
Total equity capital	120 000	120 000	
Total liabilities	12 546 754	10 993 887	

Operating accounts 2002

	2002 CHF	2001 CHF	Number in Appendix
Total performance			
Contributions to administration costs	600 000	600 000	
Contributions for project expenditure	26 331 386	20 711 271	
Balancing of income/expenditure excess	-4 765 413	-4 963 633	
Total contributions of Cooperative Members	22 165 973	16 347 638	7
Research contributions	788 575	1 263 002	
Income from services for GNW	2 399 123	2 211 354	
Income from other services for Cooperative Members	4 256 341	3 375 606	
Income from services for third parties	4 808 530	4 278 330	
Total income from deliveries and services	12 252 569	11 128 292	8
Adjustment in balance sheet for ongoing contracts	-547 320	1 350 964	3
Other operating income	579 866	3 051 090	9
Total performance	34 451 088	31 877 984	
Operating expenditure			
External expenditure	15 893 880	15 699 414	10
Personnel costs	10 952 499	10 486 599	
Depreciation of assets	41 232	43 765	
Other operating expenditure	7 417 170	5 723 431	11
Operating expenditure	34 304 781	31 953 209	
Operating profit before interest and taxes	146 307	-75 225	
Financial income	47 745	111 001	
Financial expenditure	-92 839	-34 637	
Taxes	-101 213	-1 139	
Total operating expenditure	34 451 088	31 877 984	

Cash flow statement 2002

	2002 CHF	2001 CHF	Number in Appendix
Change in liquid assets			
Research contributions	788 575	1 263 002	
Income from services for GNW	2 399 123	2 211 354	
Income from other services for Cooperative Members	4 256 341	3 375 606	
Income from services for third parties	4 808 530	4 278 330	
Adjustment in balance sheet for ongoing contracts	-547 320	1 350 964	
Income from third parties including adjustment for ongoing contracts	11 705 249	12 479 256	8
Other operating income	579 866	3 051 090	9
Total income	12 285 115	15 530 346	
Contributions of Cooperative Members	22 165 973	16 347 638	7
Total performance	34 451 088	31 877 984	
External expenditure	-15 893 880	-15 699 414	10
Personnel expenditure	-10 952 499	-10 486 599	
Other operating expenditure	-7 417 170	-5 723 431	11
Result, neutral result, taxes	-146 307	75 225	
Total expenditure (without depreciation)	-34 409 856	-31 834 219	
Cash flow	41 232	43 765	4
Change in receivables	-524 055	-1 293 599	2
Change in ongoing contracts	547 320	-1 350 964	3
Change in active accruals and deferrals	-15 104	550 000	
Change in liabilities	1 466 582	-1 272 694	3, 5
Change in short-term bank loans	-	-	
Change in passive accruals and deferrals	-123 944	3 359 071	6
Change in reserves	210 229	83 276	
Cash flow from company activities	1 602 260	118 855	
Investments in tangible assets	-1 874 625	-10 765	4
Cash flow from investments	-1 874 625	-10 765	
Change in Cooperative capital	-	-	
Cash flow from financing activities	-	-	
Change in liquid assets	-272 365	108 090	1

Accumulated accounts

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

	Status 31.12.2001 CHF	Increase 2002 CHF	Status 31.12.2002 CHF	Number in Appendix
Total performance				
Contributions for administration costs	80 120 000	600 000	80 720 000	
Swiss Confederation	21 318 428	781 737	22 100 165	
BKW FMB Energie AG	73 022 281	2 287 105	75 309 386	
Kernkraftwerk Gösgen-Däniken AG	207 428 996	6 258 773	213 687 769	
Kernkraftwerk Leibstadt AG	223 610 693	7 328 332	230 939 025	
Nordostschweizerische Kraftwerke AG	161 890 779	4 711 806	166 602 585	
Contributions to project expenditure	687 271 177	21 367 753	708 638 930	
Project expenditure still to be covered by Members of Cooperative	–	–	–	
Prepayments of Members of Cooperative for project expenditure	-4 963 633	198 220	4 765 413	
Balancing of income/expenditure excess	-4 963 633	198 220	-4 765 413	
Total contributions of Members of Cooperative	762 427 544	22 165 973	784 593 517	12
Research contributions	4 023 631	788 575	4 812 206	
Income from services for GNW	58 661 176	2 399 123	61 060 299	
Income from other services for Cooperative Members	4 949 381	4 256 341	9 205 722	
Income from services for third parties	14 893 130	4 808 530	19 701 660	
Total income from deliveries and services	82 527 318	12 252 569	94 779 887	13
Adjustment in balance sheet for ongoing contracts	2 705 550	-547 320	2 158 230	14
Other operating income	4 125 763	579 866	4 705 629	15
Total performance of accumulated accounts	851 786 175	34 451 088	886 237 263	

	Status 31.12.2001 CHF	Increase 2002 CHF	Status 31.12.2002 CHF	Number in Appendix
Total expenditure				
Administration costs	70 313 378	600 000	70 913 378	
General project expenditure, contributions	9 806 622	-	9 806 622	
Administration and general project expenditure	80 120 000	600 000	80 720 000	
Generic studies	156 356 521	8 142 267	164 498 788	
Planning of facilities (repository concepts)	17 886 190	530 260	18 416 450	
Geological investigations for site selection	396 080 933	6 131 679	402 212 612	
Experimental programmes (rock labs)	67 541 637	2 603 645	70 145 282	
Public relations, documentation	50 932 977	5 050 161	55 983 138	
Project-related expenditure	688 798 258	22 458 012	711 256 270	16
Total administration, general and project-related expenditure	768 918 258	23 058 012	791 976 270	
Project expenditure for GNW	58 051 623	2 607 133	60 658 756	
Project expenditure for Cooperative Members	5 080 895	4 387 520	9 468 415	
Project expenditure for third parties	19 735 399	4 398 423	24 133 822	
Project-related expenditure from deliveries and services	82 867 917	11 393 076	94 260 993	17
Total expenditure for accumulated accounts	851 786 175	34 451 088	886 237 263	
Expenditure according to repository project				
Low- and intermediate-level waste project	260 058 934	5 225 644	265 284 578	
High-level waste project	428 739 324	17 232 368	445 971 692	
Wellenberg project	58 051 623	2 607 133	60 658 756	
Expenditure in accumulated accounts according to repository project	746 849 881	25 065 145	771 915 026	18



Die Schweiz hat radioaktiven Abfall.
Wir kümmern uns darum.

NAGRA. Wer sonst.

Notes on the annual accounts

1 Liquid assets

- Liquid assets decreased by 0.3 million CHF compared to the previous year. As of 31st December 2002, there were no fixed term deposits.

2 Receivables from deliveries and services

- Receivables from deliveries and services increased by a total of 0.8 million CHF to 5.0 million CHF.
- Receivables from deliveries and services with respect to third parties decreased by 0.5 million CHF to 1.8 million CHF. As before, the largest single debtor is GNW, with 1.2 million CHF (1.8 million CHF in the previous year).
- Under this position, there are also claims against the Members of the Cooperative in the amount of 3.2 million CHF (1.9 million CHF in the previous year). The largest claim relates to Kernkraftwerk Leibstadt AG, with 1.9 million CHF.

3 Ongoing contracts

- Ongoing contracts for third parties decreased compared to the previous year by 0.5 million CHF to 2.2 million CHF.
- Passive prepayments for ongoing contracts now amount to 0.9 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 that is rented up to the middle of the next year.
- Other fixed assets showed a slight increase, due to acquisition of a replacement vehicle and trailer and to depreciation.
- No fixed assets were activated during 2002. Small acquisitions are contained in the position "Other operating expenditure".
- 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 in Mellingen is 2.2 million CHF.

5 Payables from deliveries and services

- Payables from deliveries and services increased during 2002 by around 1.1 million CHF to 4.9 million CHF.
- The position contains liabilities towards Members of the Cooperative in the amount of 0.1 million CHF (same as in previous year).

6 Passive accruals and deferrals

- Passive accruals and deferrals decreased in 2002 by around 0.1 million CHF.

- The balance shown contains liabilities towards Members of the Cooperative of around 4.8 million CHF (5.0 million CHF in the previous year) for claimed project costs that have not been applied.

- Passive accruals and deferrals towards third parties increased by 0.1 million CHF.

7 Contributions of Members of the Cooperative

- Contributions of Members of the Cooperative increased during the year by around 5.8 million CHF and are made up as follows:
 - Administration costs 0.6 million CHF; taxes on nuclear facilities 1.7 million CHF; contribution to project costs 24.6 million CHF. At the end of the year, the latter amount was reduced by 4.8 million CHF (excess demand) to 19.8 million CHF (15.0 million CHF in the previous year).

8 Income from deliveries and services

- Research contributions decreased by 0.5 million CHF to 0.8 million CHF. Services to GNW increased by 0.2 million CHF to 2.4 million CHF.
- Other services to Members of the Cooperative increased by 0.9 million CHF to 4.3 million CHF; around 3.5 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 increased in 2002 by 0.5 million CHF to 4.8 million CHF. Taking into account the decrease in ongoing contracts (for third parties), services to third parties decreased by around 1.3 million CHF compared to the previous year.

9 Other operating income

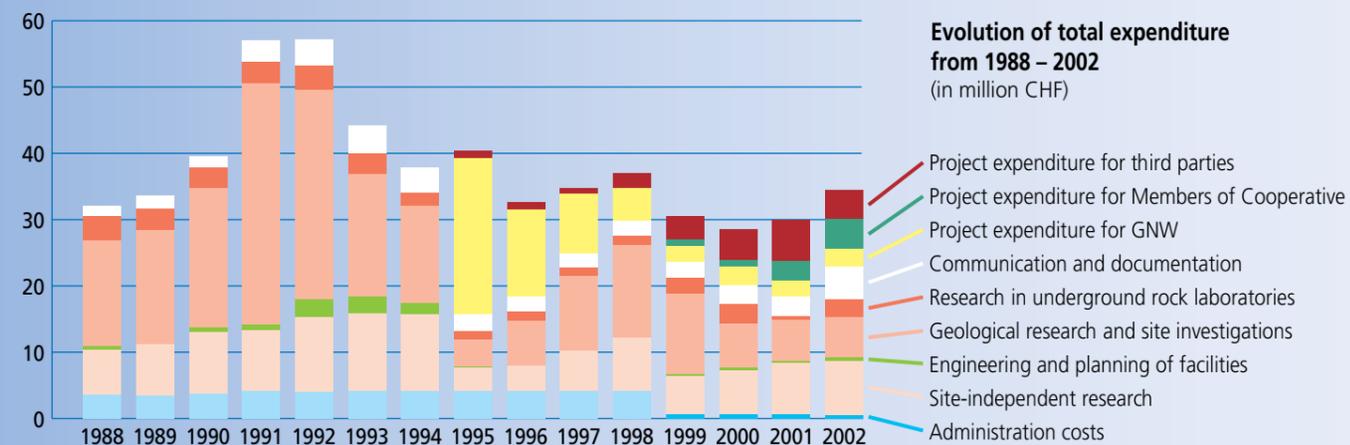
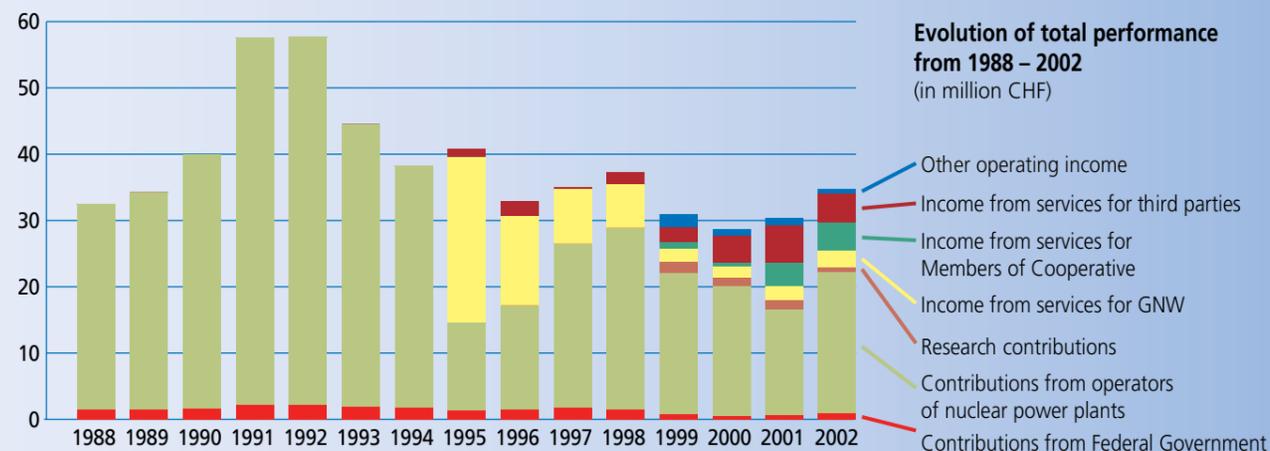
- Other operating income decreased markedly during 2002 by around 2.5 million CHF to 0.6 million CHF. On the one hand, an income of 1.9 million CHF was obtained in the previous year from a pending legal claim. On the other hand, the amount passed on to GNW for taxes on nuclear facilities decreased from 1.0 million CHF to 0.5 million CHF.

10 External expenditure

- External expenditure increased in 2002 by 0.2 million CHF.

11 Other operating expenditure

- Other operating expenditure increased during the year by 1.7 million CHF. Of this, 1.0 million CHF was due to increased expenditure on public relations activities.



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.

12 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 2002, the Members of the Cooperative made gross payments to Nagra in the amount of 26.9 million CHF. Taking into account prepayments by Members of the Cooperative that have not yet been applied in the amount of 4.8 million CHF, this results in contributions of the Members in the total amount of 22.2 million CHF (16.3 million CHF in the previous year).
- Included in this is the contribution to administration costs in the amount of 0.6 million CHF, as well as taxes passed on for nuclear facilities in the amount of 1.7 million CHF.

13 Income from deliveries and services

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

14 Adjustment for ongoing contracts

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

15 Other operating income

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

16 Project-related expenditure

- Project-related expenditure in 2002 amounted to around 22.5 million CHF. These monies were applied as follows:
 - Non-site-specific (generic) studies 8.1 million CHF
 - Planning of facilities 0.5 million CHF
 - Geological investigations for site selection 6.1 million CHF
 - Experimental work (rock laboratories) 2.6 million CHF
 - Public relations and documentation 5.1 million CHF

a) Non-site-specific (generic) studies

Site-independent studies include proportional expenditure on documenting and inventorying radioactive wastes, development of technical disposal concepts, development of safety assessment methodologies and carrying out performance assessments.

b) Planning of facilities

This includes expenditure on the project for a deep geological repository in the Opalinus Clay.

c) Geological investigations for site selection

Geological investigations included studies in the investigation area of Northern Switzerland associated with disposal of high-level waste, analysis of geophysical measurements in the Zürcher Weinland and analysis of the results from the Benken borehole.

d) Experimental work

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

e) Public relations and documentation

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

17 Project-related expenditure from deliveries and services

- This expenditure in the amount of 11.4 million CHF results from contracts included under "Income from deliveries and services" and covers the following positions:
 - Project expenditure for GNW of 2.6 million CHF
 - Project expenditure for Members of the Cooperative of 4.4 million CHF
 - Project expenditure for third parties of 4.4 million CHF, which also contains some expenditure for project costs.

18 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 22.5 million CHF for project-related expenditure, (see note 16), for the year 2002 5.2 million CHF can be assigned to the programme for low- and intermediate-level waste and 17.2 million CHF to the programme for high-level waste. Following the negative decision by Canton Nidwalden, the Wellenberg project will be brought to a close in 2003 and no longer pursued.

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

Als Kontrollstelle haben wir die Buchführung, die Jahresrechnung bestehend aus Bilanz per 31. Dezember 2002, Betriebsrechnung 2002, Mittelflussrechnung 2002 und Anhang zum Jahresabschluss sowie die Geschäftsführung der NAGRA Nationale Genossenschaft für die Lagerung radioaktiver Abfälle für das am 31.12.2002 abgeschlossene Geschäftsjahr geprüft.

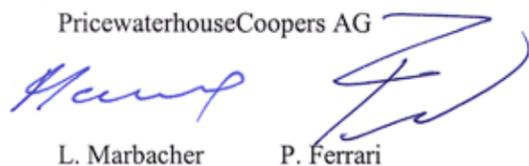
Für die Jahresrechnung und die Geschäftsführung ist die Verwaltung verantwortlich, während unsere Aufgabe darin besteht, die Jahresrechnung und die Geschäftsführung zu prüfen und zu beurteilen. Wir bestätigen, dass wir die Anforderungen hinsichtlich Befähigung und Unabhängigkeit erfüllen.

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



L. Marbacher P. Ferrari

Zürich, 22. April 2003

Nagra Technical Reports (NTBs)

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

NTB 00-10

"SANTA-CHEM – A Nagra-JNC co-developed hyperalkaline water-rock interaction code. Code description and applications"; F. B. Neall, P. A. Smith, H. Owada and M. Mihara; (February 2002), approx. 80 pages. Also available as CD-ROM (PDF format).

NTB 01-04

"Calculations of the Temperature Evolution of a Repository for Spent Fuel, Vitrified High-level Waste and Intermediate Level Waste in Opalinus Clay"; L. H. Johnson, M. Niemeyer, G. Klubertanz, P. Siegel and P. Gribi; (October 2002), approx. 60 pages. Also available as CD-ROM (PDF format).

NTB 01-08

"Porewater chemistry in compacted re-saturated MX-80 bentonite: Physico-chemical characterisation and geochemical modelling"; M. H. Bradbury and B. Baeyens, Paul Scherrer Institute, Villigen PSI; (June 2002), approx. 40 pages.

NTB 02-02

"Projekt Opalinuston – Konzept für die Anlage und den Betrieb eines geologischen Tiefenlagers. Entsorgungsnachweis für abgebrannte Brennelemente, verglaste hochaktive sowie langlebige mittelaktive Abfälle"; (December 2002). Also available as CD-ROM (PDF format).

NTB 02-03

"Projekt Opalinuston – Synthese der geowissenschaftlichen Untersuchungsergebnisse. Entsorgungsnachweis für abgebrannte Brennelemente, verglaste hochaktive sowie langlebige mittelaktive Abfälle"; (December 2002). Also available as CD-ROM (PDF format).

NTB 02-05

"Project Opalinus Clay – Safety Report. Demonstration of disposal feasibility for

spent fuel, vitrified high-level waste and long-lived intermediate-level waste (Entsorgungsnachweis)"; (December 2002). Also available as CD-ROM (PDF format).

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 2002). Also available as CD-ROM (PDF format).

NTB 02-07

"Partitioning of Radionuclides in Swiss Power Reactor Fuels"; L. H. Johnson and D. F. McGinnes; (August 2002), approx. 25 pages. Also available as CD-ROM (PDF format).

NTB 02-10

"Project Opalinus Clay – Radionuclide concentration limits in the near-field of a repository for spent fuel and vitrified high-level waste"; U. Berner, Paul Scherrer Institute, Villigen PSI; (December 2002), approx. 70 pages.

NTB 02-16

"NAGRA/PSI Chemical Thermodynamic Data Base 01/01"; W. Hummel, U. Berner, E. Curti, F. J. Pearson and T. Thorén; (July 2002), approx. 560 pages.

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.

Two issues of "nagra News", in German, French and Italian, appeared during the year:

- "nagra News 8" (June 2002) presents Nagra's national information tour and explains the three steps on the

way to safe, permanent management of radioactive waste.

- "nagra News 9" (December 2002) reports on the refusal of the concession for the exploratory drift at Wellenberg, looks back at the information tour of 2002 and provides information on the work going on at the Grimsel Test Site.

In the "nagra Bulletin" series, which contains more technically orientated articles on nuclear waste management, one issue appeared in German and English:

- "nagra Bulletin 34" on rock laboratories (July 2002). The journal contains an overview article on the role of rock laboratories in waste management programmes and presents the ongoing experiments at the Grimsel Test Site and the Mont Terri Rock Laboratory.

In December, to mark the submission to the federal authorities of the "Entsorgungsnachweis" for spent fuel, vitrified high-level waste and long-lived intermediate-level waste, a 24-page summary overview of the project was produced in German, French and English.

The video on natural analogues produced in 1994 – "Traces of the Future – Lessons from Nature on Safe Waste Disposal" – was produced in German as a DVD.

Glossary

AGNEB – Federal Interagency Working Group on Nuclear Waste Management.

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

ARIUS – Association for Regional and International Underground Storage.

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’Energie Atomique, France.

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

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

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

EDI – Federal Department of Home Affairs.

EDRAM – International Association for Environmentally Safe Disposal of Radioactive Materials.

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

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.

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, Vienna.

ILW – Long-lived intermediate-level waste.

JNC – Japan Nuclear Cycle Development Institute, Tokai (headquarters).

JNFL – Japan Nuclear Fuel Limited, Tokyo.

KFW – Cantonal Technical Working Group Wellenberg.

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.

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

Numo – Nuclear Waste Management Organization of Japan, Tokyo.

Obayashi – Obayashi Corporation, Japan.

OECD – Organisation for Economic Cooperation and Development, Paris.

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.

SCK•CEN – Studiecentrum voor Kernenergie•Centre d’Etude de l’Energie Nucléaire, Belgium.

SF – Spent fuel elements.

SKB – Svensk Kärnbränslehantering AB, Sweden.

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



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