2023 ANNUAL REPORT

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“THE REGION IS INVOLVED IN SHAPING THE PROJECT”

President Lino Guzzella and CEO Matthias Braun look back on the year 2023, on the constructive collaboration with the siting region – and on how Nagra plans to forge ahead.

Almost two years have passed since Nagra announced its siting proposal. It will soon submit the general licence applications. How has this changed Nagra’s work?
Matthias Braun: Our focus has become more local: since the siting proposal, we have directed much of our attention to the Nördlich Lägern region. This change is clearly evident and tangible. We set up an information pavilion in Stadel and have since opened an office there. We drilled in the Haberstal area and expanded the boreholes to include measurement stations for groundwater analysis. We are already working closely with the local authorities and with residents and organisations from Stadel and the surrounding area. In this respect, our day-to-day work has changed significantly.

How does this close collaboration manifest itself?
Lino Guzzella: For one, the tone is constructive. At our dialogue event in Fisibach, different stakeholders – community representatives, the authorities, residents and NGOs – engaged in objective and solution-oriented discussions. I was particularly impressed with the pragmatic approach of the local residents to our collaboration: this makes me optimistic about the next steps. For me, this event was one of the highlights of 2023.
Braun: The region as a whole has shown a great deal of commitment. The communities of Glattfelden, Stadel and Weiach, for example, organised information events. The mayors of the three communities travelled to Finland with us and were able to see first-hand how the Finnish communities deal with their deep geological repository. A new organisation called “STADELaktiv” has been established. It sees itself as a working group consisting of res-

“I was particularly impressed with the pragmatic approach of the local residents to our collaboration.”
Lino Guzzella, President

idents who are committed to a compatible project. The “LoTi” organisation has also been in contact with us, for example, visiting us at the information pavilion or in the Mellingen drill core archive, and asking important and critical questions. The regional conference and its working groups are also engaged in valuable work. Overall, we are in a position to say that the region has assumed the role of an important stakeholder, participates actively and is involved in shaping the project. I am convinced that the commitment of the local residents will improve the repository project.

So the region has become more active and is collaborating well. What else was Nagra working on in the reporting year?
Braun: We have made great progress in preparing the general licence applications. Many members of our staff are putting in a lot of work to make this happen. We are also concretising the repository project and making very good progress there, too.
Guzzella: I am aware that Nagra staff are under significant pressure. Thanks to their notable commitment, we expect to be able to submit the applications on schedule in November 2024. The quality of the reports is very high. That speaks for itself, but that we are also progressing on schedule is something that everyone at Nagra can be proud of and that I, for one, greatly appreciate. Working on the reports is very demanding and requires a huge amount of diligent work. Staff are quietly doing most of this behind closed doors. I have the greatest respect for that.

What also became evident in 2023 is that Nagra is forging ahead and evolving from a research organisation into a project organisation. I can feel this transformation in the corridors of Nagra, and I can sense it when I talk to staff members.

Braun: We are on the verge of taking a new path. We are convinced that we have found the most suitable site for a deep geological repository. We will now focus on implementing the project.

What does this mean for Nagra staff?
Guzzella: Many job profiles will change. I am positive that these changes are an opportunity for everyone at Nagra.

And what will change for Nagra’s Board of Directors?
Guzzella: The course that we, the Board of Directors, are now defining, the decisions we are now making, concretely impact costs and schedule – we are proceeding with great respect.

At the same time, we are confident that the project is safe and cost-effective and will remain so. Nagra staff have earned a great deal of trust, especially with the siting proposal, which was well received and understood. Furthermore, in this new

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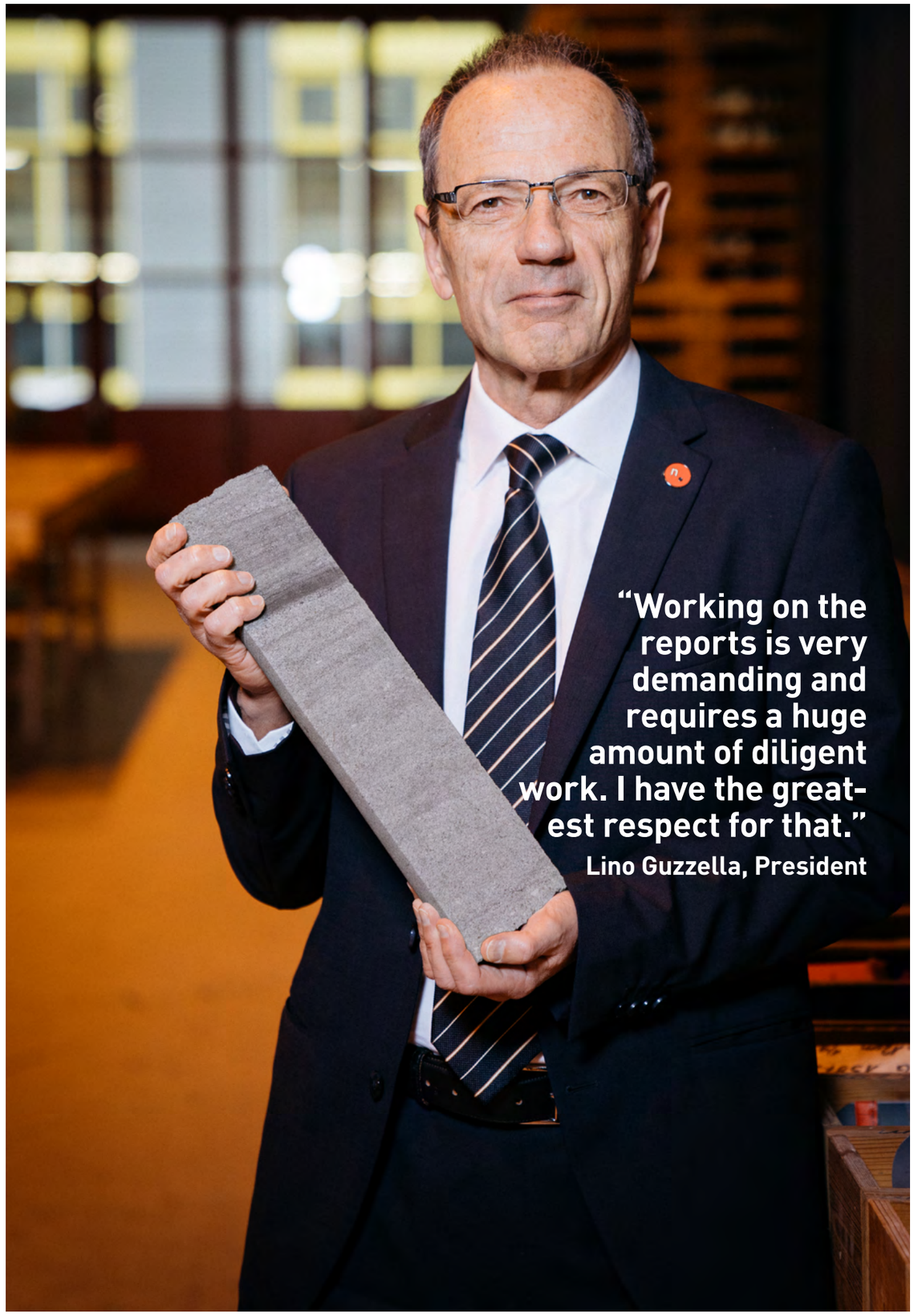

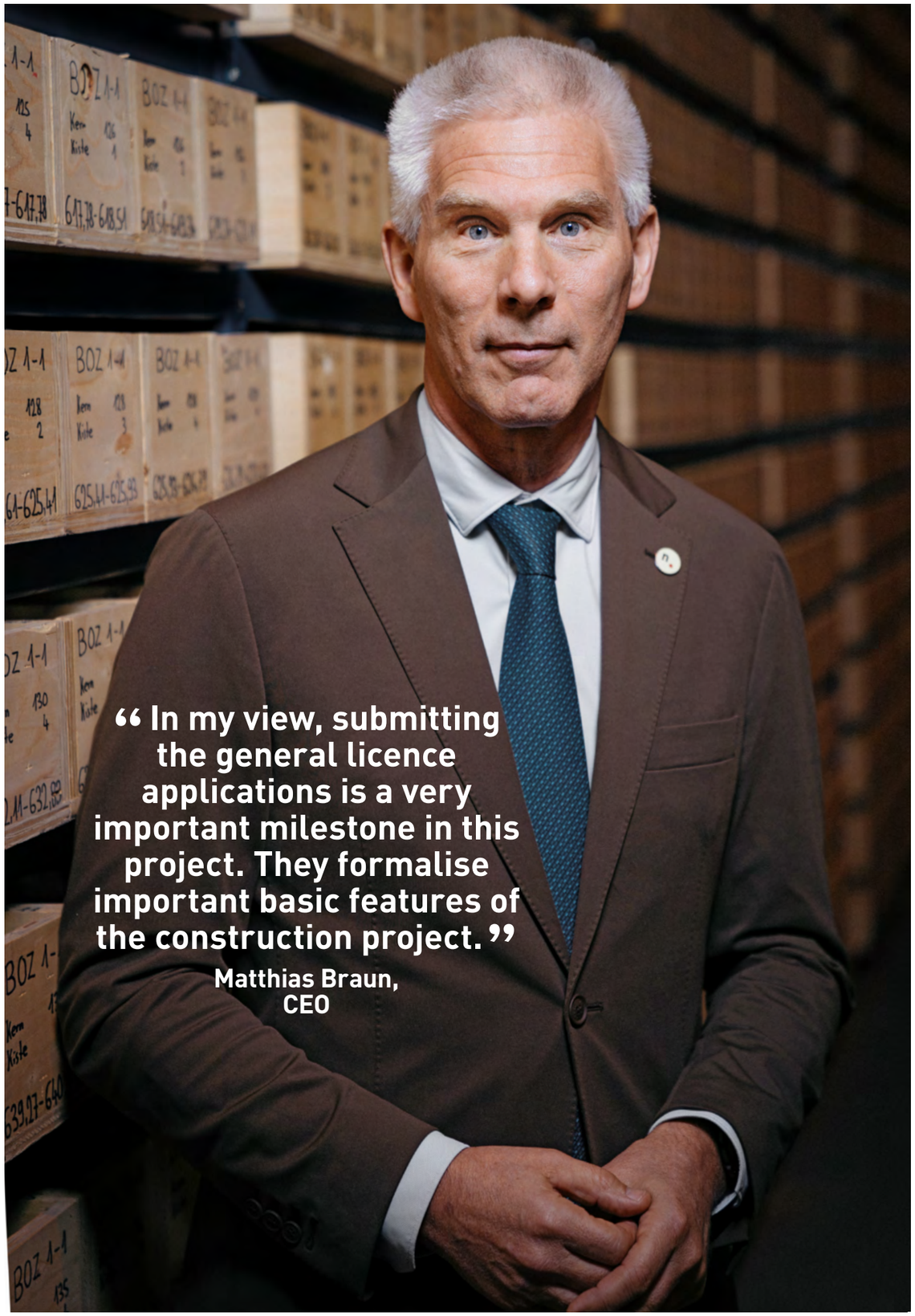

Lino Guzzella and Matthias Braun in Nagra's drill core archive in Mellingen

phase, Nagra can increasingly benefit from the know-how of the members of the Cooperative, as they have a great deal of experience with major projects.

Why is the submission of the general licence applications so important for Nagra?
Braun: In my view, submitting the general licence applications is a very important milestone in the repository project. They formalise important basic features of the construction project, for example, the siting proposal or the surface perimeter of the structures.
Guzzella: I strongly agree with this assessment. Above all, it is an important political milestone. The siting proposal was perhaps more interesting for the media and of course very important for the region. Formally speaking, however, the submission of the general licence applications is, in fact, the decisive step, because only then can our proposal be reviewed by the authorities.
Braun: I remain convinced that the Sectoral Plan works and that all stakeholders involved are doing

“I am convinced that the commitment of the local residents will improve the repository project.”
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a great job. The collaboration with the region, for example, is so successful and pragmatic largely because of the Sectoral Plan. In this sense, the general licence applications are a direct consequence of the Sectoral Plan.
Guzzella: Yes, the Sectoral Plan has proven its worth. I am convinced that it will continue to contribute to the success of the project right up to the end.

“Up to the end” means: until the general licences are granted in the late 2020s or early 2030s. What lies ahead until then?
Guzzella: Nagra is making good progress, the Nagra Board of Directors works together very well, and collaboration with the authorities and the region is also constructive and goal-orientated. The Swiss deep geological repository concept is robust, financing is secured, the Opalinus Clay is a suitable host rock, and Nördlich Lägern is the safest site. These are more than enough reasons to be optimistic about the future.
Braun: In 2024, we will still be working intensively on the general licence applications, which we will submit in November. At the same time, we will continue to plan the deep geological repository, the encapsulation plants and the surface facilities. And we will probably carry out exploratory drilling in the Haberstal before the general licence is granted. The project of the century of deep geological disposal is therefore making good headway.

FACTS & FIGURES

CONTINUOUS IMPROVEMENT

A digital version of Nördlich Lägern

One year ago, Nagra created a new division, the Optimisation Project. Irina Gaus explains its exact purpose.

"Our job is to keep learning to ensure that Nagra is in a position to make the right decisions and construct a state-of-the-art deep geological repository." With this aspiration, Irina Gaus heads the Optimisation Project, which was created one year ago. "We are still in the process of establishing ourselves," says Gaus, who holds a doctorate in hydrogeology and was elected to Nagra's Executive Board at the end of 2022. Until November 2024, Nagra must focus on the general licence applications. "Optimisation will only begin following submission," says Gaus. "However, we are preparing the project in such a way that our staff members can then join our future programme immediately." How can the project become more sustainable? How do you document several decades' worth of information? But also: how can costs be optimised? These are all questions that Irina Gaus and her team will be dealing with. However, they will never lose sight of Nagra's top priority: putting safety first.

NAGRA AS TRAILBLAZER

Digitalisation is also a high priority. Gaus calls it "the digital Nördlich Lägern project, one that is always up to date and is constantly being improved." This will be achieved by means of the "digital twin" concept, in other words, the digital representation of the deep geological repository project. All data, models and simulations – from geological investigations to cost calculations – will flow into this digital twin. "In the long term, all of this information will help us to make better decisions," explains Gaus.

One concrete example is Building Information Modelling, or BIM for short. Engineers use this digital approach to link the planning of buildings with the construction phase. However, BIM is still in its infancy for underground projects such as the deep geological repository. Nagra wants to play a pioneering role in its development. "Our approach follows the 'single-source-of-truth' principle," Gaus clarifies. "All technical disciplines flow into one single digital environment that you can rely on completely." This is made possible by focusing on just one region.

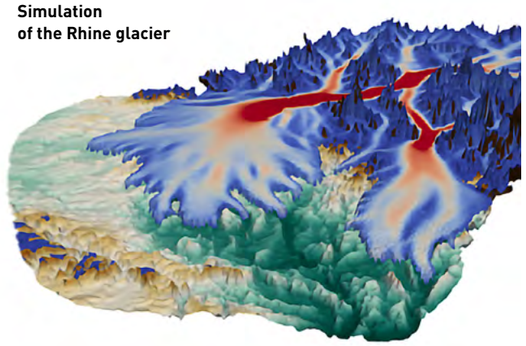
Other waste management organisations are following suit in terms of digitalisation and Nagra is working together with them, says Gaus. "The focus on a single site is an advantage, as we can benefit from a lot of previous groundwork. Even after submitting the general licence applications, we still want to keep improving."

INTERNATIONAL RESEARCH

International research and collaboration are extremely important for Nagra. It worked on the EURAD I programme alongside other waste management organisations, universities and research institutes such as the Paul Scherrer Institute. This project will continue until mid-2024. "This is THE research project in our industry," Irina Gaus points out. "We were able to refine our knowledge and have made great progress in, for example, the issue of gas transport in deep geological repositories. We can directly incorporate these insights into our general licence applications." Nagra also learned a lot about dealing with uncertainties. "The project was a success for us because we could directly integrate the results into our post-closure safety case."

EURAD I will be followed directly by EURAD II in the autumn. As Switzerland now only has limited access to "Horizon Europe", the European Union's framework programme, participation in the successor programme was on the brink. However, thanks to the support of the State Secretariat for Education, Research and Innovation (SERI), Nagra will be able to participate as a third-party organisation. "Topics will include 'digital twins' and optimisation in general. The impact of climate on our safety analyses is also being researched," says Irina Gaus, looking ahead to EURAD II. This programme will run until 2029.

Simulation of the Rhine glacier



FOCUS ON THE RHINE GLACIER

The past is our key to the future

More accurate than ever before: how new simulations of Alpine glaciation contribute to the post-closure safety of deep geological repositories.

A genuine breakthrough: researchers from the fields of glaciology, geomorphology and climate pooled their expertise for the first time. As a result, they were able to more accurately simulate the glaciation of the Alps during the last ice age. "The past is our key to the future," says Urs H. Fischer, Project Manager for Long-Term Geological Evolution at Nagra. "The more accurately we can simulate the past, the more reliably we can predict the future." These findings help Nagra to demonstrate the post-closure safety of the deep geological repository. The radioactive waste must remain protected from the impact of natural evolution, such as erosion by glaciers, in the distant future.

For this project, Nagra conducted research alongside several universities and institutes. "This led to a breakthrough. Thanks to complex modelling of past climates, we were able to gain a much better understanding of conditions such as temperature and precipitation distribution during the last ice age," explains Fischer. With this knowledge, ice flow models could be improved. These models show where and when glaciers formed and advanced into the Alpine foreland. "We focused on the Rhine glacier, which was of special interest to us, and we learned a lot."

This type of collaboration was innovative and very complex, says Fischer. However, the results show that it was well worth the effort.

RESEARCH IN THE ROCK LABORATORIES

A different kind of border security

How do cement types interact with the Opalinus Clay? Answers to this question are being sought in the Mont Terri Rock Laboratory.

The porewater of the Opalinus Clay is pH-neutral. In contrast, the pH value of cement exceeds 12 and is therefore alkaline. Could this difference in pH lead to problems in the tunnel walls of the deep geological repository? Nagra is researching this question at the Mont Terri Rock Laboratory. The CI experiment was installed in 2007. CI stands for Cement-Clay Interaction. As part of this long-term experiment, various types of cement have been interacting with the Opalinus Clay for years. Last year, a new type of annular gap mortar was used to fill a borehole. Nagra developed this in collaboration with the company Master Builders Solutions. This mortar could be used during the construction of the deep geological repository to seal the cavities between the tunnel walls and the concrete liner segments.

However, this experiment is not just about testing a building material, it is also relevant to safety: the pH values of porewaters in the annular gap mortar differ from those in the Opalinus Clay. As a result, a chemical interaction could occur, possibly causing the formation of a boundary layer with lower permeability. The experiment investigates under realistic conditions whether the chemical disruption really is limited to a millimetre scale – as predicted by models. Initial results are expected in 2028.

In the Mont Terri Rock Laboratory, mortar is mixed for the experiment.

Nagra scientist Martin Schoenball accesses a rig cellar equipped with a long-term monitoring system.

LONG-TERM MONITORING

What is happening at the drill sites?

Nagra has equipped five boreholes with measurement systems and has largely dismantled the drill sites.

The purpose of long-term monitoring is to measure porewater pressure and temperature. Although the data from the boreholes are transmitted directly to Nagra, the systems have to be regularly checked and maintained on site. For this reason, people can still occasionally be seen accessing the former drill sites. Apart from that, there is not much to see from the outside: the drill sites were largely dismantled in 2023. Only a few tasks are still pending. The objective: "When we are done here, the site will be in as good a condition as it was before – maybe even a little better," says Jürg Neidhardt, who is responsible for dismantling Nagra's drill sites. Special care must be taken with the soil, explains Neidhardt. As part of the dismantling process, the soil, which has been carefully removed and set aside, is returned to its original place. While being stored, the humus was planted with a special seed to keep the soil loose and fertile until it could be spread over the drill site after dismantling and planted according to precise specifications. These measures will help to restore the natural habitat.

In summer 2023, the M1 mortar (in the foreground of the photo) was tested in an experiment.

SUCCESSFUL FIELD TRIAL

From the laboratory to the real world

Building materials for a deep geological repository must meet stringent requirements. In collaboration with the Putzmeister company, Nagra was able to achieve an important breakthrough.

In the deep geological repository, low- and intermediate-level waste will be emplaced in caverns. Cement – or, more precisely, mortar – will be used as backfill material between the waste containers and the Opalinus Clay cavern wall. However, conventional masonry mortar does not fulfil the requirements for a deep geological repository because the waste produces gases over thousands of years, which the mortar must be able to store temporarily before eventually allowing them to dissipate via the sealing system. To this end, it must have a certain permeability. At the same time, it should also contribute to a high pH value, which is the favourable chemical environment to slow down undesirable processes such as corrosion or microbial activity. In the laboratory, a technical solution for all these requirements was found with the so-called single-grain mortar M1. Nagra tested it in a field trial in summer 2023 in collaboration with the concrete pump manufacturer Putzmeister. The results are promising: "The field trial has shown that we can successfully handle the mortar using two different conveying techniques," says Lukas Martin, Project Manager Chemical Interactions at Nagra. The desired porosity and permeability are also established, as the drilled samples show. Thorsten Steils, Project Manager Construction and Environment at Nagra and also involved in this field trial, summarises: "We can confirm that the mortar not only works in the laboratory but that we can also use it on the construction site."

RETRIEVAL: PROBABLY UNNECESSARY, BUT DOABLE

In this interview, Nagra mining engineer Thorsten Steils explains how radioactive waste can be retrieved from a deep geological repository.

Thorsten Steils, radioactive waste will be disposed of in a deep geological repository. Nagra likes to emphasise, and does so often, that this solution is safe. Why are you then still working on solutions to retrieve the waste?
Let me begin by stressing that we do not expect to need to retrieve the waste. However, the law requires the waste to remain retrievable without undue effort until the final closure of the repository. Should the repository evolve in a different way than expected and should we then no longer demonstrate that the repository would remain safe in the long term, we would have to be able to retrieve the waste. However, we estimate the likelihood of such a scenario to be very small. First of all, we will only be allowed to emplace the waste if the authorities confirm that this is very safe. Should there be any safety-related doubts making retrieval a likely scenario, we would not be granted the licence to emplace the waste to begin with. We cannot rule out such a scenario with absolute certainty; that would be unscientific. But we can rule it out with almost 100 per cent certainty.

Future generations might also want to retrieve the waste for other reasons. For example, they might prefer other disposal methods or want to reuse the waste as a resource. But this decision will be left to the generations to come.

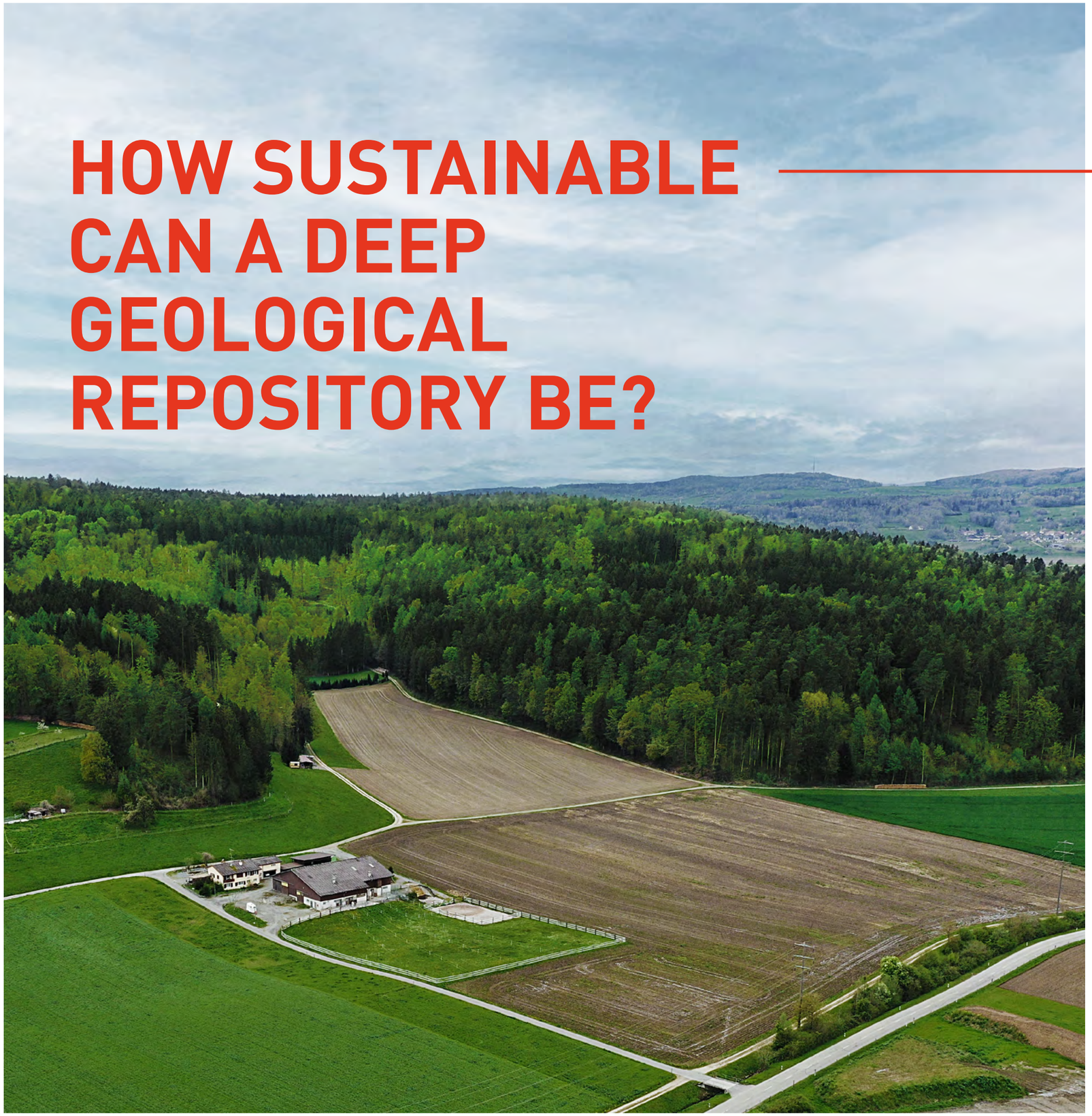
So even if you do not anticipate the need for retrieval, you are obliged to provide the option. What exactly does this mean?
It is crucial to consider the retrieval option during the emplacement process. Carefully documented emplacement is key: we will use a structured approach and document the exact location and content of each disposal canister. The canisters will be emplaced in such a way that they can be accessed again and brought to the surface if necessary. The voids in the emplacement drifts housing the canisters will be backfilled. Thanks to this backfill material, the canisters are protected and will remain intact for a very long time. We already possess the technology today to retrieve the waste. To put it simply, the retrieval process is just like the emplacement process – just the other way around.

Until when will waste retrieval remain possible?
Retrieval will remain possible without undue effort until the final closure of the repository. At the moment, we expect the monitoring phase to last 50 years. After this, the shafts will be backfilled and the repository sealed. Retrieval will also be possible at a later date, but would require greater effort. This makes sense because our repository provides passive safety after closure, meaning that it will remain safe without the need for human intervention. The disposal canisters – especially those for high-level waste – are very robust and will contain the waste for thousands of years. As long as these canisters remain intact, waste retrieval will be relatively easy from a technical point of view. As time goes on, however, retrieval will become more complex.

→ Retrieval concept for a deep geological repository. Nagra Arbeitsbericht (work report) NAB 21-13 (in German)

THORSTEN STEILS
has been working as a mining engineer for Nagra since 2020. He works not only on waste retrieval but also on the final closure of the repository.

HOW SUSTAINABLE CAN A DEEP GEOLOGICAL REPOSITORY BE?



How can Nagra plan, construct and operate the deep geological repository and the surface facilities in the most resource-efficient and environmentally compatible way possible? This is the question that concerns the construction team led by Severin Wälchli, Division Head Planning and Realisation and Member of the Executive Board.

The deep geological repository is expected to go into operation in 2050. The time span between project planning and eventual implementation is long. Does it make sense to consider the issue of sustainability for such a megaproject at this stage, when construction of the structures will not even be completed for another few decades?

Absolutely. Whether we are looking at a deep geological repository or a single-family home – every construction project can be planned sustainably. Especially in the case of a major infrastructure project such as the one we are planning, sustainability must be included. This is also part of our responsibility towards society and the environment. We can already meet this today by means of various activities in the area of environmental protection.

What does sustainability mean when constructing a project that is supposed to be safe for one million years?

We adhere to strict guidelines in order to ensure the safety of the deep geological repository for one million years. There are specifications on what types of building materials we have to use. This is why we are limited in our use of alternative building materials that are low in CO_2. Concrete will become more sustainable in the future, and the corresponding specifications will change. It cannot be ruled out that we will have new possibilities for underground construction over time. The surface facility for the deep geological repository offers more potential in this respect, as

A drone image from last year of the Haberstal area in the community of Stadel. This is where Nagra is planning the surface facility for the deep geological repository.

“During construction, we will try to keep transport and emissions to a minimum.”

Severin Wälchli, Division Head Planning and Realisation

“We want to dispose of the radioactive waste in an exemplary manner and as sustainably as possible.”

the requirements above ground are more compatible with sustainable construction.

What requirements must be met for this?
As with everything we do, safety also has the top priority here. We therefore have to evaluate where sustainable construction is possible while still fulfilling the safety requirements for the deep geological repository. If a measure can be implemented and makes economic sense, we will consider it.

When is a construction project sustainable?
To judge whether a construction project is sustainable, the entire life cycle of the project must be considered. This includes using raw materials and energy sparingly to minimise environmental impact. Personally, I want to implement sustainability for the deep geological repository project where it makes sense and where it is possible and necessary. This allows us to create good framework conditions for the people working on the project of the century or for those who are affected by it as neighbours.

The repository construction project is worth billions. It will cause high emissions and involve numerous transports, and enormous quantities of concrete will be used. Is it then even possible to speak of sustainability?
The repository project will not have a positive ecological balance. We are under no illusions in this regard. Even if we can benefit from sustainable innovations in the more distant future, the overall balance will remain negative. Still, one thing is clear to us: we want to dispose of the radioactive waste in an exemplary manner and as sustainably as possible. The deep geological repository is a cross-generational project, so sustainability is very important.

Your team is currently drafting the tenders for the construction project. Does sustainability already play a role here?
Definitely, because the planning stage will strongly influence the end product. For example, we can already lay the foundations today for the energy efficiency of future structures. When awarding mandates to planners, sustainability is weighted more heavily than before from a legal perspective. Contractors must therefore not only have experience in construction and statics, but also in sustainable construction.

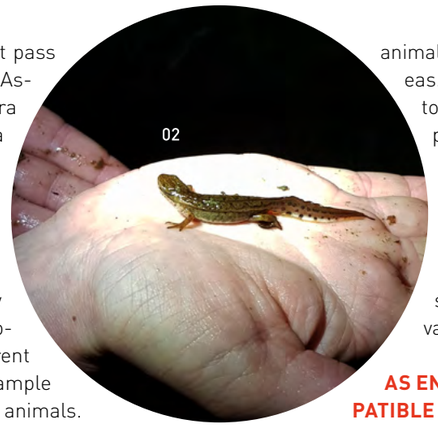
How and when will we learn whether the repository project is being implemented as sustainably as possible?
During construction, we will try to keep transport and emissions to a minimum for the residents’ sake. Later, during the operational phase, our staff in particular will benefit from the construction method: for example, through good and sustainable working conditions and energy-efficient operation.

01

WHAT CREEPS AND CRAWLS IN THE HABERSTAL?

The deep geological repository project must comply with strict environmental standards. Discovering wildlife clues with Seraina Kauer.

The repository project must pass an Environmental Impact Assessment (EIA) before Nagra is authorised to construct a deep geological repository in Switzerland. In 2023, Nagra therefore conducted field investigations in the Haberstal, where the surface facility of the repository is to be constructed. The objective was to map the current state of this habitat, for example with regard to its plants and animals. The field investigations were coordinated by Nagra and carried out by external specialists. "The aim of the field surveys is to obtain a rough overview of all relevant environmental domains and existing habitats," explains Seraina Kauer, Specialist Spatial Planning and Environment at Nagra. Important topics include flora, fauna and habitats, but also groundwater, soil, forests and crop rotation areas. This explains why Nagra could be found in the Haberstal in the summer of 2023, counting dragonflies, grasshoppers, lizards and many other species.



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A COMPLEX CONSTRUCTION PROJECT

It is important to take precautions for endangered species on the Red List. "We have, for example, discovered fire salamanders, common toads and yellow-bellied toads," Kauer points out. What happens to these protected species? "We have to take measures to protect their habitats as far as possible or minimise the impact of our project on these species." If neither of these options are possible, the animals are relocated to suitable areas. The deep geological repository is a complex construction project within an agricultural zone. It takes up valuable arable land, so-called crop rotation areas, for which a substitution must be found. To assess the quality of the soil, samples were taken by excavator and by hand.

AS ENVIRONMENTALLY COMPATIBLE AS POSSIBLE

Assessing the environmental impact is a multi-stage process. This means that the authorities will repeatedly express their opinions on it – first for the general licence applications and later for the construction licence application. As the project progresses, the field investigations will become more detailed and the measures more specific. The Federal Office for the Environment (FOEN) is responsible for the review. Nagra has set itself the goal of continuously optimising the project to lower the environmental impact to the greatest degree possible.

Field investigations similar to those in the Haberstal were also carried out at the interim storage facility in Würenlingen, where the encapsulation plant for spent fuel assemblies is to be constructed. Constructing this plant also requires an Environmental Impact Assessment. The inventories of all habitats, animal and plant species and forest soil were completed at the end of September 2023.

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01 Marsh frog (Pelophylax ridibundus)
02 Palmate newt (Lissotriton helveticus)
03 Specialist conducting field investigations in the Haberstal
04 Might this corrugated iron sheet shelter a slow-worm?
05 Seraina Kauer, Nagra's Specialist Spatial Planning and Environment
06 Inventorying butterflies in the Haberstal
07 Spawn of the common frog (Rana temporaria)
08 Common toad (Bufo bufo)

“ We have, for example, discovered fire salamanders, common toads and yellow-bellied toads. ”

Seraina Kauer, Specialist Spatial Planning and Environment

FOUR BOREHOLES IN THE HABERSTAL

Independently of the field investigations carried out for the Environmental Impact Assessment, four boreholes were drilled in the Haberstal between November 2023 and March 2024. The boreholes reached a maximum depth of 55 metres, and they were used to analyse the on-site subsoil and groundwater. The boreholes were then converted into groundwater measurement stations. Their purpose is the long-term monitoring of groundwater levels. All boreholes were drilled on existing agricultural roads.

The only signs that remain visible at the surface are manhole covers with a diameter of 30 centimetres. The exploratory investigations were managed by an external geological consultancy and communicated in advance to all tenants and landowners. The results of these boreholes are no longer included in the general licence application, but will become important for the construction licence application at a later date.

“WE ARE WORKING SIDE BY SIDE TOWARDS THE SAME GOAL”

Could gas jeopardise the deep geological repository? Typhaine Guillemot is looking for answers to such questions. Her work helps to understand the processes in the rock.

“I wanted to leave academia. While working on climate research, I was frustrated by not being able to develop tangible solutions to a major problem. Here at Nagra, I can directly contribute to one of Switzerland’s most important projects of the century. I hope to live long enough to see the opening of the deep geological repository. This is extremely exciting!

As Project Manager Material Performance, my job is to determine how much gas could one day form in the repository. This is important because gas can create a lot of pressure. We have to demonstrate that we can accurately predict the amount of gas produced from radioactive waste and building materials. The biggest challenge is to base predictions as closely as possible on real conditions by understanding the processes that take place in the rock. For example, corrosion causes hydrogen, but there are also microbes that consume hydrogen and can thus help to reduce the pressure in the deep geological repository. We have to show that gas development does not negatively impact the performance of the barriers.

AN EMOTIONALLY CHARGED TOPIC

My main responsibility is to determine and better understand those processes that could take place underground after the final closure of the deep geological repository, where they could potentially impact post-closure safety. To this end, we have to consider the latest scientific data and develop or improve conclusive experiments. Nagra carries out long-term experiments in the two rock laboratories Mont Terri and Grimsel, at the Paul Scherrer Institute (PSI) and in the Zwilag interim storage facility in Würenlingen. While working for PSI myself, I was involved in a long-term project for Nagra.

Today I no longer venture “into the field”, but manage projects with external contractors instead. We try to set up short-term, small-scale experiments in such a way that we can make long-term predictions based on the results. We are looking at a timescale of up to one million years – that is no easy task.

The entire radioactive waste issue can be frightening and emotionally charged for some people. I am sometimes told that I must surely be in favour of nuclear power since the nuclear industry is paying my salary. The fact is: the waste is there regardless, and right now it is being stored at the surface. It is safe there in the short and medium term, but in the long term, thousands of years from now, a deep geological repository is the safest solution. To me, it is only right that the producers of radioactive waste should also finance waste management.

WE ARE NOT DONE YET

People have been involved in this project for generations, and they have always been committed to the current state of the art. Our focus is on safety. For the general licensing procedure, we will demonstrate that our work is based on a robust concept. We are all working side by side towards the same goal: to construct a safe deep geological repository. I am very optimistic that we are on the right track, and I am proud to be part of this project of the century.”

TYPHAINE GUILLEMOT
comes from Brittany, France, studied environmental sciences in Orléans and completed a doctorate in climate research at the Université de Bourgogne. She then worked as a postdoc at the Swiss Federal Institute of Aquatic Science and Technology, Eawag, and later in a Nagra-funded postdoc programme at the Paul Scherrer Institute. She is in her element in the water and swims and dives as often as she can. To alleviate her culinary longing for her homeland, she bakes a lot.

FABIAN MAIER

grew up near Tübingen, Germany, studied geography in Munich, completed his Master's degree in Innsbruck, Austria, with a thesis on water circulation systems in high mountain regions and then went on to obtain his doctorate in hydrology at the University of Zürich. The Swabian is fascinated by glaciers. He spends much of his free time in the Alps, either hiking or ski touring. He has been working for Nagra as a specialist in long-term geological evolution since May 2021. Fabian Maier and his wife live in Zürich.

"MY WORK HELPS TO PROTECT THE ENVIRONMENT"

Fabian Maier makes sure that the figures used in the general licence applications are produced by the same hand. This means that the hydrologist will have a lot of work in 2024.

"At the moment, a deep geological repository is the safest solution. The current interim storage facility is safe, but storing radioactive waste at the earth's surface is not a long-term solution – just think of the war in Ukraine. I am a hydrologist and interested in how the landscape evolves over long time periods, particularly through the impact of water and glacial flow. Such changes can be seen quickly at the earth's surface, for example in the moraines of Alpine glaciers. Underground, change takes longer. But the issues are very similar and often involve risk assessments. From a hydrological point of view, structures must be able to withstand a flood that occurs perhaps only every 100 years. In the case of a deep geological repository, we are talking about a timescale of one million years, so the uncertainties are, of course, much greater. We can now say that the subsurface at the selected repository site has hardly changed over a very long time and is therefore safe.

TRACES LEFT BY GLACIERS

In the past, the glaciers we now see in the Alps spread extensively over the Swiss Plateau. At the time, they scraped away several hundred metres of the earth's surface, which would have exposed a repository constructed at these depths. We model future glacial flow and ice ages using the findings of the past. This allows us to assess the risks for the deep geological repository. At the moment, however, I am mainly working on the geosynthesis, which we will submit to the federal government at the end of 2024 as part of the general licence applications. We collate data from all the different geological disciplines to present the current state of the art. I am responsible for harmonising the majority of the figures. Several authors are working on this report and they each have their own idiosyncratic styles, which is why this work is necessary. I also code the raw data, analyse it statistically and prepare it graphically.

I have been working for Nagra since May 2021. The privilege of doing highly relevant scientific work and not just researching in an "empty space" was new to me. This distinction is very important to me. I also really appreciate working in an interdisciplinary team and dealing with topics such as tectonics and seismics that are outside my field of expertise. The announcement of the site for the deep geological repository last year was an important milestone in the project. The tension in the run-up to the event was very high, and the positive mood afterwards was clearly noticeable. The work environment and the collegiality here in the geology team are great – to me, that is just as important as the actual work.

CONTRIBUTING TO ENVIRONMENTAL PROTECTION

I am a mountaineer. Remote areas in the Alps fascinate me and I find it exciting to learn more about them. This means I am also emotionally invested in environmental issues. The retreating glaciers break my heart. I am so grateful that I can still experience nature like this but, at the same time, it makes me sad that future generations might not be able to experience the same I can. In this respect, I really do see my work as a legacy for future generations and as an environmental protection mission."

BERRAK FIRAT LÜTHI
is a geological engineer and has worked at Nagra for around ten years. She completed her Bachelor's degree in Geological Engineering at the Middle East Technical University in Ankara and her Master's degree in Engineering Geology at the Swiss Federal Institute of Technology Zürich. After completing an internship at Nagra while obtaining her Master's degree in 2014, Berrak Firat Lüthi was certain: this is where she wanted to work in the future. Today she is Deputy Project Manager of the FE Experiment.

"CHANGE FORCES US OUT OF OUR COMFORT ZONE"

Berrak Firat Lüthi analyses the data from one of Nagra's most important experiments: the Full-Scale Emplacement Experiment simulates the emplacement of a disposal canister on a 1:1 scale.

"Since my first internship at Nagra in 2014, a lot has changed – both personally and professionally. Back then, the idea of realising a deep geological repository seemed like a dream and the start of construction lay in the distant future. Our key focus was on research. Now many of the things that we used to talk about as something theoretical are becoming concrete. The general licence applications, for example, that we will submit in 2024. After decades of research, the focus is now shifting towards implementation. This also means that there is change in store for me, too.

1:1 TEST LABORATORY FOR THE REPOSITORY

Over the past ten years, I have mainly worked for Nagra in a scientific capacity. I have been working on the FE experiment since day one: the full-scale emplacement experiment is one of Nagra's most important scientific experiments. In the Mont Terri Rock Laboratory, we use heaters to simulate the repository on a 1:1 scale. We want to find out how the heat emitted by the radioactive waste will affect the surrounding rock. To this end, we installed more than 1,000 sensors. We analyse different parameters such as temperature, water pressure and rock movement. It helps me enormously that I know the sensors so well. During my internship, I helped to set up the experiment and put the sensors into operation. In addition to working on the FE experiment, I am responsible for storing the drill cores.

I don't yet know in detail what my future tasks will be and which projects I will be working on, but I can well imagine that I will continue to be responsible for measurements. Handling data suits me. However, there will now be fewer scientific experiments. Instead, we will look at, for example, so-called zero measurements at the site of the deep geological repository. We use them to record the current status of the site. In this way, we want to demonstrate over the coming decades that the deep geological repository will have no impact on the environment. I find my work at Nagra very fulfilling. The radioactive waste already exists: every time we switch on a light, we use nuclear energy. We therefore need a solution for the disposal of this waste. The deep geological repository will protect the environment, future generations and natural resources. To be allowed to contribute to the solution to this problem is a special privilege.

EMBRACING PERSONAL CHANGES

In recent years, not only have my professional responsibilities changed a lot, but also my personal ones: I had my second child in 2022. The time before and after the birth was very stressful as there were some health issues. Fortunately, things are fine again. I am very grateful to my supervisor and colleagues for always supporting me. Everyone at Nagra was there for me during those difficult times – that is not something I take for granted. I am really looking forward to increasing my workload again in 2024. We are currently in an exciting time of adjustment. Change is in the air, I can feel it. I find this slightly daunting, because change always forces us out of our comfort zone. However, I am also convinced the only way to progress is to embrace change and keep learning."

“I WILL ACCOMPANY THE PROJECT OF THE CENTURY TO THE NEXT PHASE”

After a long, intensive period of research, Nagra is getting ready to implement the project. Project planner Anastasia Escallon links the different threads, solves tricky problems and keeps an eye on the overall picture.

As a student, I visited the Grimsel Test Site, which made a lasting impression on me. I completed my studies a few years ago, but my fascination with the deep geological repository project still resonates today. When I moved to Switzerland for personal reasons, Nagra’s website was the first place I turned to when looking for a job. And I was lucky! A job matching my qualifications was available and, since spring 2023, I have been working as a project planner at Nagra. I would never have thought that I would be part of the team at such an exciting time. We are currently right in the middle of a transformation phase – after decades of research, we are now moving on to actual implementation. I can actively contribute by accompanying the project of the century of deep geological disposal to the next phase.

ON THE ROAD TO IMPLEMENTATION

My work currently centres on the general licence applications that we will submit in November. They set out the general framework of the repository project; without general licences, the construction project will not be allowed to proceed. Submitting the complete documentation on time is therefore of the utmost importance. The strands converge on my desk: I keep an eye on the deadlines and track the status of the milestones – there is quite a lot to look out for. I also helped to introduce our new project management tool, which allows us to record the progress of the project centrally. Incidentally, the introduction of the tool was also a welcome door opener for me because it allowed me to quickly get to know the organisation and my new colleagues. I help the project managers to map their planning in the tool, assist with training and offer technical support. The latter in particular is a constant challenge for me but, so far, I have been able to solve every tricky problem. However, I also know that the next technical glitch is sure to come. All of this makes my job so exciting. The tool is now so advanced that we have been able to extend it to all Nagra divisions.

WORKING FOR TRANSPARENCY

Another important project that I am closely involved in is the digitalisation of the general licence applications. We are working on making all reports and dossiers available online on a website. These reports include hundreds of documents with numerous cross-references and references, reflecting decades of research. Even for the experts at ENSI (Swiss Federal Nuclear Safety Inspectorate), reviewing the general licence applications is a highly complex task. The digital version will allow them to navigate through the reports more easily as the references are directly linked. This means the experts can avoid working their way through mountains of paper.

A RELEVANT CONTRIBUTION

My job is not only varied, but also very instructive. It gives me great pleasure to be able to support my colleagues. It is wonderful that, with my work, I can make a socially relevant contribution to a secure future. My professional highlight in 2023 was therefore starting at Nagra. At the moment, our top priority is the submission of the general licence applications, but we are already preparing intensively for what is to follow. Many changes lie ahead of us, but I see a lot of innovative approaches that will help to ensure that we are well equipped for change. I am really looking forward to the exciting times that lie ahead.”

ANASTASIA ESCALLON
has been working for Nagra since March 2023. She studied applied geosciences at RWTH (Rheinisch-Westfälische Technische Hochschule) Aachen University. After graduating, she worked in an RWTH spin-off as a geologist in the field of microstructure analysis. There, she discovered her talent for project management, which she now brings to Nagra with great pleasure and success.

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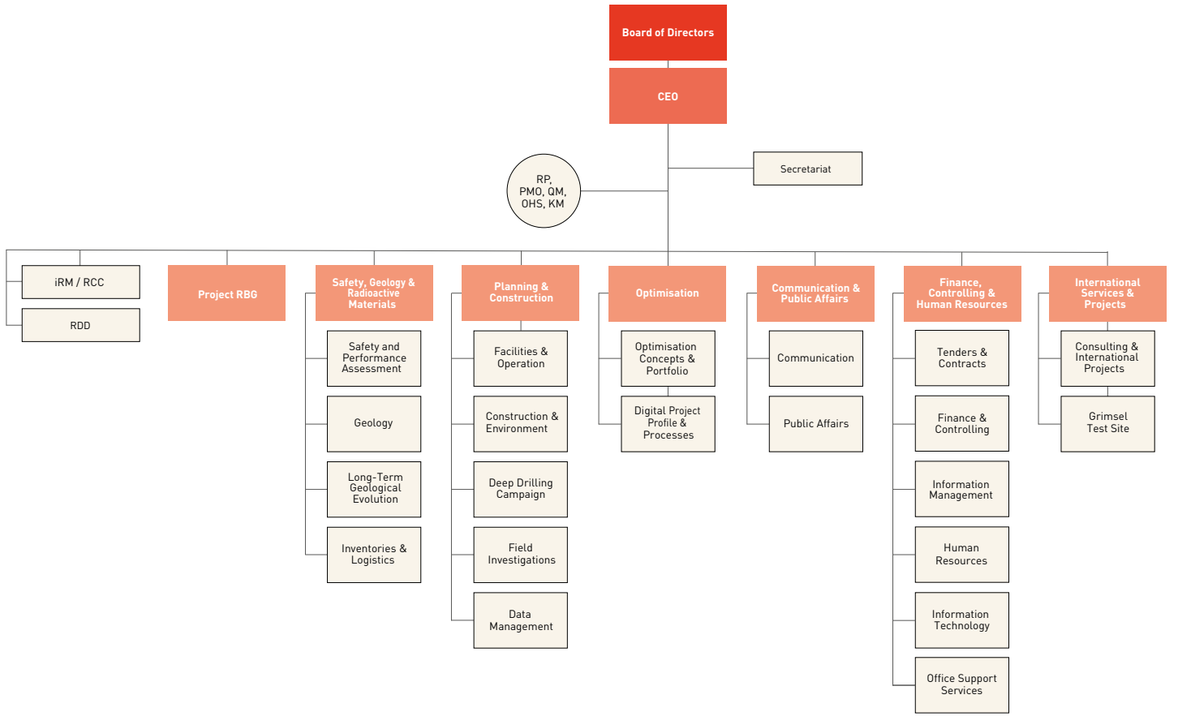
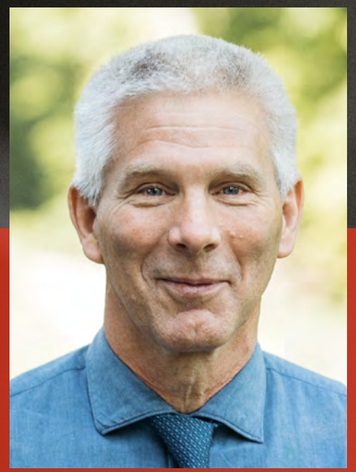
ORGANIGRAM OF THE HEAD OFFICE



As of 2023

iRM	integrated Risk Management
KM	Knowledge Management
QM	Quality Management
OHS	Occupational Health & Safety
PMO	Project Management Office
RCC	Requirements, Configuration and Change
RDD	Research, Development and Demonstration
RP	Radiation Protection

EXECUTIVE BOARD



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CEO

Reto Beutler
DIVISION HEAD FINANCE & SUPPORT

Irina Gaus
DIVISION HEAD OPTIMISATION

Severin Wälchli
DIVISION HEAD PLANNING & REALISATION

Maurus Alig
COORDINATOR MAJOR PROJECT SECTORAL PLAN STAGE 3 / GENERAL LICENCE APPLICATIONS

Philipp Senn
DIVISION HEAD COMMUNICATION & PUBLIC AFFAIRS

Tim Vietor
DIVISION HEAD SAFETY, GEOLOGY & RADIOACTIVE MATERIALS

ANNUAL FINANCIAL STATEMENTS 2023

COMMENTS ON THE ANNUAL FINANCIAL STATEMENTS 2023

The current financial statements for 2023 were prepared in line with the provisions of the relevant Swiss legislation, in particular the articles on commercial accounting and financial reporting of the Code of Obligations for individual financial statements (Articles 957 to 962).

Total expenditure minus proceeds from sales of goods and services and other income is borne by the members of the Cooperative, which results in a balanced year-end result.

Operating income amounted to CHF 61.7 million (2022: CHF 76.3 million) and project expenditure amounted to CHF 34.9 million (2022: CHF 51.2 million). The decrease in project expenditure is primarily due to the completion, after three years, of the deep borehole campaign. Only a few related tasks are still pending. Staff costs amounted to CHF 21.9 million (2022: also CHF 21.9 million) and all other expenditure amounted to CHF 4.9 million (2022: CHF 3.2 million).

Further information can be found in the notes on the annual financial statements.

Wettingen, 18th March 2024

Dr. Matthias Braun, CEO

INCOME STATEMENT

Note		1.1.–31.12.2023 CHF	1.1.–31.12.2022 CHF
C1	**Net proceeds from sales of goods and services**		
	Net proceeds from services for third parties	3 495 794	2 770 996
	Research contributions from third parties	231 339	198 622
	Net proceeds from services for Cooperative members	70 790	62 587
	Total net proceeds from sales of goods and services	**3 797 923**	**3 032 205**
C2	**Contributions of members of the Cooperative**		
	Contributions to administration costs	700 000	700 000
	Contributions to project expenditure	57 080 034	72 165 833
	Total contributions of members of the Cooperative	**57 780 034**	**72 865 833**
	Other operating income	**149 698**	**435 417**
	Total operating income	**61 727 655**	**76 333 456**
C3	Cost of materials (project expenditure)	34 855 372	51 233 787
C4	Staff costs	21 861 767	21 872 351
C5	Other operating costs	3 497 841	2 865 671
C11	Depreciation and value adjustments on fixed assets	191 521	177 481
	Operating result	**1 321 155**	**184 166**
	Financial income	–74 905	–62 284
	Financial costs	31 974	116 099
	Ordinary result	**1 364 087**	**130 352**
C6	Extraordinary, non-recurring or prior-period expenditure	1 248 081	–
	Annual profit before taxes	**116 006**	**130 352**
	Direct taxes	116 006	130 352
	Annual result	**–**	**–**

Explanations pages 42-46

BALANCE SHEET

Note	Assets	31.12.2023 CHF	31.12.2022 CHF
	Current assets		
	Cash and cash equivalents	18 169 554	2 586 659
C7	Trade receivables	1 134 017	3 511 749
	Due from third parties	150 200	374 448
	Due from members of the Cooperative	983 817	3 137 301
C8	Other short-term receivables	217 118	82 217
	Due from third parties	217 118	82 217
C9	Non-invoiced services	2 346 342	1 818 486
C10	Accrued income and prepaid expenses	194 311	8 955 848
	Total current assets	**22 061 342**	**16 954 958**
	Capital assets		
C11	Tangible fixed assets	1 907 559	1 388 612
	Total capital assets	**1 907 559**	**1 388 612**
	Total assets	**23 968 901**	**18 343 570**
	Equity and liabilities		
	Short-term liabilities		
C12	Trade payables	7 494 953	4 888 750
	Due to third parties	7 343 781	4 884 209
	Due to members of the Cooperative	151 172	4 541
	Other short-term liabilities	1 425 586	1 599 042
	Due to third parties	1 425 586	1 599 042
C13	Advance payments received	6 782 137	5 305 589
C14	Deferred income and accrued expenses	8 126 225	6 410 189
	Total short-term liabilities	**23 828 901**	**18 203 570**
	Total liabilities	**23 828 901**	**18 203 570**
C15	**Equity**		
	Cooperative capital	140 000	140 000
	Annual result	–	–
	Total equity	**140 000**	**140 000**
	Total equity and liabilities	**23 968 901**	**18 343 570**

Explanations pages 42-46

CASH FLOW STATEMENT

Note		1.1.–31.12.2023 CHF	1.1.–31.12.2022 CHF
	Annual result	–	–
C11	Depreciation and value adjustments on fixed asset items	191 521	177 481
	Change in net current assets		
C7	Decrease (+) / increase (-) trade receivables	2 377 732	–1 937 402
C8	Decrease (+) / increase (-) other short-term receivables	–134 901	811 416
C9	Decrease (+) / increase (-) non-invoiced services	–527 856	1 268 182
C10	Decrease (+) / increase (–) prepaid expenses	8 761 537	–4 262 028
C12	Decrease (–) / increase (+) trade payables	2 606 203	–5 056 764
	Decrease (–) / increase (+) other short-term liabilities	–173 456	–223 223
C13	Decrease (–) / increase (+) advance payments received	1 476 548	1 001 105
C14	Decrease (–) / increase (+) deferred income and accrued expenses	1 716 035	–496 339
	Cash flow from operating activities	**16 293 363**	**–8 717 572**
C11	Investments in fixed assets	–710 468	–82 023
	Cash flow from investment activities	**–710 468**	**–82 023**
	Cash flow from financing activities	**–**	**–**
	Change in cash and cash equivalents	**15 582 895**	**–8 799 595**

Change in cash and cash equivalents	2023	2022
Cash and cash equivalents as of 1st January	2 586 659	11 386 254
Cash and cash equivalents as of 31st December	18 169 554	2 586 659
Net increase/decrease in cash and cash equivalents	**15 582 895**	**–8 799 595**

Explanations pages 42-46

NOTES ON THE ANNUAL FINANCIAL STATEMENTS

A) General information

Accounting legislation
The current financial statements were prepared in line with the provisions of Swiss law, in particular the articles on commercial accounting and financial reporting of the Code of Obligations for individual financial statements (Articles 957 to 962).

Company, name, legal form and registered office
Nagra, National Cooperative for the Disposal of Radioactive Waste,
Hardstrasse 73, Postfach, 5430 Wettingen, Switzerland

Type of audit
According to legal requirements (Article 727 Paragraph 1 Item 2 of the Code of Obligations),
the annual financial statements of Nagra are subject to an ordinary audit.

Currency used for the accounting
The accounting is in the national currency (Swiss Francs, CHF).

Cash flow statement
The cash and cash equivalents form the basis for the presentation of the cash flow statement.
Cash flow from operating activities is calculated using the indirect method.

Approval of the annual financial statements
The Board of Directors approved the annual financial statements on 18th March 2024
on behalf of the annual general meeting.

B) Information on the principles applied in the annual financial statements

The main positions in the annual financial statements are assessed as follows:

Cash and cash equivalents
Cash and cash equivalents comprise petty cash and credit balances on bank accounts. They are carried at nominal value. Foreign currency positions are carried at the exchange rate on the reporting date.

Trade receivables
Trade receivables are reported at the invoiced amount minus allowance made for the bad debts provision. Allowance is formed based on the maturity structure and recognisable credit risks.

Receivables and payables towards involved parties
These positions are exclusively receivables and payables towards involved parties
(i.e. the members of the Cooperative).

Non-invoiced services
The capitalised work in progress and the received advance payments result exclusively from contracts for third parties. For the ongoing projects, all expenditure is capitalised as work in progress, and all advance payments received are booked as a liability.

Fixed assets
Fixed assets are reported at acquisition cost minus the accumulated depreciation over the estimated useful lifetime of each asset category. Investments in hardware below CHFk 20 and software below CHFk 100 are debited directly to the income statement.

The lifetimes for depreciation fall within the following bandwidths for the individual categories that are relevant for Nagra:

Land	Depreciation only in the case of value impairment
Buildings	20 to 50 years
Operating and business equipment	5 to 10 years
IT (hard- and software)	2 to 3 years

Expenditure on repairs and maintenance that does not add value is debited directly to the income statement. Renewals that change the useful lifetime of assets are capitalised.

Assets removed from operation or sold are written off on the assets account at their acquisition values and the accumulated depreciation. The resulting profits or losses are entered in the income statement.

Payables
All payables are carried at nominal value. Services received and incurred liabilities are deferred according to the period.

Provisions
Provisions are formed when, based on events that have occurred in the past, the company has a legal or factual obligation, the extent and due date of which are unknown but can be estimated.

C) Information, breakdowns and notes on the annual financial statements

C1) Net proceeds from sales of goods and services
Net proceeds from sales of goods and services are made up of proceeds from contract work, partner contributions to the Grimsel Test Site, research contributions and service revenues from members of the Cooperative. There is a high order backlog for future work.

C2) Contributions of the members of the Cooperative
The contributions of the members of the Cooperative are invoiced on a monthly basis according to the budget approved by the Board of Directors. A deviation from the budget leads to an additional charge or a credit that is booked in the year of accounting as prepaid expenses or deferred income. This has an annual result of CHF 0.

The 2023 accounting year resulted in an income surplus of CHF 4.1 million (2022: an expenditure excess of CHF 7.9 million), which will be returned to the members of the Cooperative.

C3) Cost of materials (project expenditure)

The project expenditure is made up as follows:

External services for:	2023	2022	2021
	CHFk	CHFk	CHFk
Projects: – deep borehole campaign	3 814	17 958	53 006
– scientific basis, studies, work related to the L/ILW and HLW programmes	20 713	21 484	26 970
Communication	1 424	2 158	1 631
Fees (ENSI, SFOE)	8 312	9 062	8 987
Travel expenses	592	572	333
Project-related external services	**34 855**	**51 234**	**90 927**

C4) Staff costs

At CHF 21.9 million, staff costs, including social contributions, remained stable compared to the previous year. The average staffing level in 2023 was 118.9 full-time positions and 4.2 temporary positions (2022: 114.7 full-time positions, 6.1 temporary positions and 1.0 apprenticeships).

C5) Other operating costs

Other operating costs include rents and expenditure on property of CHF 1.4 million (2022: CHF 1.2 million), expenditure on information technology of CHF 0.8 million (2022: CHF 0.7 million) and further operating costs of CHF 1.3 million (2022: CHF 1.0 million).

C6) Extraordinary, non-recurring or prior-period expenditure

In 2022, the VAT was revised following an audit, as a result of which the tax authorities claimed an additional CHF 0.9 million. Nagra has lodged an appeal and booked the conditional payment made in 2022 for the years 2017 to 2021 under prepaid expenses. An initial response in which the tax authorities insist on their decision was received in January 2024. Although Nagra is now lodging an appeal with the Federal Administrative Court, the payment made in 2022 and the potentially additional liability for 2022 and 2023 (CHF 0.35 million) have been booked as extraordinary expenses in the interests of commercial prudence.

C7) Trade receivables

Compared to the previous year, trade receivables decreased by CHF 2.4 million. Almost all project cost contributions from members of the Cooperative could be credited in December.

C8) Other short-term receivables

Other short-term receivables include guarantee and cash contributions. The guarantee service with the Swiss Directorate General of Customs (ZAZ) had to be adjusted slightly.

C9) Non-invoiced services

Non-invoiced services consist of accrued internal services and third-party services for various projects. Verification is provided on a project-specific basis.

C10) Accrued income and prepaid expenses

Accrued income and prepaid expenses are primarily made up of advance payments to the Swiss National Accident Insurance Fund (SUVA). In 2022, the credit balance of CHF 7.9 million towards members of the Cooperative resulting from the 2022 expenditure excess was booked here.

C11) Tangible fixed assets

	Land and buildings	Office and workshop	Vehicles	Total
	CHFk	CHFk	CHFk	CHFk
Acquisition value as per 01.01.2022	**1 825**	**745**	**833**	**3 404**
Additions	33	9	40	82
Disposals			–114	–114
Reclassifications				
Acquisition value as per 31.12.2022	**1 858**	**754**	**759**	**3 372**
Additions	645	13	54	712
Disposals			–3	–3
Reclassifications				
Acquisition value as per 31.12.2023	**2 503**	**767**	**810**	**4 081**
Accumulated depreciations as per 01.01.2022	**585**	**659**	**676**	**1 920**
Additions	33	80	64	177
Disposals			–114	–114
Reclassifications				
Accumulated depreciations as per 31.12.2022	**618**	**739**	**626**	**1 983**
Additions	105	13	75	193
Disposals			–3	–3
Reclassifications				
Accumulated depreciations as per 31.12.2023	**723**	**752**	**698**	**2 173**
Carrying value as per 01.01.2022	**1 240**	**87**	**157**	**1 484**
Carrying value as per 31.12.2022	**1 240**	**16**	**133**	**1 389**
Carrying value as per 31.12.2023	**1 780**	**15**	**113**	**1 908**

C12) Trade payables

Compared to the previous year, trade payables increased by CHF 2.6 million to CHF 7.5 million, mainly due to higher obligations towards the Paul Scherrer Institute and the Swiss Federal Nuclear Safety Inspectorate (ENSI) as of the reporting date.

C13) Advance payments received

Advance payments received are for accrued internal services and third-party services for various projects. Verification is provided on a project-specific basis. Due to the higher volume of third-party contracts, the advance payments received as per 31st December 2023 rose by CHF 1.5 million to CHF 6.8 million.

C14) Deferred income and accrued expenses

The 2023 accounting year resulted in an income surplus of CHF 4.1 million, which will be returned to the members of the Cooperative and has therefore been booked as accrued expenses. Deferred income primarily consists of outstanding settlements for services rendered. Additional important accrued expenses include remuneration for work carried out by the University of Bern or payments to partners in the EURAD research programme (CHF 0.3 million each). The deferral for the head office amounts to CHF 0.7 million. CHF 0.35 million were deferred for a possible additional VAT liability. The deferral for outstanding vacation time and overtime amounts to CHF 1.8 million.

C15) Equity

The Cooperative capital is unchanged with CHF 140k and is divided into 140 share certificates of CHF 1 000 each, with 7 certificates of 20 shares each being distributed.

D) Further information

Liabilities towards pension schemes

As of 31st December, there were the following liabilities towards pension schemes:	31.12.2023	31.12.2022
	CHF	CHF
Contribution statement December	272 965	262 643

Contingent liabilities
Nagra is not involved in any legal actions, legal disputes, regulatory or tax investigations, inquiries or other legal procedures that could have financial consequences for the annual financial statements for 2023.

As of 31st December 2023, there were no guarantee obligations.

Risk report 2023
On 30th June 2023, the Board of Directors approved Nagra's risk report for 2023.

Remuneration disclosure of the Statutory Auditor (in accordance with Article 961a of the Code of Obligations). The Statutory Auditor claimed the following remuneration:

	2023	2022
	CHF	CHF
Audit of the annual financial statements	16 000	25 500
Additional audits	2 500	3 200
Total	**18 500**	**28 700**

(excluding expenses and VAT)

ACCUMULATED ACCOUNTS

Note	Total income	Increase 2022 CHF	Excluding interest: adjustment payments 2022 CHF	As per 31.12.2022 CHF	Increase 2023 CHF	Excluding interest: adjustment payments 2023 CHF	As per 31.12.2023 CHF
	Swiss Confederation	6 323 867	–	159 645 104	5 473 262	–	165 118 366
	Axpo Power AG	15 267 705	–	378 986 890	11 966 474	–	390 953 366
	BKW Energie AG	7 719 456	–	180 691 636	6 160 314	–	186 851 951
	Kernkraftwerk Gösgen-Däniken AG	18 610 073	–	486 626 602	14 443 948	–	501 070 549
	Kernkraftwerk Leibstadt AG	24 244 733	–	586 564 434	19 036 036	–	605 600 470
	Contributions to project expenditure	**72 165 833**	**–**	**1 792 514 666**	**57 080 034**	**–**	**1 849 594 700**
	Contributions to administration costs	700 000	–	93 770 000	700 000	–	94 470 000
	Contributions of Cooperative members to Nagra	**72 865 833**	**–**	**1 886 284 666**	**57 780 034**	**–**	**1 944 064 700**
	Contributions GNW	**–**	**–**	**65 265 331**	**–**	**–**	**65 265 331**
E1	**Total contributions**	**72 865 833**	**–**	**1 951 549 997**	**57 780 034**	**–**	**2 009 330 031**

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Note	Total expenditure	Increase 2022 CHF	As per 31.12.2022 CHF	Increase 2023 CHF	As per 31.12.2023 CHF
	Geoscientific studies	9 898 164	283 339 539	6 177 724	289 517 262
	Nuclear technology and safety	2 443 995	64 102 593	3 410 899	67 513 492
	Radioactive materials	1 556 623	54 487 969	1 641 670	56 129 640
	Facility planning	2 357 194	42 380 435	2 250 062	44 630 497
	Generic (site-independent) work	3 032 529	127 917 359	2 305 452	130 222 810
	General programme costs	4 895 768	123 818 857	4 940 448	128 759 305
	Fees and compensation	4 530 976	92 618 133	4 155 854	96 773 987
	L/ILW programme	**28 715 248**	**788 664 883**	**24 882 109**	**813 546 993**
	Geoscientific studies	21 350 163	543 701 322	9 796 595	553 497 917
	Nuclear technology and safety	3 732 058	94 829 158	4 469 467	99 298 625
	Radioactive materials	2 228 679	36 246 440	1 325 131	37 571 571
	Facility planning	3 500 790	40 926 977	3 682 242	44 609 218
	Generic (site-independent) work	2 948 159	149 619 055	3 220 077	152 839 132
	General programme costs	5 159 759	109 453 229	5 548 559	115 001 788
	Fees and compensation	4 530 976	94 338 933	4 155 854	98 494 786
	HLW programme	**43 450 585**	**1 069 115 114**	**32 197 925**	**1 101 313 038**
E2	**Project expenditure for repository programmes**	**72 165 833**	**1 857 779 997**	**57 080 034**	**1 914 860 031**
	Administration and general project expenditure	**700 000**	**93 770 000**	**700 000**	**94 470 000**
	Total expenditure for L/ILW and HLW programmes, administration and general project expenditure	**72 865 833**	**1 951 549 997**	**57 780 034**	**2 009 330 031**

NOTES ON THE ACCUMULATED ACCOUNTS

The accumulated treatment of the contributions of the members of the Cooperative and the application of these contributions form the basis, at the time of waste disposal, for any adjustments of payments among the members. It also indicates which work has resulted in project-related expenditure.

The structure of the total income is oriented primarily to the operating accounts.

E1) Contributions of the members of the Cooperative

The contributions of the members of the Cooperative towards covering project costs are calculated based on the thermal output, the service-lifetime-weighted output and the expected waste volumes of the individual nuclear power plants of the members.

The contributions of the members in the total amount of CHF 57.8 million (2022: CHF 72.9 million) correspond to those in the income statement. A contribution of CHF 0.7 million to administration costs is included.

In the 2023 financial year (as in 2022), no compensation payments were made among the members of the Cooperative.

Contributions of the "Cooperative for Nuclear Waste Management Wellenberg" (GNW) include payments by GNW for contract work on the Wellenberg project. This project is terminated.

E2) Project-specific expenditure for the repository programmes

The two repository programmes (L/ILW and HLW) essentially have the same structure in the presentation of the accumulated accounts and are oriented towards the most important technical tasks to be performed up to the completion of waste disposal activities. If there is no explicit reference to a specific programme, the following explanations of the individual positions apply to both projects.

a) Geoscientific investigations
Geological investigations for identifying potential siting regions comprise geological studies in the investigation area of Northern Switzerland for the deep geological disposal of high-level waste, as well as the processing of geological information for the disposal of low- and intermediate-level waste.

b) Nuclear technology and safety
The work comprises the safety-based evaluation of potential siting regions as well as laboratory studies on the near-field and on the different backfill materials.

c) Radioactive materials
This includes expenditure on assessing the disposability of waste packages and on ongoing documentation and inventorying of radioactive waste.

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d) Facility planning
This position includes expenditure on developing the concepts for the surface and underground facilities for the repositories for HLW and L/ILW.

e) Generic (site-independent) work
This includes work on developing methodologies, modelling and validation of the models used in safety analyses, laboratory studies, participation in the work in the rock laboratories (Grimsel and Mont Terri) and the research programmes of the EU.

f) General programme costs
This expenditure results from programme management, expenditure on cost studies and from public affairs activities.

g) Fees and compensation
This includes the fees passed on to Nagra from the regulatory and safety authorities.

REPORT OF THE STATUTORY AUDITOR

Report of the Statutory Auditor to the general meeting of Nagra, National Cooperative for the Disposal of Radioactive Waste

Wettingen

Report on the audit of the annual financial statements for 2023

Audit opinion
We have audited the annual financial statements of Nagra, National Cooperative for the Disposal of Radioactive Waste (the Cooperative), which comprise the income statement, balance sheet as of 31st December 2023 and the cash flow statement for the year ended then, as well as the notes on the annual financial statements, including a summary of significant accounting policies.

In our opinion, the attached annual financial statements comply with Swiss law and the Cooperative's articles of incorporation.

Basis for the audit opinion
We conducted our final audit in accordance with Swiss law and Swiss Auditing Standards (SA-CH). Our responsibilities according to these legal provisions and standards are described in more detail in the section "Responsibilities of the statutory auditor when auditing the annual financial statements" of our report. In accordance with Swiss law and the requirements of the auditing profession, we are independent of the Cooperative and have fulfilled our other professional duties in compliance with these requirements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Other matters
The annual financial statements of the Cooperative for the year ended 31st December 2022 were audited by another statutory auditor, who issued an unmodified opinion on these annual financial statements on 16th March 2023.

Other information
The Board of Directors is responsible for the other information. The other information comprises the information included in the annual report, but does not include the financial statements and our auditor's report thereon.

Our opinion on the financial statements does not cover the other information and we do not express any form of assurance conclusion thereon.

In connection with our audit of the financial statements, our responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit or otherwise appears to be materially misstated.

If, based on the work we have performed, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

Responsibilities of the Board of Directors for the annual financial statements
In accordance with the requirements of Swiss law and the Cooperative's articles of incorporation, the Board of Directors is responsible for the preparation of the annual financial statements and for such internal control as the Board deems necessary to enable the preparation of annual financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the annual financial statements, the Board of Directors is responsible for assessing the ability of the Cooperative to continue business operations. Further responsibilities include disclosing, as applicable, matters related to continuing business operations, and applying the accounting policy of continued business operations unless the Board of Directors either intends to liquidate the Cooperative or to cease operations, or has no realistic alternative but to do so.

Responsibilities of the statutory auditor when auditing annual financial statements
Our objectives are to obtain reasonable assurance that the annual financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue a report that includes our audit opinion. Reasonable assurance provides a high level of security, but it is not a guarantee that an audit conducted in accordance with Swiss law and Swiss Auditing Standards will always detect potential material misstatements. Misstatements can result from fraud or error and are considered material if, individually or as a whole, they could reasonably be expected to influence the economic decisions of users taken on the basis of these annual financial statements.

A more detailed description of our responsibilities for the audit of the annual financial statements can be found on the EXPERTsuisse website: expertsuisse.ch/wirtschaftspruefung-revisionsbericht (in German). This description forms part of our report.

Report on other legal requirements
In accordance with Article 906 CO in connection with Article 728a Par. 1 Item 3 CO and Swiss Auditing Standard PS-CH 890, we confirm the existence of an internal control system designed for the preparation of annual financial statements according to the instructions of the Board of Directors.

We also confirm that the register of the members of the Cooperative is kept in compliance with Swiss law and the Cooperative's articles of incorporation. We recommend that the financial statements submitted to you be approved.

Hüsser Gmür + Partner AG

Jonas Schwegler
Audit expert
Auditor in charge

Mathias Dietrich
Audit expert

Baden-Dättwil, 18th March 2024

APPENDICES

WASTE INVENTORIES AND VOLUMES

Radioactive waste arises mainly from electricity production in the Swiss nuclear power plants. It is also produced from the use of radioactive materials in the areas of medicine, industry and research (MIR waste).

Waste volumes at the end of 2023
Nagra maintains a centralised database of all waste packages as a service to the waste producers. The following table shows the volumes and activities of waste prepared for deep geological disposal as of the end of 2023. The Zwilag waste consists of waste packages delivered to the interim storage facility from the nuclear power plants, waste packages from the plasma furnace and steel flasks with vitrified high-level waste from reprocessing.

Conditioned waste (31st December 2023, figures rounded)	**Volume (m^3)**	**Activity (Bq)**
Nuclear power plants	2 803	$8.8 \cdot 10^{14}$
Zwilag interim storage facility	3 444	$6.5 \cdot 10^{18}$
Swiss Federal Interim Storage Facility (MIR) (waste from medicine, industry and research)	1 696	$1.4 \cdot 10^{16}$

The table does not include raw waste and preconditioned waste packages that are foreseen to undergo further treatment in the interim storage facility.

Predicted waste volumes and inventories for deep geological disposal
Planning the deep geological repository requires information on expected waste volumes. The total volume of waste for disposal will be around 82 000 cubic metres packaged in disposal containers (see table for details). The volume of waste from the nuclear power plants (NPPs) and Zwilag results from the given operating lifetimes; the volume of waste from medicine, industry and research is based on the end of operation of the L/ILW* repository.

Predicted waste volumes (47- /60-year NPP operation) [1]	**L/ILW* (m^3)**		**ATW* (m^3)**		**HLW/SF* (m^3)**	
	conditioned	packaged	conditioned	packaged	conditioned	packaged
Operational waste from the NPPs (from cleaning systems and mixed waste), incl. post-operational phase	11 100	29 691				
NPP reactor waste (activated components)	407	1 436				
NPP decommissioning waste	19 239	24 951	25	25		
NPP reprocessing waste			99	432	114	377
MIR waste	11 762	15 614	165	524	9	11
Surface facility waste Waste from the future surface facilities for the L/ILW & HLW repositories	220	582				
Spent fuel assemblies					1 367	8 892
Total volumes	**42 727**	**72 274**	**289**	**981**	**1 490**	**9 280**
Percentage (rounded)	96.0%	87.6%	0.7%	1.2%	3.3%	11.2%

[1] Basis: Waste Management Programme 2021 (WMP 21)
Operating lifetimes: NPP Mühleberg 47 years (till 2019), other NPPs 60 years
Takes into account a decay storage period of radioactive materials for a maximum of 30 years with subsequent conventional disposal. As the predictions are based on the boundary conditions of WMP 21, they partially deviate from the predictions in the Model Inventory of Radioactive Waste for the general licence applications, particularly with regard to the packaged volume.

* L/ILW = low- and intermediate-level waste; ATW = alpha-toxic waste; HLW/SF = high-level waste/spent fuel

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Page 10: Nagra scientists in front of seismic data display
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Page 11: Simulation of the Rhine glacier
Image: Nagra

Page 12 (bottom left): Research work at the Mont Terri Rock Laboratory
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Page 12 (top right): Access to a rig cellar equipped with a long-term monitoring system
Photo: Nagra

Page 13: Field test with the Putzmeister company in 2023
Photo: Nagra and Putzmeister

Page 15: Thorsten Steils
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Page 16: Drone image of the Haberstal
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Page 18: Severin Wälchli
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Pages 20–22: Field investigations in the Haberstal
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