



SÚRAO

RADIOACTIVE
WASTE REPOSITORY
AUTHORITY

Annual Report 2018

Radioactive waste
repository authority

2018

Mission and principles of the activities of the Czech Radioactive Waste Repository Authority (SÚRAO)

The Czech Radioactive Waste Repository Authority (hereinafter SÚRAO) is a technical organisation accountable to the Ministry of Industry and Trade, the main task of which is to ensure the safe management of radioactive waste in the Czech Republic. A key part of the activities of the authority is, therefore, to provide for the operation of radioactive waste repositories and the preparation of a future deep geological repository for high-level waste and spent nuclear fuel. In addition, however, SÚRAO is involved in a number of other activities: it monitors the impact of its repositories on the surroundings, maintains records of radioactive waste received and its producers, ensures the payment of contributions to municipalities from the nuclear account and manages and coordinates research and development work in the area of nuclear waste disposal. SÚRAO's activities are defined in the Atomic Act (No. 263/2016 Coll.).

JUDr. Jan Prachař
Managing Director of SÚRAO

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Introduction

Dear readers,

Please allow me via this annual report to acquaint you with our activities and the results achieved in 2018.

SÚRAO is a state technical organisation and, as such, is required to conduct its activities transparently and in a predictable manner. This is a key priority for SÚRAO and it will continue to be a priority in the future.

In 2018, SÚRAO operated all three of its low- and intermediate-level waste repositories safely and in accordance with the relevant permits. We continue to devote our attention to the safe operation of our repositories as well as to effective communication with the public in their vicinities.

With respect to the preparation work for

the future Czech deep geological repository (DGR) for high-level waste and spent nuclear fuel, research work continued during the year, especially geophysical research, aimed at reducing the number of candidate DGR sites. The main priority of the site selection process remains to determine a demonstrably safe DGR design solution.

The number of sites will be reduced based on an assessment process that applies consistent criteria with respect to long-term safety, siting and the potential impacts of the construction and operation of the repository on the environment. All the work conducted in 2018 with concern to the DGR focused on expanding the amount of information and documentation relevant to the assessment of the candidate sites.

With respect to ensuring the efficient and effective use of funds from the SÚRAO budget for external subcontracting services, the procedure was fully in accordance with legislation and the funds were employed effectively so as to fulfil SÚRAO's various responsibilities according to the approved budget and 2018 plan of activities.

In 2018, we continued to keep the public fully informed on all our activities through our information centres, websites, social networks and printed materials.

I would like to thank all SÚRAO's employees and cooperating organisations for their hard work in 2018.



A handwritten signature in blue ink, consisting of stylized initials 'JP'.

Mr. Jan Prachař
Managing Director of SÚRAO

Key events of 2018

Geophysical research

The “Geophysical research for the description of the geological structure of potential sites for the DGR in the Czech Republic” research project continued in 2018 at all 9 candidate sites. The aim of the project is the geophysical verification of near-surface and deep geological structures in the wider vicinities of the potential sites in order to refine existing geological models and to reduce their uncertainties. Thus, SÚRAO expanded its knowledge base with further information that will be used for the assessment of the defined sites.

Reconstruction of the Richard repository

The winner of the public tender for the supplier of the first stage of the reconstruction of the Richard repository comprised a consortium of three companies: Energie - stavební a báňská a.s., Vodohospodářské stavby, s.r.o. and Slezská důlní díla a.s. The signing of the contract was

followed by the submission of an application for a reconstruction permit from the State Office for Nuclear Safety. The reconstruction project, which will take place in 2019–2020, includes the adapting of part of the facility's unused space for use as new disposal chambers. SÚRAO will thus both acquire the necessary additional disposal capacity and be able to work towards the gradual closure of the Bratrství repository.

Full operation of the Bukov URF

In 2017, the construction of the Bukov underground research laboratory, which is located at a depth of 550 metres in the former Rožná uranium mine complex, was completed. In 2018, a series of experiments was launched aimed at supporting research on the safety assessment of the candidate sites and the technical feasibility of the future deep geological repository (DGR), including experiments on, for example, hydrogeological and microbial monitoring, a project for obtaining data from deep geological horizons and so on.

The underground laboratory will provide SÚRAO with extensive and valuable information that will be used in the planning of the future DGR.

International cooperation

SÚRAO continued during 2018 to intensify its contacts with foreign organisations that address the same or similar issues in the field of radioactive waste disposal. Following the previous conclusion of contracts with Posiva (Finland) and KORAD (South Korea) and a number of other partners, in 2018 SÚRAO signed memoranda of cooperation with the Slovak Nuclear and Decommissioning Company (JAVYS) and PURAM, the Hungarian organisation for the preparation and implementation of spent nuclear fuel (SNF) disposal and radioactive waste management. SÚRAO is convinced that close international cooperation and the exchange of information and experience makes up one of the key factors in terms of addressing the various issues surrounding the construction of the future Czech DGR.

SÚRAO currently operates three radioactive waste repositories intended for the final disposal of low- and intermediate-level waste generated via the use of radioactive substances in the industry, healthcare and research sectors and the operation of nuclear power plants.

Current situation

An aerial photograph showing a vast, dense forest of coniferous trees. In the foreground, there are several large, dark green agricultural fields with visible plowing patterns. The background shows rolling hills and more forest, with a hazy sky. The entire image has a green color cast.

Radioactive waste disposal

Low-level waste from the nuclear energy sector is disposed of in a surface repository located within the Dukovany nuclear power plant complex; the repository was put into operation in 1995. The total volume of the disposal space of 55,000 m³ (around 180,000 waste drums) is sufficient for the disposal of all the waste (that meets defined waste acceptability conditions) generated by the Dukovany and Temelín power plants, even in the case of the extension of the operation of the two power plants.

Low- and intermediate-level waste from the industry, research and healthcare sectors is disposed of at the Richard (near Litoměřice) and Bratrství (near Jáchymov) near-surface repositories; moreover, the Dukovany repository can also be partially used for this purpose.

The Richard near-surface repository is located in the former Richard II limestone mine complex (below the Bídnice hill). Institutional waste has been disposed of here since 1964. The total volume of the reconstructed underground areas exceeds 17,000 m³, and the waste disposal capacity makes up approximately half this volume (the rest consists of service corridors). The robustness of the natural barriers of the facility and the existence of additional former limestone mining areas create some of the best conditions in Europe for the disposal of radioactive waste.

The Bratrství near-surface repository is intended exclusively for the disposal of radioactive waste containing only naturally-occurring radionuclides. The disposal facility was created by adapting one of

the mining tunnels of the former Bratrství uranium mine and comprises 5 chambers with a total volume of approximately 1,200 m³. It was put into operation in 1974. Around 80% of the capacity of the repository has now been filled and preparations are underway for its gradual closure.

To a lesser extent, long-term low- and intermediate-level waste is generated that is not acceptable for disposal in currently operational near-surface repositories. Requirements have been set concerning the method and quality of the treatment of such waste for interim storage and subsequent disposal in the future DGR. Such waste is stored both by its producers and by SÚRAO.

High-level waste and spent nuclear fuel (following its declaration as waste) cannot be disposed of in existing repositories. Spent nuclear fuel is stored by the producer, ČEZ, pending a decision on its potential re-use for the production of energy or its direct disposal. It is planned that all the Czech Republic's high-level waste will be disposed of in the future DGR in accordance with the RAW Management Concept.

Total disposal capacity

Dukovany radioactive waste repository

55 000 m³

Richard radioactive waste repository

10 249 m³

Bratrství radioactive waste repository

1 200 m³



Richard radioactive waste repository



Dukovany radioactive waste repository



Bratrství radioactive waste repository

The percentages indicate the amount of used disposal capacity.

Operation of the Dukovany repository

The Dukovany repository is located within the complex of the nuclear power plant of the same name and is the only surface repository in the Czech Republic. It is also the country's youngest repository; waste has been disposed of here since 1995. In 2018, the operation of the facility was provided by ČEZ, a.s. (the operator of the Dukovany nuclear power plant). However, SÚRAO was directly responsible for the acceptance of waste at the repository and certain other activities, particularly inspection and monitoring.

The Dukovany surface repository occupies an area of 1.3 hectares within the Dukovany nuclear power plant complex. It is intended primarily for the disposal of low- and intermediate-level waste from the Dukovany and Temelín nuclear power plants. The total volume of the disposal spaces is 55,000 m³, which corresponds to approximately 180,000 waste disposal packages (drums).

Every year, an average of two thousand waste disposal packages are accepted and subsequently disposed of at the repository. They contain primarily contaminated protective items, textile materials, paper, electrical installation materials, construction rubble, etc., while other waste is generated via the water management systems of the power plants, consisting of wastewater, sludge and ion exchangers.

Since the direct disposal of liquid waste is prohibited, it is necessary to treat this type of waste using special technologies. Wastewater is concentrated using evaporation equipment and the resulting concentrate is solidified using a hardener material, i.e. mostly via so-called bituminisation (fixation in a bitumen matrix). The waste disposal packages are disposed of in concrete chambers, which are backfilled with concrete following filling and closure.

In 2018, a total of 1,439 waste disposal packages containing radioactive waste (315.2 m³) were disposed of at the Dukovany repository.

The Dukovany nuclear power plant (EDU) delivered a total of 1,101 radioactive waste disposal packages (236.4 m³) for disposal, of which 213 packages with unconsolidated

waste, 563 packages with bituminised items and 325 packages with used ion exchange sludges reinforced in an aluminosilicate matrix.

The Temelín nuclear power plant (ETE) delivered a total of 330 radioactive waste

disposal packages (73 m³) for disposal, of which 58 packages with unconsolidated waste, 252 packages with bituminised items and 20 packages with sludge reinforced in an aluminosilicate matrix.

Eight radioactive waste packages (5.8 m³)

containing institutional waste were delivered by ÚJV Řež, a.s. The monitoring of the repository revealed no exceeding of operating limits and conditions during the year. Four inspections by the State Office for Nuclear Safety (SÚJB) also served to confirm the safe operation of the facility.

Basic information on the waste disposed of in 2018 is provided in the following table:

Dukovany repository / operation in 2018

Volume of waste disposed of	m ³ / waste disposal package (WDP)	315,2 / 1439
of which from EDU	m ³ /WDP	236,4 / 1101
of which from ETE	m ³ /WDP	73 / 330
of which institutional waste	m ³ /WDP	5,8 / 8
total mass of the waste received	tonnes	415,6



Operation of the Richard and Bratrství repositories

SÚRAO operates two near-surface radioactive waste repositories, Richard and Bratrství. Richard is used for the disposal of institutional waste, while Bratrství is used only for the disposal of waste containing naturally-occurring radionuclides. The Richard facility will take over the role of the Bratrství repository in the future.

The Richard repository has been in operation since 1964 and is used for the disposal of institutional waste generated in the healthcare, industry, agriculture and research sectors. In 2018, 712 radioactive waste disposal packages (160.7 m³) with a total mass of 231.3 tonnes were disposed of at the Richard repository.

SÚRAO also operates a test laboratory within the Richard repository complex for the testing of WDPs and radioactive substances of special form; the laboratory is designed for the testing of containers for the transport, storage and disposal of radioactive or fission materials with a mass of up to 3,200 kg as well as for the testing of radioactive substances of special form according to the relevant test procedures. In 2018, one certificate was issued based on an assessment of changes introduced with respect to previously performed tests.

In 2018, the supplier of the first stage of the Richard repository reconstruction programme was selected via the standard tendering procedure. The supplier is a consortium comprising Energie - stavební a báňská a.s., Vodohospodářské stavby, s.r.o. and Slezská důlní díla a.s. A contract was signed with the consortium and, subsequently, an application for permission for reconstruction was submitted to the SÚJB. As part of the reconstruction programme that will continue into 2020, areas in the as yet unused underground complex will be adapted for use as disposal chambers.

In 2018, 34 radioactive waste disposal packages (7.3 m³) with a total mass of 13.1 tonnes were disposed of at the Bratrství repository. The operation of this facility will gradually be phased out in connection with the expansion of the capacity of the Richard repository.

SÚRAO's facilities were inspected during the year by the State Office for Nuclear Safety (3 inspections at the Richard repository and 2 inspections at the Bratrství repository) and the relevant mining authorities (1 inspection at the Richard repository and 1 at the Bratrství repository). In all cases, inspectors concluded that the operation of the repositories was in full compliance with the relevant standards.



Basic information on the radioactive waste disposed of in 2018 is provided in the following tables:

Richard repository / operation in 2018

Volume of waste disposed of	m ³ / WDP	160,7/ 712
Mass of the accepted waste	tonnes	231,3
Number of waste containers accepted for disposal	number	0

Bratrství repository / operation in 2018

Volume of waste disposed of	m ³ obalových souborů / OS	7,3 / 34
Mass of the accepted waste	tonnes	13,1

Around one-third of the Czech Republic's electricity is generated by nuclear power plants. The Temelín and Dukovany plants produce around 100 tonnes of spent nuclear fuel and high-level waste annually. At present, this waste is safely stored in so-called interim storage facilities within the complexes of the two nuclear power plants. In the future, according to the State Concept for the Management of Radioactive Waste, such waste will be disposed of in a deep geological repository (DGR). SÚRAO is responsible for the development of the Czech DGR.



Development of the deep geological repository

Site selection

The selection of potentially suitable sites for the construction of the deep geological repository is a long-term process. The first steps were taken in this direction in the early 1990s. In 2018, SÚRAO continued to gather important geological and other information and to refine the data on the 9 selected candidate sites in order to ensure that the final site recommendation from SÚRAO is as objective and scientifically justified as possible.



The information on the sites considered for the future DGR has been updated and refined considerably in recent years. The result is an up-to-date list of nine selected areas on which SÚRAO is focusing its scientific research activities.

The candidate sites comprise: Březový potok, Čertovka, Čihadlo, Horka, Hrádek, Janoch, Kraví hora, Na Skalním and Magdaléna. Research work continued at all these sites in 2018 aimed at increasing the accuracy of the data obtained on

geophysical and other phenomena with the final objective of obtaining a sufficient amount of information that will enable the reduction of their number from 9 to 4 (which is assumed for 2020).

The number of sites will be reduced based on an assessment process that considers uniform criteria in terms of the siting of the future DGR nuclear facility and that prioritises long-term safety with respect to the potential impacts of the construction and operation of the repository on the environment.

The result of the assessment process will comprise the recommendation of preferred sites for the next site evaluation phase. All the research in 2018 focused on this stage of DGR development, i.e. on the preparation of all the relevant information, documentation and arguments for the evaluation of the sites.

The activities conducted in 2018 in this respect included the continuation of the “Geophysical research for the description

of the geological structures of potential DGR sites in the Czech Republic” project, the aim of which is the geophysical verification of near-surface and deep geological structures in the wider vicinities of the candidate sites with respect to enhancing the accuracy of existing geological models and reducing the uncertainties thereof.

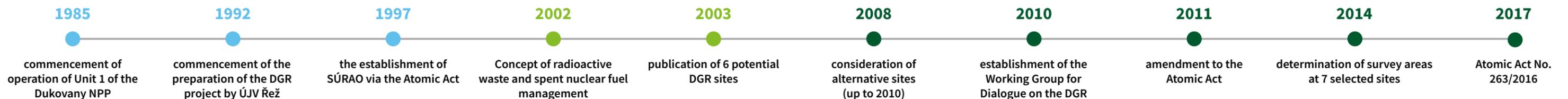
Other key projects in 2018 included:

- The probabilistic assessment of the

seismic hazard of the sites selected for the potential construction of the DGR;

- Public opinion research in the 9 sites selected for the potential construction of the DGR;
- Hydrogeological models of the rock environment for the DGR;
- The compilation of safety reports for the siting of the DGR (for each site);
- The creation of 3D structural-geological models of the potential DGR sites;
- The compilation of DGR siting studies (for each site)

The subsequent research stage (following the reduction in the number of sites from 9 to 4) will focus on obtaining information from the expected depth of the DGR and the wider surroundings of the candidate sites, and the interpretation of the resulting data aimed at determining final and backup sites for DGR construction. It is assumed that the site assessment process will be based on the detailed processing of all the relevant documentation.



Project design activities

The concept of the technical design of the DGR, including an estimate of the related construction and operation costs, is set out in the DGR Reference Project (the first version of which was compiled in 1999) and subsequent updates thereof. The project focuses primarily on the issue of the engineered barriers of the DGR, which make up a key component of any safe DGR disposal system. The main engineered barriers comprise the metal container (waste disposal package) with the spent nuclear fuel rods and a bentonite barrier that surrounds the container, thus creating a so-called supercontainer. Hence, a number of SÚRAO projects and projects in which SÚRAO is involved concern the construction of the waste disposal package and the study of the properties of bentonite.

Research has been underway on the project since 2013, the final output of

which will comprise the materials and the design of the spent nuclear fuel disposal package. The project currently considers two waste disposal package design proposals, both of which are presently in the verification phase of the research. With respect to the development of the engineered barriers, SÚRAO has been conducting the Mock-up Josef project since 2010 at the Josef Underground Research Laboratory near the village of Chotilsko in the Příbram region. The aim of the experiment is to verify the properties and behaviour of a bentonite barrier. The project involved the creation of a realistic model of a supercontainer disposal system, which was installed in a specially-prepared borehole in the Josef underground complex. The project continued during 2018 with the continuous collection and evaluation of the experimental data.

The “Research Support” project, conducted by a research consortium led by the Czech Technical University and which is concerned with the DGR design concept, continued during 2018. The project includes research on the optimisation of the technical design of important technological components of the DGR with respect to technical feasibility, operational safety and economic considerations.

In addition to a number of other domestic projects, SÚRAO is also closely involved in several international research projects, one of the most important of which comprises the MaCoTe (Material Corrosion Test) project underway at the Grimsel underground laboratory in Switzerland. The project is examining the rate and mechanism of the corrosion of various materials that are being considered for the construction of waste disposal packages.

Activities concerning the safety assessment of the deep geological repository

In accordance with the Medium-Term Research and Development Plan for the requirements of the siting of the DGR, the Research Support for the Safety Assessment of the Deep Repository project is currently underway. The main output of this project, which was launched in 2014, concerns the interpretation of primary data obtained from the geological characterisation of the candidate sites and the gathering of information, models and arguments for the preparation of safety analyses, based on which the long-term safety of the candidate sites will be

assessed. The most important part of the project comprises the preparation of 3D structural-geological, hydrogeological and transport models for all the sites and the preparation of a model safety analysis.

Geological, hydraulic and transport models form the basis for the safety assessment of the construction of the DGR at the potential sites. The information obtained from the creation of such models and the preparation of the model safety analysis will allow for the more accurate

focusing of the geological exploration at the sites (especially with concern to the drilling of deep boreholes in the more advanced stages of the geological exploration research) and the updating of the R&D programme concerning the selection of sites for the safe disposal of spent nuclear fuel and other radioactive waste, including the gathering of the necessary information on the properties of the SNF and RAW itself, the long-term stability of the engineered barriers and the migration parameters of both the engineered barriers and the rock environment.

Generic research for the development of the DGR

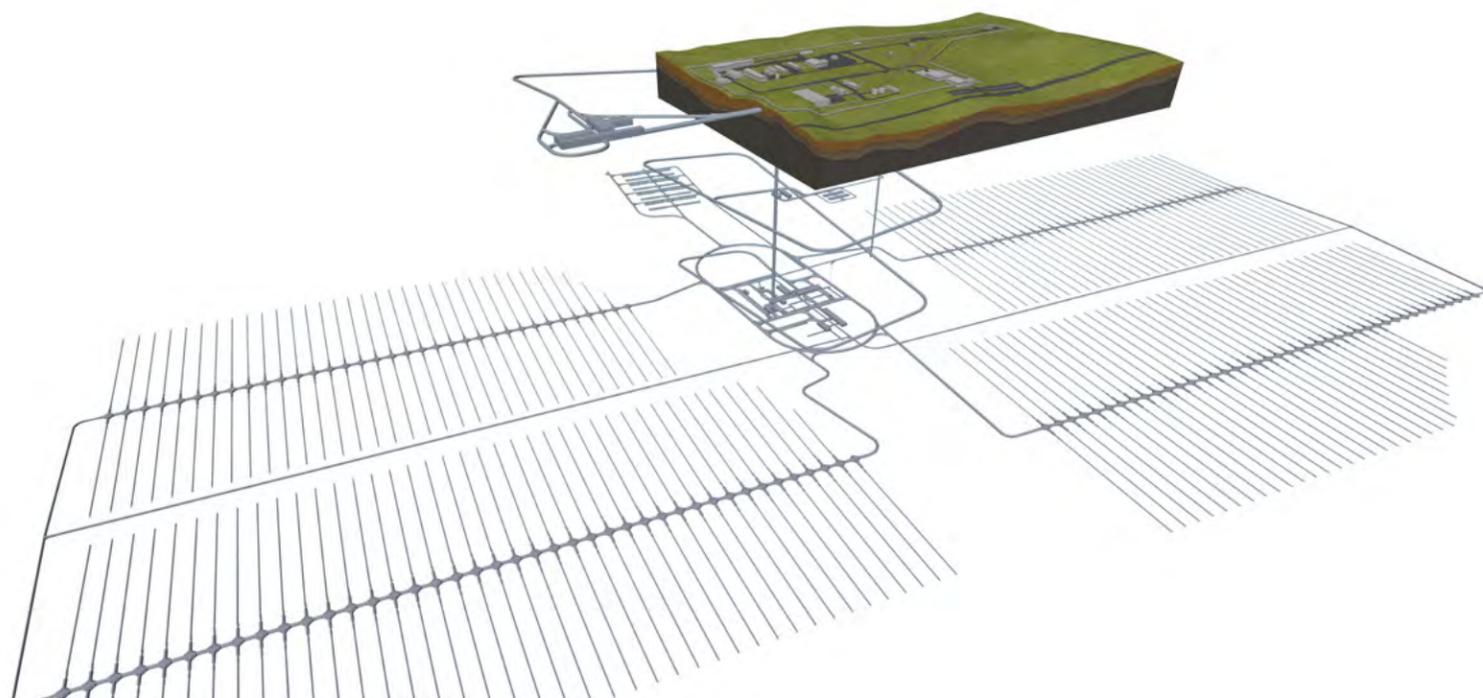
The so-called generic research programme, aimed at obtaining the data and arguments required to prove the feasibility and safety of the DGR at the candidate sites is underway both in Czech underground laboratories and via participation in projects being conducted in foreign underground laboratories. Information from underground laboratories (in which conditions in the future DGR can be accurately simulated) is unique and cannot be obtained in any other way. SÚRAO is active in a number of international experiments underway e.g. at the Grimsel Test

Site in Switzerland and the Äspö facility in Sweden.

The former Josef mine, which hosts an underground laboratory constructed by the Czech Technical University, is one of the most important research facilities in the Czech Republic. SÚRAO uses this laboratory primarily for the conducting of demonstration experiments that contribute towards proving the feasibility and safe behaviour of the engineered barriers. The international DOPAS (Demonstration of Plugs and Seals) project at the Josef

facility, for example, enables SÚRAO to test a number of potential plugs for the sealing and closure of disposal spaces. A further experiment underway at the facility comprises the Mock-Up Josef experiment, which serves for the modelling of the thermal stress of bentonite.

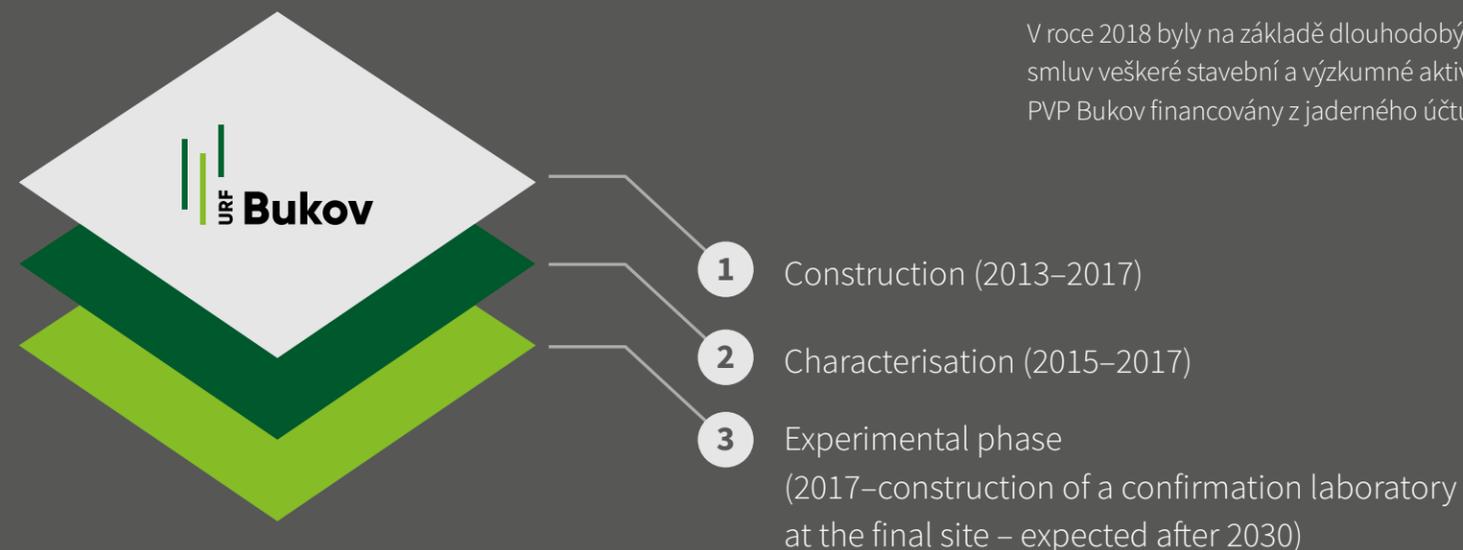
The most important underground laboratory in the Czech Republic is the SÚRAO-owned Bukov Underground Research Facility (URF), the research activities at which will be of key importance for the Czech deep geological repository project.



Bukov underground research facility

The Bukov underground research facility (URF) is located at a depth of 550 metres below the surface in the former Rožná uranium mine. It serves as a test site for obtaining information on all the phases of the DGR life cycle. Currently, the laboratory is providing valuable data that will serve for the accurate interpretation of the research underway at the candidate sites and for the testing of the engineered barriers.

The Bukov URF, located at a depth of 550 m below the surface, was constructed by SÚRAO as a site for the verification of the behaviour of the rock environment and various materials at a depth that corresponds to that of the future deep geological repository. The Bukov URF project schedule has been divided into three distinct phases:



Mimo prostorů PVP Bukov, nacházejících se na 12. patře dolu Rožná, lze využít pro potřeby výzkumných projektů i jiné části dolu, a to až po 24. patro (hloubka 1 200 m).

Vlastní výzkumný program PVP Bukov je rozdělen do celkem sedmi základních okruhů, označovaných jako VEP (Výzkumný a Experimentální Plán). Všechny VEP vycházejí ze střednědobých a dlouhodobých strategických plánů a jsou konfigurovány tak, aby získaná data byla užitečná pro interpretaci informací získaných v kandidátních lokalitách a celkově přínosná pro další detailnější zpřesňování projektu hlubinného úložiště. PVP Bukov tak přinese neocenitelné informace například o geologii či hydrologických podmínkách a umožní rovněž otestovat řadu technologických řešení.

V roce 2018 byly na základě dlouhodobých smluv veškeré stavební a výzkumné aktivity PVP Bukov financovány z jaderného účtu.

Experimental programme

REP 1

The characterisation and creation of geoscientific models of the rock environment

The research is focusing on the collection of descriptive geological data and its interpretation in the form of 3D models. The following project is currently underway:

The acquisition of data from the deep horizons of the Rožná mine (2017–2020)

The aim of the research is to obtain unique spatial geological data from depths of between 600 and 1,200 m below the surface in the rock complexes of the Kraví hora candidate site.

The research will provide data from an environment similar to that of the Kraví hora site. The data can then be used by SÚRAO for the assessment of rocks obtained during the future drilling exploration of the other candidate sites.

REP 2

Long-term monitoring of the rock environment

This experimental area will involve the assessment of long-term data obtained

from continuous sample-based research. The following projects are currently underway:

1. Hydrogeological and hydrochemical monitoring of the groundwater and mine water in the surroundings of the Bukov URF (2018–2023)

The research is directed towards the evaluation of the development and variability of the flow and chemical composition of the groundwater and mine water in the underground laboratory and its surroundings (Rožná mine, surface site).

The data obtained will enable SÚRAO to assess the hydrogeology and hydrochemistry at the candidate sites more rapidly and with a greater degree of accuracy. For example, the experiment allows for the assessment of the influence of newly-excavated mine workings on the flow of water and the groundwater chemical composition.

2. Microbiological screening of the Bukov URF and the Rožná mine (2017–2019)

The aim of the project is to obtain information on the microbial activity in the rock environment of the Bukov URF and in the deep horizons of the Rožná mine. The research findings will enable the estimation and predict of the microbial environment in the deeper parts of the rock masses of the candidate sites. The presence of natural and human-induced organisms (especially bacteria) may influence the decision on the final location of the repository (for example, some bac-

teria may exert a negative influence on the metal components of the waste disposal packages).

3. Monitoring of the activity of the brittle structures of the Bukov URF and the Rožná mine (2018–2022)

The project includes the monitoring of the shifting of rock masses along brittle structures and faults. The measured data will make up one of the various sources of information on rock mass stability. The research will determine to what extent displacements at depth are influenced by natural processes and, for example, excavation techniques, etc. This will improve the accuracy of the prediction of the likely movements in the disposal wells and the various effects on the waste disposal packages.

4. Long-term monitoring of the rock mass of the Bukov URF via non-destructive geophysical methods (2018–2022)

Geophysical methods are capable of providing very valuable information on the geological structure, properties and behaviour of the rock mass, including the influence of so-called excavation damaged zones. The research is focusing on the development and optimisation of various geophysical study methods and the characterisation of the more important geological interfaces, which are accessible only via indirect observation. The project will allow for the evaluation of the extent to which mining work (especially excavation) will affect the properties of

the neighbouring compact rock mass.

REP 3

The testing of groundwater flow and radionuclide transport models

This experimental area concerns the verification of the accuracy of the various considered water flow mechanisms at various scales. The commencement of this research area is expected in 2019.

REP 4

Engineered barriers of the deep geological repository

The research in this area concerns the verification of the characteristics, rate of degradation and interaction of the materials currently being considered for the disposal system and the waste disposal packages under real conditions. The research commenced in 2017. The following project is currently underway: **In-situ interactive physical models at the Bukov URF (2017–2022)** The project considers in-situ physical models that have been employed in an environment close to that of the future

DGR. The models simulate waste disposal packages surrounded by a damping bentonite barrier. The models have been placed in horizontal boreholes and the spent nuclear fuel is represented by a heater that generates temperatures of up to 200°C. The heater is surrounded by bentonite and the boreholes have been sealed with a concrete plug. The materials used in the experiments are the same as those being considered for use in the future DGR. Data is obtained from the various boreholes and samples are extracted on a regular basis that provide for the detailed description of the chemical and mineralogical processes that arise from the interaction between the materials (bentonite, concrete, rock). Further projects are planned in this research area over the next few years.

REP 5

Influence of the construction of the underground complex of the DGR on the rock environment

This experimental area concerns the description of the extent and character of the excavated damaged (EDZ) and disturbed (EdZ) zones created via the methods employed for the construction of the underground spaces of the DGR. The expected date for the commencement of

this area of experimentation is 2019.

REP 6

Development of technological procedures for the construction of the DGR

The research in this area will focus on the development of new procedures for the construction of the underground complex of the DGR with respect to time and financial optimisation considerations. The expected date for the commencement of this experimental area is 2022.

REP 7

Demonstration experiments

Comprehensive experiments will be conducted aimed at the testing of the behaviour of various components of the disposal system at the real scale and under DGR conditions. Emphasis will be placed on the testing of handling technologies, the construction of experimental models, and process monitoring. The expected date for the commencement of this experimental area is 2022.



International cooperation

International institutions coordinate a range of important events in the field of radioactive waste management, introduce legislative and regulatory initiatives and fund and conduct key research projects.

SÚRAO's participation in such activities at the bilateral and international levels is extremely important not only in terms of the deep geological repository project.

SÚRAO is, therefore, taking steps to form partnerships with other related organisations so as to share their experience and know-how.

Overview of selected international projects in which SÚRAO was involved in 2018:



Main partner	Project	Project description
EU	IDG – TP (Implementing Geological Disposal of radioactive waste Technology Platform)	European strategy initiative in the field of the research and development of, and support for the DGR project
EU	EURAD	Joint European programme for the development of technical and technological initiatives
EU	MoDeRn (Monitoring Developments for Safe Repository Operation and Staged Closure)	Monitoring of DGRs in various phases of operation and following closure
EU	CAST (Carbon-14 Source Term)	Research on the formation and release of ¹⁴ C from radioactive waste and the evaluation of the safety of the disposal of waste containing ¹⁴ C in DGRs
NEA (Nuclear Energy Agency) – OECD	Crystalline Club	Association of experts from countries that are considering crystalline rocks as the potential DGR host environment
Switzerland (NAGRA – National Cooperative for the Disposal of Radioactive Waste)	LTD (Long Term Diffusion)	Investigation of the transport of radionuclides via diffusion from fractures into a crystalline rock matrix
Switzerland (NAGRA – National Cooperative for the Disposal of Radioactive Waste)	MaCoTe (Material Corrosion Test)	Long-term evaluation of the rate and mechanism of the corrosion of waste disposal package materials
International	DECOVALEX (Development of Coupled Models and their Validation against Experiments)	International cooperation in the field of the development of methodologies, especially mathematical modelling (with regard to the DGR project)
Sweden (SKB – Swedish Nuclear Fuel and Waste Management Company)	TF EBS (Task Force on Engineered Barrier Systems)	International cooperation concerning the study of mechanical and chemical phenomena in engineered barriers

SÚRAO's communication activities in 2018 focused on raising awareness of radioactive waste in the Czech Republic and its safe disposal. In the vicinity of the Richard (near Litoměřice), Dukovany and Bratrství (near Jáchymov) repositories, communication concerned primarily the provision of information on the safe operation of these facilities. The communication approach included the use of information centres at which information is available for interested parties on its various activities, the operation of its repositories and the management of radioactive waste in the Czech Republic and abroad. Regular meetings of the respective civil control committees also played an important role in the dissemination of information during the year.



Communication

Communication with the public

SÚRAO is a member of the Dukovany Civil Safety Committee, and SÚRAO representatives regularly attend meetings of the committee. In recent years, SÚRAO initiated the establishment of so-called civil control committees for its two operational near-surface repositories, Bratrství and Richard. The motive for the establishment of these committees concerned efforts to strengthen the level of trust between local inhabitants and SÚRAO. The main task of these committees is to conduct independent inspections of the operation of the repositories, to compare them with the relevant international practice and to inform the local public of their findings. The members of the commissions comprise representatives from the affected and surrounding municipalities and the respective regional authorities as well as experts from SÚRAO and the Czech Mining Authority. Several non-scheduled meetings took place during the year at the request of local councils.

Once again, the Richard repository for the disposal of low-level and intermediate-level waste held an open day for those interested in visiting the facility on the second Saturday in September. The more than 200

Richard repository open day visitors had a unique opportunity to explore the repository and to see with their own eyes the strict safety measures according to which radioactive waste is disposed of in this former limestone mine. The main aim was to demonstrate that the Richard repository poses no threat to its surroundings.

The 2018 open day was, as last year, very successful, and SÚRAO will continue to organise similar events following the completion of the reconstruction of the repository.

In 2018, communication with the public with concern to the development of the Czech deep geological repository focused primarily on the provision of information on the current progress of the research work that will lead to an eventual reduction in the number of candidate sites. SÚRAO organised presentations of the latest results of the research to the general public at all nine sites being surveyed for the potential construction of the deep geological repository. The presentations allowed for local inhabitants to discuss issues of concern directly with experts. A number of additional discussion sessions

were held with local inhabitants during the year at the request of the relevant local councils.

An excursion was organised during the year for mayors from the sites selected for the potential location of the deep geological repository to the Grimsel Test Site underground laboratory in Switzerland. The visit included discussions with local citizens concerning involvement in the DGR decision-making process. In 2018, SÚRAO continued to publish its quarterly “News from SÚRAO” newsletter, which is distributed directly to all the inhabitants of the candidate DGR sites and the respective municipal authorities. In addition to the printed newsletter, SÚRAO also uses other communication channels, including its website and social media networks, aimed at both the inhabitants of the candidate sites and the wider population of the Czech Republic.

SÚRAO organises public opinion polls at regular intervals aimed at obtaining information on public attitudes to the issue of the deep geological repository at the potential sites. An extensive questionnaire survey was conducted in 2018 for SÚRAO

by the Public Opinion Research Centre of the Institute of Sociology of the Czech Academy of Sciences. 300 local residents from each site were invited to express their opinions on this issue.

One of the key target groups with respect to communication comprises the younger generation. Therefore, SÚRAO regularly organises presentations for primary and secondary schools as part of its wider educational programme. In 2018, 500 schoolchildren attended such presentations in

schools across the country. In addition, the main SÚRAO information centre in Prague was visited by a total of around 1,000 students in 2018.

As part of the educational programme for university students, the first SÚRAO summer school was held in 2018, which was attended by 11 students from various universities. The project included a series of lectures and 2 excursions to SÚRAO facilities. As part of its communication approach to the professional public, SÚRAO

organised an international conference held in the Chamber of Deputies building in 2018 entitled “How to effectively address the back-end of the fuel cycle?”.

SÚRAO is obliged to provide information to the public pursuant to Act No. 106/1999 Coll., on free access to information, and pursuant to Act No. 123/1998 Coll., on the right to access information on the environment. In 2018, SÚRAO received 5 requests for the provision of information in connection with Act No. 106/1999 Coll.

Provision of information to the public during 2018 according to Act No. 106/1999 on free access to information:

Number of applications for information under the Act	5
Number of appeals against a ruling	0
Conclusions of proceedings on sanctions for infringement of the Act	–
Other information concerning the implementation of Act No. 106/1999	–

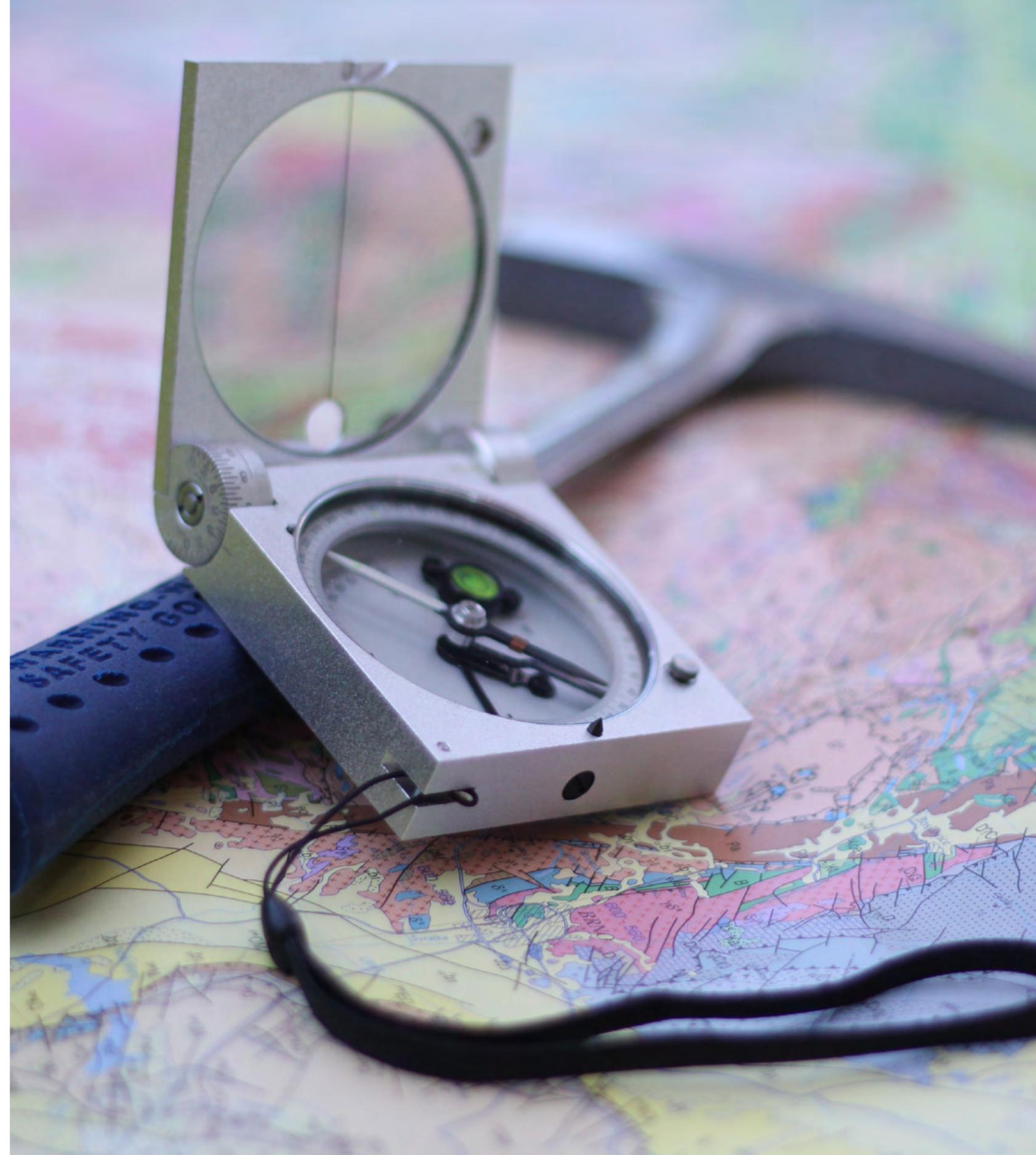
In addition to the activities listed in the previous chapters of this report, SÚRAO also performs a number of other activities in the field of nuclear waste management and other fields resulting from the requirements of the relevant generally binding statutory regulations.



Other activities

In addition to the operation of existing repositories and the preparation of the DGR project, SÚRAO is also responsible for the following:

- the monitoring of the impact of its radioactive waste repositories on the environment;
- radioactive waste management and the provision of related services;
- ensuring the safe handling of nuclear materials and other sources of ionising radiation;
- the maintaining of records of radioactive waste and nuclear materials received;
- the administration of charges for the disposal of radioactive waste (in the nuclear account);
- the inspection of the reserves of decommissioning permit holders, including the inspection of contractual conditions governing the maintenance of regulated accounts and the granting of approval for the withdrawal of funds from such reserves;
- the provision of financial contributions to municipalities;
- the provision of subsidies for the disposal of old radiation sources.



SÚRAO's activities are financed primarily from the Nuclear Account and state budget funds in compliance with the Atomic Act, Article 113, paragraph 6 which sets out rules for the management of radioactive waste disposed of prior to 1 July 2017 and abandoned radiation sources. SÚRAO is authorised to manage state property and consequently maintains the relevant accounts in pursuance of Act No. 563/1991 on accounting and Decree No. 410/2009 that implements certain provisions of Act No. 563/1991, and according to Act No. 218/2000, on budgetary rules. SÚRAO's budget is determined according to a budget structure defined by Ministry of Finance Regulation No. 323/2002, as amended. SÚRAO creates no reserves and all its revenues from services provided to radioactive waste producers are deposited in the Nuclear Account.

Financial management



Utilisation of Budget Funding in 2018

Item no.	Item (CZK thousand)	Approved budget	Adjusted budget	Budget utilisation	Utilisation percentage
5	Current expenses	480 980,65	480 980,65	279 254,23	58,06
6	Capital expenses	335 871,40	335 871,40	271 036,76	80,70
	Total expenses	816 852,05	816 852,05	550 290,99	67,37

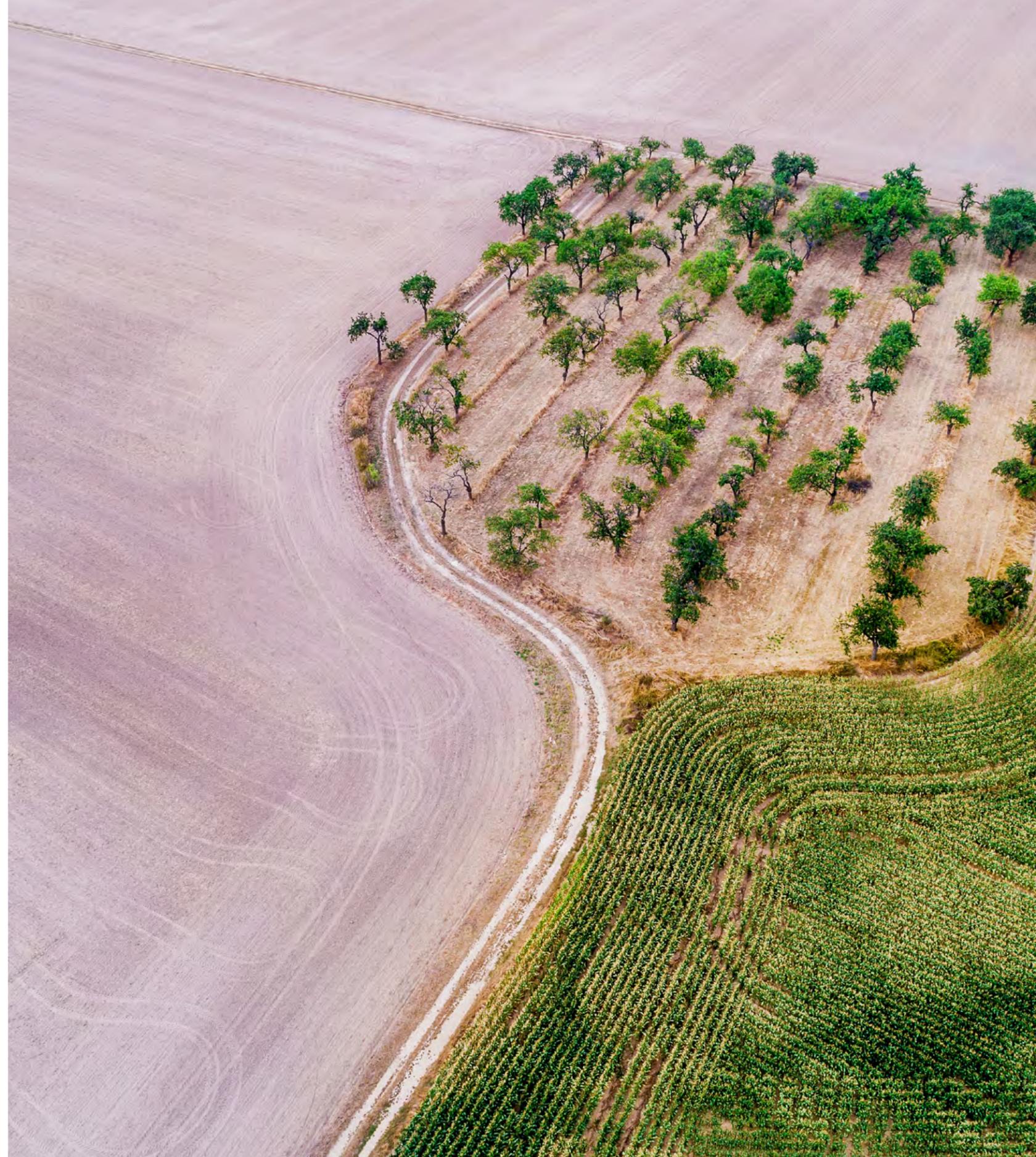
Expenses are subdivided into current expenses and capital expenses. In addition to items included in mandatory indicators, expenses concerning purchases and services relating to repository operation and those ensuing from external consultancy, telecommunications, transfers and administration services are included in current expenses. Expenses relating primarily to the DGR programme including research and development work, the reconstruction of existing repositories

and expenses resulting from other partial investment purchases are included in capital expenses. A detailed review of the utilisation of budget funding by individual item, accompanied by a commentary, was submitted to SÚRAO's Board as required.

The balance sheet is shown in Annex A, the profit and loss account in Annex B.

Auditor's report

The financial statements of SÚRAO were subjected to an external audit performed by the Diligens s.r.o. auditing company, registered in the list of audit companies maintained by the Chamber of Auditors of the Czech Republic (No. 196). An abridged version of the auditor's report is provided in Annex C to this report.



Assessment of SÚRAO's Performance in 2018

SÚRAO met its responsibilities for the safe and reliable operation of Czech radioactive waste repositories during 2018 as defined in the Atomic Act.

Preparations continued for the development of a deep geological repository in which high-level radioactive waste and spent nuclear fuel will be disposed of in the future. Concerning the efficient utilisation of budget funds allocated to external subcontractors, SÚRAO complied with the provisions of Act 134/2016, on the procurement of public contracts. Funds were employed efficiently and in compliance with the budget in order to fully meet the targets set out in the yearly plan of activities.

SÚRAO has successfully fulfilled its primary mission, i.e. the statutory guarantee of the safe disposal of all radioactive waste in the Czech Republic, since 1997.

The safe operation of our three repositories provides proof of the fulfilment of our mission. Today, SÚRAO enjoys a strong position in the radioactive waste management system and is well prepared for future challenges.

- A. Balance sheet**
- B. Profit and Loss Statement**
- C. Auditor's Report with the Auditor's Opinion**

Annexes

Annex A: Balance sheet as at 31 December 2018 (CZK thousand)

	Gross	Current period		Previous period	
		Correction	Net		
ASSETS	1 721 697 436,50	481 925 894,25	1 239 771 542,25	920 616 755,37	
A. Fixed assets	1 699 659 770,18	481 925 894,25	1 217 733 875,93	905 875 739,32	
I. Long-term intangible fixed assets	1 077 563 913,57	317 491 280,51	760 072 633,06	555 194 100,86	
II. Long-term tangible fixed assets	622 081 896,61	164 434 613,74	457 647 282,87	344 073 685,46	
III. Long-term financial assets	0	0	0	0	
IV. Long-term receivables	13 960,00	0	13 960,00	6 607 953,00	
B. Current assets	22 037 666,32	0	22 037 666,32	14 741 016,05	
I. Stocks	430 688,45	0	430 688,45	391 804,08	
II. Short-term receivables	453 277,70	0	453 277,70	1 619 181,30	
III. Short-term financial assets	21 153 700,17	0	21 153 700,17	12 730 030,67	
LIABILITIES			1 239 771 542,25	920 616 755,37	
C. Equity capital			1 116 161 341,42	889 731 338,89	
I. Owned capital and adjustments			860 948 187,81	860 965 535,81	
II. Financial funds			2 612 035,17	3 216 133,73	
III. Profit/loss account (including unpaid losses from previous years)			-848 174 642,58	-524 935 093,90	
IV. Budget management income and expenditure account			1 100 775 761,02	550 484 763,25	
D. Other sources			123 610 200,83	30 885 416,48	
I. Reserves			0	0	
II. Long-term payables			1 858 274,00	1 858 274,00	
III. Short-term payables			121 751 926,83	29 027 142,48	

Annex B: Profit and Loss Statement as at 31 December 2018 (CZK thousand)

Item no.	Item name	Current period Main activity	Previous period Main activity
A.	Total expenses	350 600 158,05	335 045 916,49
I.	Expenses from activities	292 119 773,39	226 196 561,52
II.	Financial activities	101 068,28	43 660,03
III.	Transfer expenses	58 379 316,38	108 805 694,94
IV.	Shared tax expenses	0	0
B.	Total revenues	27 360 609,37	13 630 343,41
I.	Revenue from activities	27 328 897,55	13 600 194,94
II.	Financial revenue	31 711,82	30 148,47
III.	Revenue from taxes and charges	0	0
IV.	Transfer revenue	0	0
V.	Revenue from shared taxes	0	0
VI.	SURPLUS/DEFICIT		
1.	Surplus/deficit before tax	-323 239 548,68	-321 415 573,08
2.	Surplus/deficit after tax	-323 239 548,68	-321 415 573,08

Annex C: Auditor's Report with the Auditor's Opinion – abridged

Auditor's Opinion

We have audited the financial statements of the Radioactive Waste Repository Authority (SÚRAO) (also referred to as the "Organisation") prepared in compliance with the accounting regulations effective in the Czech Republic and comprising the balance sheet as at 31 December 2018, the profit and loss account as at 31 December 2018, and annexes to the financial statements which include other explanatory information relating to the accounting entity concerned – a state organisational unit.

In our opinion, the financial statements give a true and fair view of the assets and liabilities of the Organisation – the Radioactive Waste Repository Authority / SÚRAO/ as at 31 December 2018 as well as the costs, revenue and profit/loss for 2018 in compliance with the accounting regulations effective in the Czech Republic.

Basis for the Auditor's Opinion

The audit has been conducted in accordance with the Czech Auditor Act and the standards of the Czech Chamber of Auditors which comprise International Standards on Auditing (ISA) supplemented and modified by related application clauses. Our responsibility defined by the

se regulations is described in more detail in the Auditors' Responsibility for Auditing the Financial Statements section. In accordance with the Auditor Act and the Code of Ethics adopted by the Czech Chamber of Auditors, we are independent of the Organisation and have fulfilled other ethical obligations arising from these regulations. We believe that the probative information collected gives an adequate basis for forming our opinion.

Other Information Provided in the Annual Report

Other information means all information provided in the Annual Report in addition to the financial statements and the Auditor's Report. The management of the Organisation is responsible for any other information provided.

Management responsibility for the financial statements

The management of the Organisation is responsible for compiling financial statements which provide a true and fair view in accordance with the accounting regulations effective in the Czech Republic and for such an internal control system which the management regards as necessary for the compilation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's responsibility for auditing the financial statements

Our objective is to gain reasonable assurance that the financial statements are free from apparent material misstatements due to fraud or error and to issue an auditor's report containing our opinion. Our responsibility is to identify and assess the risks of the significant (material) misstatement of the financial statements due to fraud or error, to design and implement audit procedures to address these risks and to obtain sufficient and appropriate probative evidence to provide a basis for expressing our opinion. It is also our responsibility to assess the appropriateness of the accounting rules applied, the reasonableness of the accounting estimates made and the information the management of the Organisation stated in the Annex to the financial statements.

Ing. Pavla Císařová, CSc.
Auditor, registration no. 1498

Prague, 4 March 2019

SÚRAO's Board

SÚRAO Board Membership

Ms. Lenka Kovačovská, Ph.D.

Deputy Minister, Energy sector at the Ministry of Industry and Trade

Mr. Bohdan Zronek

(Senior Vice Chairperson)
Head of the Nuclear Energy Division at ČEZ

Mr. Vítězslav Jonáš

(Deputy Vice Chairperson)
Chairman of the "Energy Třebíč Region" Association

Mr. Martin Holý

Director of the Geology Department at the Ministry of the Environment

Ms. Hana Slavíčková

Head of the Agriculture and Environment Financing Department at the Ministry of Finance

Mr. Vladimír Černý

Chairman of the Rouchovany town council

Mr. Pavel Gryndler

Head of the Environment Department of the Litoměřice town council

Mr. Bronislav Grulich

Chairman of the Jáchymov town council

Mr. Ladislav Štěpánek

Head of the Conventional Energy Division at ČEZ

Mr. Karel Křížek

Managing Director of ÚJV Řež

Mr. Radek Trtílek

Head of the Chemistry of the Fuel Cycle and Waste Management Division at ÚJV Řež

Prof. Radim Blaheta

Head of the Institute of Geonics of the Czech Academy of Sciences

Mr. Martin Ďurdovič

Institute of Sociology of the Czech Academy of Sciences

SÚRAO's Board is an advisory body established by the Ministry of Industry and Trade. The main task of the Board is to supervise the cost-effective and efficient use of funds. Board members are appointed by the Minister of Industry and Trade and include representatives of state administration authorities, radioactive waste producers and the public.

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Abbreviations

DGR

Deep geological repository

HLW

High-level waste

IAEA

International Atomic Energy Agency

OECD/NEA

Atomic Energy Agency of the Organisation for Economic Cooperation and Development

RAW

Radioactive waste

SNF

Spent nuclear fuel

SÚJB

State Office for Nuclear Safety

SÚRAO

Czech Radioactive Waste Repository Authority

WDP

Waste disposal package

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