



Our safe future

1997—2017

contents

4

Who are we?

8

Radioactive waste repositories

12

Deep geological repository

14

Science and research

14

Our team

16

Caring for radioactive waste in the Czech Republic – timeline

Introduction



Dr. Jiří Slovák,
Managing Director
of SÚRAO

The Czech Republic has close historical links to radioactivity. Our country boasts a rich supply of uranium ore, and uranium deposits have been known to have existed in the Czech Lands since the late Middle Ages. Indeed, we have one of the longest traditions of radionuclide use in the world. In the late 19th century in the Czech town of Jáchymov, Marie Curie-Sklodowska used local pitchblende uranium ore in her research. At the beginning of the 20th century, the processing of natural radioisotopes was commonplace in the Czech Lands for use in the industrial, research and health care sectors. From 1945 onwards, the Czech Republic was involved in cutting-edge research and development in the field of nuclear energy which, eventually, led to the construction of the country's nuclear power plants, both of which, naturally, led to the production of radioactive waste (RAW). The Czech Republic thus has a long history of issues surrounding the disposal of radioactive waste. As early as by the end of 1991, the Institute for the Research, Production and Use of Ra-

dioisotopes was involved in the management and final disposal of RAW. From 1992, following repository privatisation, the companies NYCOM and, subsequently, ARAO were responsible for such activities. After the adoption of the Atomic Act in 1997, repository management was transferred to the state and RAW disposal and the safe operation of repositories was entrusted to a newly-established state organisational body - the Radioactive Waste Repository Authority (SÚRAO). This year, the Authority celebrates its 20th anniversary. This brochure provides basic information on our various activities; more detailed information is available on our website or via our information centres. The Radioactive Waste Repository Authority has been successfully fulfilling its role for 20 years, for which we would like to thank all our employees, without whose sustained hard work and perseverance we would not have been able to achieve such successful results. Grateful thanks are also extended to our various partner organisations.

Who are we?

The Radioactive Waste Repository Authority (SÚRAO) was established on 1 June 1997 by the Ministry of Industry and Trade pursuant to section 26 of Act No. 18/1997 Coll., on the peaceful use of nuclear energy and ionising radiation (the Atomic Act). On 1 January 2001, SÚRAO became a state organisational body.

The main activities of the Radioactive Waste Repository Authority include ensuring the safe operation of low- and medium-level radioactive waste repositories. SÚRAO is responsible for the operation of all the Czech Republic's radioactive waste repositories.

Most of the costs associated with the operation of the country's repositories are covered by the so-called Nuclear Account, to which all producers of radioactive waste in the Czech Republic are required to contribute. The costs of disposing of old radioactive waste are met by the Ministry of Industry and Trade.

SÚRAO is also responsible for all the work involved in the development and construction of the country's deep geological repository (DGR) for high-level waste and spent nuclear fuel. All SÚRAO's work is performed in accordance with its Plan of Activities which is approved by the Government.

Examples of waste producers

- 1 Dukovany nuclear power station
- 2 Temelín nuclear power station
- 3 Research – ÚJV Řež, a. s. – hot chamber
- 4 Research – ÚJV Řež, a. s.
- 5 Health sector – positron emission tomography
- 6 Health sector – handling of radiopharmaceuticals



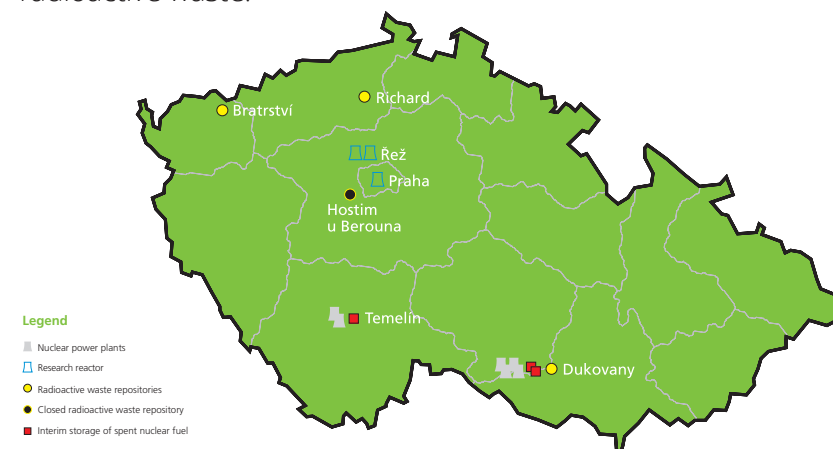
Radioactive Waste Repositories

SÚRAO safely operates three repositories

The Bratrství repository is designed for the disposal of waste containing only naturally-occurring radionuclides. The Richard repository is designated for the disposal of institutional radioactive waste. The Dukovany repository is intended for the disposal of radioactive waste from both the Dukovany and Temelín power plants. The three waste repositories currently contain around 19,000m³ of radioactive waste.

In 2000, SÚRAO took over both the Richard and Bratrství repositories from the private company ARAO and, in the same year, took over the Dukovany repository from the ČEZ power company.

The Czech Republic also has one closed-down repository, which is located around three kilometres east of Beroun in the abandoned Hostim I limestone quarry, also known by the name Alkazar. The repository was in operation from 1959 to 1964. In the 1990s, a waste inventory was conducted and it was decided to close the site indefinitely. Final closure took place in 1997. SÚRAO monitors the radiation situation of the repository and its surroundings on a regular basis. During its 20-year history, SÚRAO has overseen the disposal of over 9,000m³ of radioactive waste.



Repositories and their capacity

Richard repository, Litoměřice

Since

1964

Volume of waste disposed of:

Up to 2000 — **4790 m³**

2000–2016 — **2615 m³**

Bratrství repository, Jáchymov

Since

1974

Volume of waste disposed of:

Up to 2000 — **603 m³**

2000–2016 — **324 m³**

Dukovany repository, Rouchovany

Since

1995

Volume of waste disposed of:

1995–1999 — **1468 m³**

2000–2016 — **6171 m³**

Deep geological repository

Since

2065

Planned for roughly

9000 tonnes

of spent nuclear fuel

1

Richard repository

The Richard repository has been in operation since 1964 and serves for the disposal of institutional waste produced in the healthcare, industrial, agricultural and research sectors. The facility is situated in a former limestone mine complex near the town of Litoměřice. Richard exhibits ideal isolation properties due to the thick and stable layers of impermeable rocks positioned both above and below the mine corridors. Several hundred waste packages are disposed of annually at the Richard repository.



2

Dukovany repository

The Dukovany surface repository occupies an area of 1.3 hectares and is located within the Dukovany nuclear power plant complex. It is primarily intended for the disposal of low- and intermediate-level waste from the Dukovany and Temelin power plants. The total disposal area amounts to 55,000 cubic metres, enough for the disposal of approximately 180,000 waste packages. The capacity of the repository is sufficient for the disposal of all the operational waste from both power plants, even if their planned lifetimes are extended. The repository was put into operation in 1995 and is the youngest of the Czech Republic's repositories.



3

Bratrství repository

The Bratrství repository in Jáchymov was constructed in part of the abandoned underground area of a former uranium mine of the same name and has been in operation since 1974. It serves for the disposal of institutional radioactive waste containing only naturally-occurring radionuclides. Waste of this category originates primarily from the decommissioning of certain types of radiation emitters used in the healthcare and research sectors. Such waste makes up only a small percentage of the total amount of radioactive waste produced in the Czech Republic. Several dozen waste packages are disposed of at the Bratrství repository annually.



Disposal of low- and intermediate-level waste

Radioactive waste must be categorised, processed and modified so that it can be safely disposed of, i.e. permanently isolated from the environment. Liquid waste must be thickened and stabilised using a suitable binding material (cement, bitumen, aluminosilicate or a glass matrix) and solid waste can be compressed. The waste is placed in 100-litre stainless steel drums which are subsequently placed in 200-litre drums. The space between them is then filled with concrete and the drum sealed with a close-fitting lid, painted with a special coating and carefully labelled for future reference. Such drum assemblages are known as waste packages.

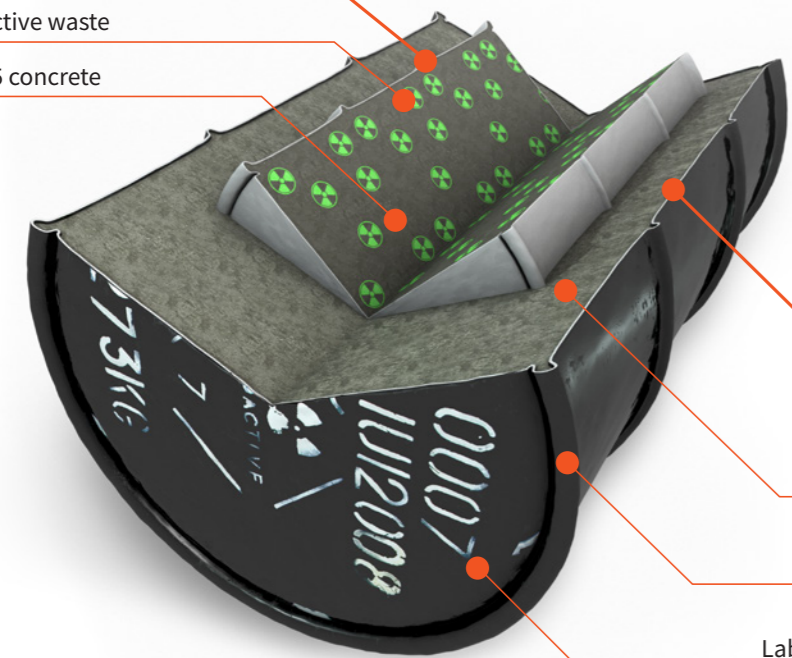
The package in which waste can be stored, the form of the waste, the amount of radionuclides, the weight and other criteria are precisely defined in terms of the limits and conditions governing the operation of each repository, i.e. a set of criteria that must be satisfied both by the waste and the operation of the relevant

repository in order that safety requirements be met. The limits and conditions for safe operation must be approved by the State Office for Nuclear Safety (SÚJB) and regularly updated on the basis of the performance of safety analyses. The waste must not contain free fluids, explosives or hazardous substances. The operation of the repositories is monitored several times per year by SÚJB inspectors and, in the case of Richard and Bratrství, mining authority inspectors. The treatment of radioactive waste into a form suitable for disposal can only be conducted by companies that have permission from the SÚJB to perform such activities (e.g. ÚJV Řež, a.s., VF, a.s., UJP PRAHA, a.s.) and waste producers are required to use their services. While SÚRAO does not hold such authorisation, it is the only institution in the Czech Republic licenced to operate radioactive waste repositories.

100-litre container

Radioactive waste

Class 25 concrete



200-litre container

Class 28 concrete

Protective coating

Labelling of the waste package

Delivery, inspection and disposal at the Richard repository



1 A truck with radioactive waste enters the Richard repository complex



2 The waste is unloaded after entering the secure area



3 The waste packages are removed one-by-one by fork-lift truck



4 Control measurements are taken of the activity and weight of individual packages



5 The waste packages are then transferred to the underground disposal area



6 The waste packages are then emplaced in a pre-determined disposal chamber

Several hundred waste packages are delivered to the Richard repository annually and subsequently disposed of. The packages contain institutional waste consisting of discarded radioactive emitters (fire alarms, gauges, etc.) and contaminated scrap materials, plastics, paper, etc.

The waste disposed of at the repository must comply with so-called disposal acceptance conditions set out and closely supervised by the State Office for Nuclear Safety. Only following a thorough inspection of the documentation which accompa-

nies each waste package and a physical check of the contents, can SÚRAO's disposal specialists accept the waste for disposal.

Inspectors from the SÚJB and the State Mining Administration of the Czech Republic conduct regular inspections of the observance of the limits and conditions set out for the safe operation of the Richard repository and the observance of nuclear and mining safety, radiation protection and other criteria contained in nuclear legislation.

Test laboratory for waste containers

drop test



leakage test



thermal test



SÚRAO operates a test laboratory for waste containers and so-called radioactive substances of special form within the Richard repository complex at Litoměřice. In 2006, the testing facility was completely reconstructed and equipped with modern technical equipment for the conducting of drop tests using a remote-controlled crane with an impact area which includes specialised outlet equipment, a special outdoor area for thermal testing using liquid propane, a pressure vessel for the conducting of leakage tests and other technology and equipment necessary for the conducting of such tests.

Deep geological repository

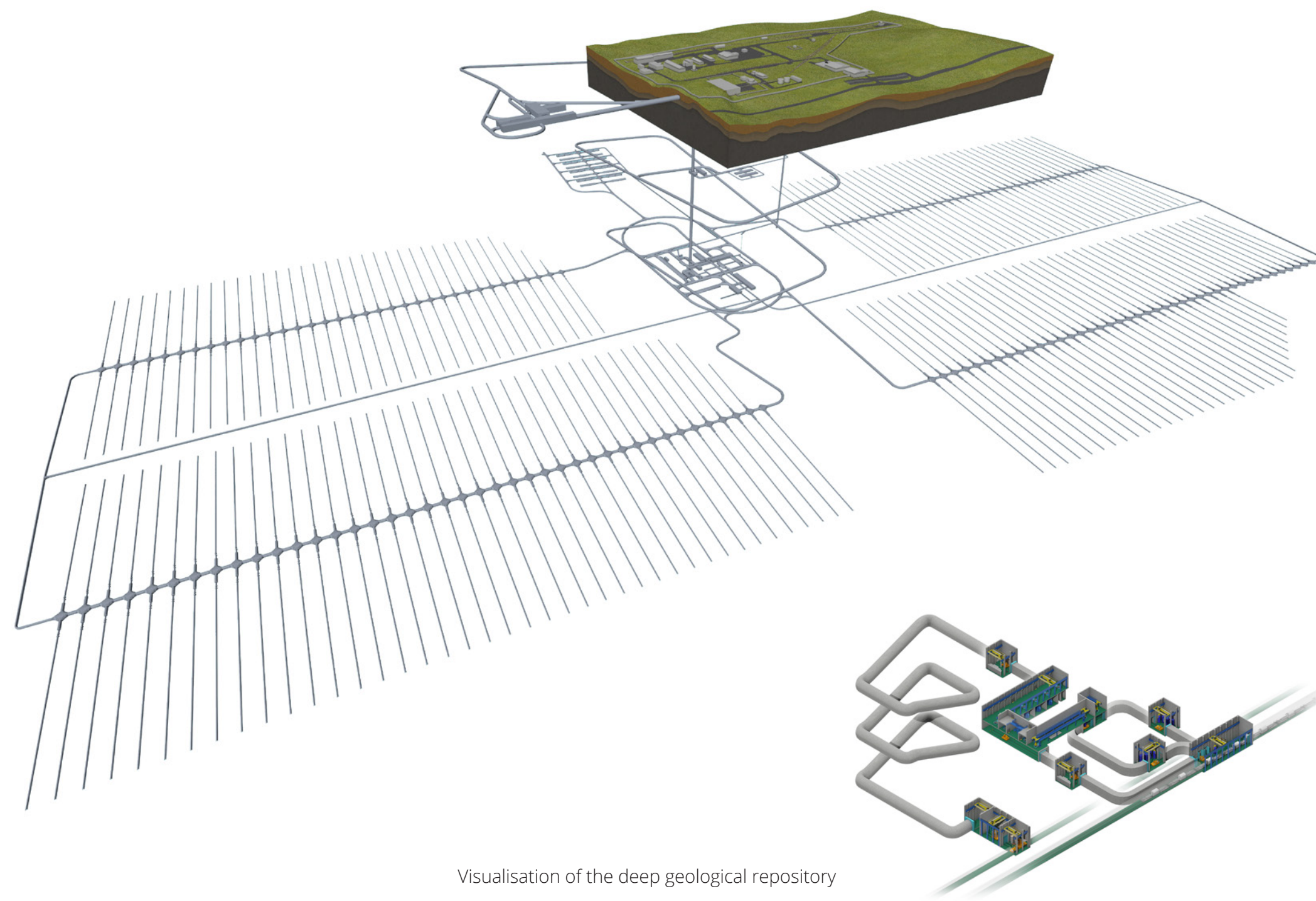
Deep geological repositories for high-level waste and spent nuclear fuel serve for the permanent disposal of spent fuel from nuclear reactors and, to a lesser extent, high-level waste from the nuclear power, industrial, research and healthcare sectors. It is planned that the Czech repository will be constructed in a suitable crystalline massif around 500 metres below the earth's surface. The start of the construction phase is planned for 2050. Up to that time, exploration, survey and design activities will continue, as will dialogue with the public concerning the search for a suitable site for the siting of the repository and preparations for its construction.

Spent nuclear fuel and high-level waste already exist in the Czech Republic and every year around 100 tonnes of such waste are generated. Spent nuclear fuel is currently stored at so-called interim storage facilities located at nuclear power stations. It is therefore planned that the deep geological repository will serve for the disposal of spent fuel from the operation of both Czech nuclear power plants as well as from other planned sources, the estimated amount of which, i.e. around 9000 tonnes of spent nuclear fuel, will determine both the technical design and the storage capacity of the facility.

The selection of the optimum location is crucial in terms of the construction of the deep geological repository. The site needs to meet not only safety requirements concerning the rock properties but also a number of other, no less important, requirements including, for example, the technical feasibility of constructing the underground disposal area, transport accessibility and public acceptance.

The first study aimed at assessing the potential of the rock environment in the Czech Republic was conducted in the 1990s.

At present, SÚRAO is exploring seven potential sites for deep geological siting, as well as verifying a number of alternative locations principally in the surroundings of nuclear power plants.



Visualisation of the deep geological repository

Science and research

Scientific research aimed at demonstrating safety

The deep geological repository for spent nuclear fuel and high-level waste cannot be constructed and operated without the credible demonstration of its safety.

As part of the deep geological repository development programme, SÚRAO is closely involved in a number of research and demonstration projects, both domestic and international. The aim is to obtain information on the feasibility of the repository and the long-term behaviour of the disposal system and the surrounding rock massif under different conditions.

In addition, SÚRAO operates the Bukov Underground Research Laboratory (URL) which serves for acquiring data and characteristics from depths in the rock environment at which the future deep geological repository will be constructed and which will be used for repository safety assessment purposes.



Our team

During its 20 years of existence, SÚRAO has grown considerably. At the end of 1997, SÚRAO employed just 8 persons; twenty years later, 58 staff are employed by the organisation on a full-time basis. The structure of the Authority consists of five administrative sections. The Office of the Managing Director section includes, inter alia, the Communications and Internal Audit departments. The Economics and Administration section deals with finance and internal management issues. Operational repositories, radioactive waste disposal and related issues are the responsibility of the Repository Operation, Safety and Authorisation Procedures section. Issues surrounding the development of the future deep geological repository and other project activities are handled by the Radioactive Waste Repository Development section and, finally, the Bukov URL section is responsible for all issues related to the operation of this underground research facility.



Major projects aimed at a safe future for all



Research support for deep geological repository safety assessment

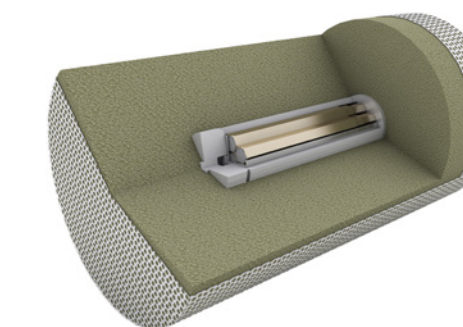
Detailed research on the phenomena, processes and events that may occur within the deep geological repository over thousands of years is essential to the understanding of their impacts on repository safety. This issue makes up one of the most demanding research tasks in terms of time and complexity. The aim of the project is to obtain the selected data, models, arguments and other information necessary for the evaluation of the long-term safety of potential sites for the deep geological repository.

Research support for the design of the deep geological repository

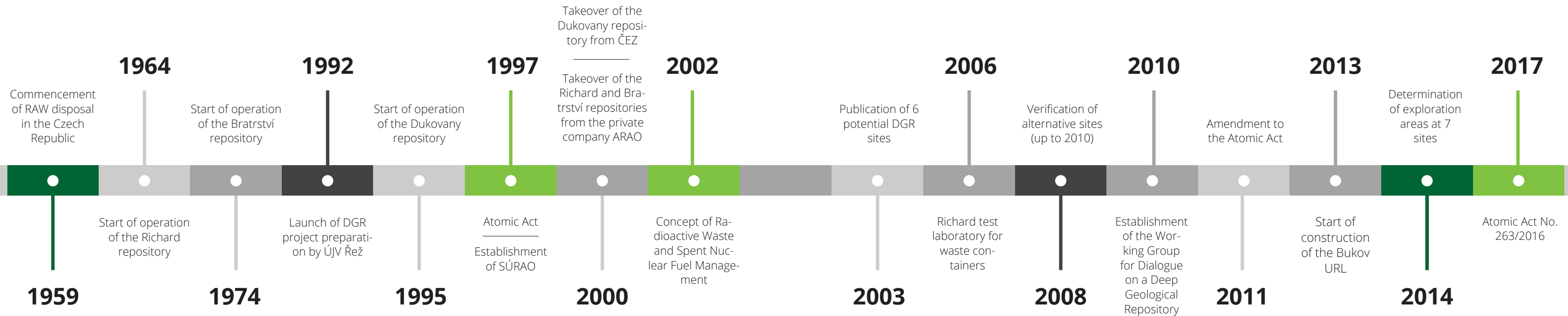
This makes up one of a number of pilot projects in which SÚRAO is involved. The aim is to develop and optimise in detail the conceptual technical design of the disposal system and its individual components in such a way that is acceptable in terms of both operational and long-term safety, while incurring reasonable investment and operating costs.

Research and development of disposal containers

The project for the safe disposal of spent nuclear fuel in a deep geological repository is based on the so-called multi-barrier safety concept, the basic barrier of which consists of the waste container that will be required to fulfil a range of demanding requirements both during the repository operational phase and, particularly, following repository closure. This involves principally ensuring the dispersal of residual heat and the avoidance of the release of radioactive substances. The disposal packages will be subject to enhanced lifetime requirements due to the material stored within them. It will be necessary to ensure not only resistance to leakage and corrosion and a high level of mechanical resistance, but also compatibility with the other engineered barriers in the disposal system.



Caring for radioactive waste in the Czech Republic – timeline





Správa úložišť radioaktivních odpadů
Dlážděná 6
110 00 Praha 1



www.surao.cz

photos: SÚRAO, FN Homolka, ÚJV Řež a.s., Petr Jan Juračka