

Nuclear Regulatory Issues and Main Developments in Germany

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Federal Ministry
for the Environment, Nature Conservation,
Nuclear Safety and Consumer Protection



Federal Office
for the Safety of
Nuclear Waste Management

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Abbreviations

ARTEMIS	Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation
BASE	Federal Office for the Safety of Nuclear Waste Management (former BfE)
BDEW	Federal Association of the Energy and Water Industry
BfS	Federal Office for Radiation Protection
BGE	Federal Company for Radioactive Waste Disposal
BGZ	Company for Radioactive Waste Storage
BMUV	Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection
ENSREG	European Nuclear Safety Regulators Group
IAEA	International Atomic Energy Agency
IRRS	Integrated Regulatory Review Service
KTA	German Nuclear Safety Standards Commission
MWe	Megawatt electrical power
NPP	Nuclear Power Plant
OECD/NEA	Organisation for Economic Co-operation and Development / Nuclear Energy Agency
RLZ	Federal Radiological Situation Centre
TWh	Terawatt hour

1. General Topics

a) *Nuclear Power Phase Out*

The nuclear power phase out in Germany is completed. According to the legal framework of 2011, the last three nuclear power plants (NPPs) Isar 2, Emsland, and Neckarwestheim 2 should have been shut down by the end of 2022 at the latest. However, due to the unexpected energy crisis in Europe following the Russian war against Ukraine, on 11 November 2022, the German parliament decided that these three nuclear power plants may continue stretch-out operation until 15 April 2023 at the latest. Stretch-out operation means that only those fuel assemblies could be used which were present in the reactor core or in the spent fuel pool at the time the amended law came into force. The need for this continued operation for a limited period of time was identified in a special analysis of the four transmission system operators who are responsible for the control areas for the power supply for winter 2022/23—the so-called stress test—as a further pillar for energy supply security in Germany. Furthermore, the continued operation of the three nuclear power plants in winter 2022/23 was also meant to strengthen the stability of the German and the European power grid in the event of impending power deficits. More information about the stretch-out operation can be found on the website of the Bundestag:

<https://www.bundestag.de/dokumente/textarchiv/2022/kw45-de-atomgesetz-freitag-917474>

The corresponding 19th amendment of the Atomic Energy Act came into force on 9 December, 2022, and can be found at:

https://www.bqbl.de/xaver/bqbl/start.xav?start=//%*%5B@attr_id=%27%27%5D#_bqbl_%2F%2F%*%5B%40attr_id%3D%27bqbl122s2153.pdf%27%5D_1678434309977

The Atomic Energy Act requires a yearly publication of the generated, transferred, and remaining electricity volumes. The status as of 31 December 2022 was published by the Federal Office for the Safety of Nuclear Waste Management (BASE) in the Federal Gazette (*Bundesanzeiger*, BAnz AT 17.04.2023 B4) on 17 April 2023, and on the BASE website:

<https://www.base.bund.de/SharedDocs/Downloads/BASE/DE/berichte/kt/elektrizitaetsmenge-2022.html>

More information about electricity production rights can be found on the BASE website:

https://www.base.bund.de/EN/ns/ni-germany/npp/operating-times/operating-times_node.html

b) Establishment of the Federal Radiological Situation Centre (RLZ)

To further develop technical and organisational cooperation for coping with emergencies, the Federal Radiological Situation Centre (RLZ) was established as a new institution within the emergency preparedness and response system of the Federation. The RLZ within the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV), as the supreme federal authority responsible for radiation protection, prepares a unique radiological situation report in the event of radiological or nuclear emergencies that may have trans-boundary or trans-regional effects within the territory of the Federal Republic. This takes the form of a situation report with a technically sound preparation, presentation, and evaluation of the information on the type, extent, and expected development of the radiological situation. In addition, the RLZ is particularly responsible for the coordination of protective measures and measurements.

c) Electricity Production and Nuclear Share

The gross electricity production in Germany reached 574.0 TWh in 2022 (585.0 TWh in 2021). The nuclear share of the gross electricity production in 2022 was 6.0 %, compared to 11.8 % in 2021 and 11.3 % in 2020. The shares of the different energy sources are shown in Table 1.

Table 1: Gross electricity production – 2020 - 2022 [TWh]

	2020		2021		2022*	
	TWh	%	TWh	%	TWh	%
Nuclear	64.4	11.3	69.1	11.8	34.7	6.0
Lignite	91.7	16.2	110.4	18.9	117.0	20.4
Hard Coal	42.8	7.5	54.9	9.4	66.0	11.5

	2020		2021		2022*	
	TWh	%	TWh	%	TWh	%
Oil	4.7	0.8	4.9	0.8	4.6	0.8
Gas	94.8	16.7	90.0	15.4	77.5	13.5
Renewables	250.8	44.2	237.1	40.5	256.2	44.6
Others	18.3	3.2	18.6	3.2	18.0	3.1
Total	567.5	100	585.0	100	574.0	100

[Data from BDEW, 20 December 2022]

* preliminary data

2. Laws and Regulations

a) *Matters under International Law*

Germany is Contracting Party to the Convention on Nuclear Safety (CNS). The eighth Review Meeting was planned to be held from 23 March to 3 April 2020. Due to the spread of COVID-19, it was first decided to postpone the meeting to 2021 and then to merge the eighth and ninth Review Meeting in one meeting from 20 to 31 March 2023. All German National Reports for the CNS are published on the website of BMUV: <http://www.bmuv.de/WS4630-1>

For more information, see: https://www.base.bund.de/EN/ns/safety/co-operation/cns/cns_node.html

Germany is Contracting Party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (JC). The seventh Review Meeting was planned to be held in May 2021. Due to the spread of COVID-19, it was postponed to 27 June – 8 July 2022. The German National Report was published on the website of BMUV: www.bmuv.de/DL2577-1

With regard to the discussion about the taxonomy in the European Union, BASE conducted an Expert Response to the report by the EU Commission's Joint Research Centre "Technical assessment of nuclear energy with respect to the 'Do No Significant Harm' criteria in Regulation (EU) 2020/852, the 'Taxonomy Regulation'". The Expert Response questions the sustainability of nuclear power. It is available on the website of BASE: https://www.base.bund.de/SharedDocs/Downloads/BASE/EN/reports/2021-06-30_base-expert-response-jrc-report.pdf?__blob=publicationFile&v=8

b) *National Legislation*

Numerous amendments and revisions of regulatory documents in the field of emergency preparedness and response were carried out, based in particular on the experience gained from the reactor accidents in Fukushima and the transposition of Directive 2013/59/Euratom into German law. Particularly important in this context are the Radiation Protection Act (*Strahlenschutzgesetz*), the Radiation Protection Ordinance (*Strahlenschutzverordnung*), the Emergency Dose Value Ordinance (*Notfall-Dosiswerte-Verordnung*), and the Nuclear Waste Management Ordinance (*Atomrechtliche Entsorgungsverordnung*).

For more information, see: https://www.bfs.de/EN/bfs/laws-regulations/laws-regulations_node.html

c) *National Regulation and KTA safety standards*

For information on currently valid regulatory documents see:

https://www.base.bund.de/EN/bfe/laws-regulations/hns/mrs_node.html

In order to further develop the safety culture, the nuclear licensing and supervisory authorities of the Federation and the Länder developed a common understanding of their safety culture and put it down in writing in a policy paper. It covers the fields of nuclear safety, nuclear security, and radiation protection in nuclear installations and of nuclear fuel transports. The policy paper considers current international developments in this area. In particular, the principles of the OECD/NEA on safety culture in supervisory authorities published in 2016 were applied. The policy paper adopted by the Länder Committee for Nuclear Energy at its meeting on 6/7 June 2019 forms the basis for further development and concretisation of the safety culture in the individual authorities.

On 22 November 2022 the German Nuclear Safety Standards Commission (Kerntechnischer Ausschuss – KTA) had its 74th meeting, also marking its 50th anniversary. During this meeting the KTA reviewed all KTA nuclear safety standards for validity. The 74th meeting had the following results:

The KTA issued one revised KTA standard:

- KTA 2207 Flood Protection for Nuclear Power Plants

The KTA issued 32 revised KTA draft standards:

- KTA 1301.1 Radiation Protection Considerations for Plant Personnel in the Design and Operation of Nuclear Power Plants; Part 1: Design
- KTA 1301.2 Radiation Protection Considerations for Plant Personnel in the Design and Operation of Nuclear Power Plants; Part 2: Operation
- KTA 1403 Ageing Management in Nuclear Power Plants
- KTA 1404 Documentation During the Construction and Operation of Nuclear Power Plants
- KTA 1501 Stationary System for Monitoring the Local Dose Rate within Nuclear Power Plants
- KTA 1502 Monitoring Volumetric Activity of Radioactive Substances in the Inner Atmosphere of Nuclear Power Plants
- KTA 1503.1 Monitoring the Discharge of Radioactive Gases and Airborne Radioactive Particulates; Part 1: Monitoring the Discharge of Radioactive Matter with the Stack Exhaust Air During Specified Normal Operation
- KTA 1503.2 Monitoring the Discharge of Radioactive Gases and Airborne Radioactive Particulates; Part 2: Monitoring the Discharge of Radioactive Matter with the Vent Stack Exhaust Air During Design-Basis Accidents
- KTA 1503.3 Monitoring the Discharge of Radioactive Gases and Airborne Radioactive Particulates; Part 3: Monitoring the Non-stack Discharge of Radioactive Matter
- KTA 1504 Monitoring and Assessing the Discharge of Radioactive Substances with Water
- KTA 1505 Suitability Verification of the Stationary Measurement Equipment for Radiation Monitoring
- KTA 1507 Monitoring the Discharge of Radioactive Substances from Research Reactors
- KTA 1508 Instrumentation for Determining the Dispersion of Radioactive Substances in the Atmosphere
- KTA 2103 Explosion Protection in Nuclear Power Plants with Light Water Reactors (General and Case-Specific Requirements)
- KTA 2206 Design of Nuclear Power Plants against Damaging Effects from Lightning
- KTA 2501 Structural Waterproofing of Nuclear Power Plants
- KTA 3101.1 Design of Reactor Cores of Pressurized Water and Boiling Water Reactors; Part 1: Principles of the Thermohydraulic Design
- KTA 3101.3 Design of Reactor Cores of Pressurized Water and Boiling Water Reactors; Part 3: Mechanical and Thermal Design
- KTA 3401.4 Steel Containment Vessels; Part 4: Inservice Inspections
- KTA 3402 Airlocks on the Reactor Containment of Nuclear Power Plants - Personnel Airlocks
- KTA 3403 Cable Penetrations through the Reactor Containment Vessel
- KTA 3407 Pipe Penetrations through the Reactor Containment Vessel
- KTA 3409 Airlocks on the Reactor Containment of Nuclear Power Plants - Equipment Airlocks
- KTA 3504 Electrical Drive Mechanisms of the Safety System in Nuclear Power Plants
- KTA 3507 Factory Tests, Post-Repair Tests and the Certification of Proven Performance of Modules and Devices of the Instrumentation and Control System Important to Safety
- KTA 3601 Ventilation Systems in Nuclear Power Plants
- KTA 3603 Facilities for Treating Radioactively Contaminated Water in Nuclear Power Plants
- KTA 3605 Treatment of Radioactively Contaminated Gases in Nuclear Power Plants with Light Water Reactors
- KTA 3702 Emergency Power Generating Facilities with Diesel-Generator Units in Nuclear Power Plants
- KTA 3703 Emergency Power Facilities with Batteries and AC/DC Converters in Nuclear Power Plants
- KTA 3704 Emergency Power Facilities with Static and Rotary AC/DC Converters in Nuclear Power Plants

- KTA 3705 Switchgear, Transformers and Distribution Networks for the Electrical Power Supply of the Safety System in Nuclear Power Plants

A revision process was started for

- KTA 2201.2 Design of Nuclear Power Plants against Seismic Events; Part 2: Subsoil.

In 2023, the KTA plans to finish most of the ongoing 33 revisions and publish the corresponding revised nuclear safety standards.

For detailed information on the KTA and its safety standards, see the KTA website:

http://www.kta-gs.de/welcome_engl.htm

d) *"National Programme" - Programme for the responsible and safe management of spent fuel and radioactive waste*

In accordance with Directive 2011/70/Euratom, BMUV set out Germany's strategy for the responsible and safe management of spent fuel and radioactive waste in its national programme. This programme was adopted by the German cabinet on 12 August 2015. BMUV carried out agency and public participation on the programme before its adoption. The national programme is not legally binding, but has to be considered by all actors in the planning of waste management and administrative decisions. The national programme consists of an overarching document giving a programmatic overview of German waste management policy and four appendices: The national programme is subject to potential revision in view of ongoing deliberations by the German parliament's Commission on the Storage of Highly Radioactive Materials.

The National Programme and supplementary documents can be found on the website:

<https://www.bmuv.de/en/download/national-programme/>

e) *Recommendations by RSK, ESK and SSK*

BMUV is supported by three advisory committees regarding nuclear safety, waste management, and radiation protection.

The Reactor Safety Commission (Reaktor-Sicherheitskommission – RSK) recently issued the following recommendations or statements:

- Continued operation of German nuclear power plants until 15 April 2023 (11/2022, in German)
- Experience gained in dealing with the corona pandemic - methods of remote supervision/inspection (10/2021, in German)
- Summary statement of the RSK on man-made hazards, aircraft crash (10/2021, in German)

The complete list of recommendations and statements by RSK is available on the website:

<http://www.rskonline.de/en/consultationresults>

The Nuclear Waste Management Commission (*Entsorgungskommission* – ESK) recently issued the following recommendations, statements, or information papers:

- Clearance of radioactive material and removal of non-radioactive material from the dismantling of nuclear power plants (09/2022)
- Comparison of the mass flows from decommissioning of nuclear power plants in Germany and France (06/2022)
- The 100 degrees Celsius criterion in § 27(4) of the Site Selection Act (05/2022, in German)
- ESK guidelines for the performance of periodic safety reviews and on technical ageing management for storage facilities for spent fuel and heat-generating radioactive waste (03/2022)
- Guidelines for the storage of radioactive waste with negligible heat generation (12/2021, in German)
- Guideline on safety management in waste management organisations (09/2021, in German)

Further information can be found on the ESK website:

<http://www.entsorgungskommission.de/en/node/93>

The Commission on Radiological Protection (Strahlenschutzkommission – SSK) recently issued the following recommendations or publications:

- Protection strategies in case of a nuclear detonation - Protective effect of iodine thyroid blocking and particle filtering half masks (02/2022)

- Radon exposure associated with radioactive legacies (03/2022, in German)
- Fact-based risk communication in social discourse - summary of the Closed Meeting of the SSK (07/2022, in German)
- Radiation emergency medicine - Handbook for medical care and education (08/2022)
- Nuclear medicine therapy (09/2022)
- Use of patient contact shielding in the diagnostic application of X-rays in humans (09/2022)
- Pediatric Imaging (09/2022, in German)
- Radiation protection dosimetry in high-energy photon fields (09/2022, in German)
- Protection strategies in case of a nuclear detonation - Use of respirators to protect the population after the explosion of a nuclear weapon (03/2023)

A listing of recommendations and statements, annual reports, and other publications are available on: http://www.ssk.de/EN/Home/home_node.html

3. Operation and Decommissioning of German Nuclear Power Plants

Due to the nuclear power phase out in Germany, the last three NPPs Isar 2, Emsland, and Neckarwestheim 2 were shut down on 15 April 2023. Consequently, there are no more operating NPPs in Germany.

a) Event Registration

In 2022, a total number of 42 events were reported from German NPPs; 18 events from NPPs in operation or permanent shut-down, and 24 events from NPPs in decommissioning.

The national Incident Registration Centre is organised at the BASE. The BASE carries out an evaluation of the events reported from the German nuclear installations, including the classification of the events according to the Nuclear Safety Officer and Reporting Ordinance (*Atomrechtliche Sicherheitsbeauftragten- und Meldeverordnung*), lists all information in a database, and reports to the BMUV in monthly reports. The current reportable events are discussed in the committees of the RSK and ESK on the basis of the monthly reports of the BASE.

The monthly as well as annual reports on reportable events of German NPPs and research reactors are available on the BASE website: https://www.base.bund.de/EN/ns/events/reports/reports_node.html

b) Evaluation of operating experience

On behalf of the BMUV, the expert organisation GRS evaluates national and international operating experience on a holistic basis, partly involving further independent experts. In particular, the international events reported within the IRS of the IAEA and in the Working Group on Operating Experience (WGOE) of the Organisation for Economic Co-operation and Development/Nuclear Energy Agency (OECD/NEA) are systematically evaluated with regard to their applicability to German nuclear installations.

If the analysis of the events with safety significance reported by German or foreign nuclear installations reveals an applicability to German nuclear installations, the GRS prepares information notices (*Weiterleitungsnachrichten*) on behalf of the BMUV. These are released by the BMUV and transmitted by the GRS to the nuclear licensing and supervisory authorities of all Länder with nuclear installations, the expert organisations, the licence holders of the nuclear installations, the manufacturers, and other specialised institutions.

In addition, the GRS also prepares statements at short notice on behalf of the BMUV in the case of special events or all events rated as INES 2 or higher at foreign nuclear installations. The released statements are systematically transmitted by the BMUV to the nuclear licensing and supervisory authorities of all Länder with nuclear installations.

Recently evaluated international events:

- INES 2 at Cattenom 3 Power Station (F) – External contamination of a worker leading to exceeding of the regulatory annual limit for the equivalent dose to the skin

c) Licensing, Supervisory Issues and Decommissioning Licenses

Germany had a total of 36 NPPs and prototype reactors. Three prototype reactors have been fully dismantled and released from nuclear regulatory control.

Table 2 gives an overview of the applications for decommissioning and the licences granted for decommissioning for German NPPs since 2011.

At the two NPP sites in Philippsburg and Neckarwestheim both new storage facilities for low and intermediate level radioactive waste and new waste treatment facilities were built. The licences for handling of radioactive substances according to § 7 StrlSchV for all four facilities were granted on 17 December 2018. The two storage facilities were taken into operation in 2020 and the two waste treatment facilities were taken into operation at the beginning of 2021. Furthermore, storage facilities for low and intermediate level radioactive waste were taken into operation at the NPP-locations Biblis (2018), Unterweser (2020), and Grafenrheinfeld (2021).

Table 2: Applications and licences for decommissioning due to nuclear phase-out (since 2011)

NPP		Permanent shutdown	First application for decommissioning	First licence granted for decommissioning
Isar 1	KKI 1	2011-08-06	2012-05-04	2017-01-17
Unterweser	KKU	2011-08-06	2012-05-04	2018-02-05
Biblis A	KWB A	2011-08-06	2012-08-06	2017-03-30
Biblis B	KWB B	2011-08-06	2012-08-06	2017-03-30
Brunsbüttel	KKB	2011-08-06	2012-11-01	2018-12-21
Neckarwestheim 1	GKN 1	2011-08-06	2013-04-24	2017-02-03
Philippsburg 1	KKP 1	2011-08-06	2013-04-24	2017-04-07
Krümmel	KKK	2011-08-06	2015-08-24	–
Grafenrheinfeld	KKG	2015-06-27	2014-03-28	2018-04-11
Gundremmingen B	KRB B	2017-12-31	2014-12-11	2019-03-19
Philippsburg 2	KKP 2	2019-12-31	2016-07-18	2019-12-17
Grohnde	KWG	2021-12-31	2017-10-26	–
Gundremmingen C	KRB C	2021-12-31	2019-07-31	2021-05-26
Brokdorf	KBR	2021-12-31	2017-12-01	–
Isar 2	KKI 2	2023-04-15	2019-07-01	–
Emsland	KKE	2023-04-15	2016-12-22	–
Neckarwestheim 2	GKN 2	2023-04-15	2016-07-18	2023-04-04

d) Safety Reviews and Peer Reviews

Nuclear installations are subject to continuous regulatory supervision in accordance with the national law over their entire lifetime from the start of construction to the end of decommissioning. In addition to the continuous regulatory supervision, comprehensive periodic Safety Reviews are performed every ten years for nuclear power plants. Due to the nuclear power phase-out no safety reviews will have to be performed.

Germany participates in EU Topical Peer Reviews. The EU Topical Peer Review is coordinated by the ENSREG. The process of the Topical Peer Review comprises three phases: a national assessment performed by the member states, a Peer Review including a workshop, and a follow-up. A Topical Peer Review is planned to take place every six years. The planning for the second TPR (TPR II), focussing on the topic of “fire protection of nuclear installations”, started in 2019. Preparatory work is conducted from 2020 until 2023. The review phase will mainly take place in 2024 followed by the follow-up phase from 2025 onwards.

For more information, including the publicly available reports, see: www.bmu.de/DL1926-1

For more information on the process, see: <http://www.ensreg.eu/eu-topical-peer-reviews>

Council Directives 2009/71/Euratom as amended by Council Directive 2014/87/Euratom and 2011/70/Euratom require EU Member States to carry out a self-assessment every ten years of the

national legislative, regulatory, and organisational framework for the nuclear safety of nuclear installations and national waste management programme, including the competent regulatory authorities, and to invite them to a subsequent peer review. In order to support the EURATOM Member States in fulfilling this obligation, the IAEA offers them the possibility of carrying out corresponding review missions using the Integrated Regulatory Review Service (IRRS) and the Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS).

The second IRRS Mission took place from 31 March to 12 April 2019. As an overall result, it was confirmed that Germany's regulatory framework for nuclear safety meets the internationally applicable standards. The review team found that Germany's nuclear licensing and supervisory authorities are mature and competent, and highlighted the effective cooperation with other organisations and interested parties. The Review Team identified a "good practice" for the Integrated Measuring and Information System for the Monitoring of Environmental Radioactivity (IMIS).

The follow-up mission of the 2019 IRRS Mission will take place from 8 to 16 October 2023. For more information, including the publicly available report, see: www.bmu.de/WS301-1. Moreover, to inform the German public, the final mission report was also published on the information portal of the Federal government and the Länder: www.nuklearesicherheit.de/P172

On 18 August 2021, the BMUV requested the IAEA to organize and carry out, in November 2022, an Integrated Review Service for Radioactive Waste and Spent Fuel, Decommissioning and Remediation (ARTEMIS) follow-up mission.

The purpose of the ARTEMIS follow-up mission was to review the implementation of the findings identified during the initial ARTEMIS mission which took place from 22 September to 4 October 2019 and, where appropriate, to address areas of significant change since the last mission including new topics as requested. The initial 2019 ARTEMIS mission was requested by Germany to satisfy its obligations under Article 14(3) of the European Council Directive 2011/70/EURATOM of 19 July 2011 establishing a Community Framework for the Responsible and Safe Management of Spent Fuel and Radioactive Waste (hereinafter the EU Waste Directive).

The follow-up review mission took place from 7 to 12 November 2022 in Cologne. It was performed by a team of five senior international experts in the field of decommissioning, radioactive waste, and spent fuel management, from multiple IAEA Member States, with three IAEA staff providing coordination and administrative support.

Representatives of German organizations during the mission itself were from the BMUV, BASE, the Federal Company for Radioactive Waste Disposal (BGE), the Company for Storage (BGZ), and GRS on the level of senior management and professional staff.

The scope of the ARTEMIS follow-up mission included all aspects and topics covered in the initial 2019 ARTEMIS mission. The outcomes from the IAEA Integrated Regulatory Review Service (IRRS) mission conducted in Germany in April 2019 were also taken into account, as appropriate, to avoid unnecessary duplication.

To assess progress made in addressing the recommendations and suggestions since the initial mission, the ARTEMIS team received presentations from the German counterparts and conducted a series of discussions in order to evaluate to which extent the findings of the initial mission could be considered closed or need to remain open.

The ARTEMIS team found that Germany has successfully implemented many recommended actions from the 2019 mission.

4. Research Reactors

In Germany six research reactors are in operation. Among the reactors in operation there are two with a continuous thermal power above 50 kW, FRM-II in Munich and FRMZ in Mainz. Additionally, four homogenous zero-power reactors with a thermal power of maximum 2 W are in operation.

Three research reactors are permanently shut down, but so far, no decommissioning licence has been granted for them. Six research reactors are under decommissioning and 31 research reactors have already been decommissioned, totally dismantled, and released from regulatory control. The latest status changes were:

- The research reactor BER-II in Berlin was permanently shut down on 11 December 2019. An application for decommissioning was filed on 24 April 2017.
- For the homogenous zero-power reactor in Aachen SUR AA a decommissioning licence was granted on 26 June 2020.
- Two research reactors, SUR-H and RFR, were released from regulatory control in 2019.

5. Site Selection for Disposal of High-Level Waste

The Site Selection Act (*Standortauswahlgesetz*) stipulates a participative, science-based, transparent, self-questioning, and learning procedure for the search and selection of a site for the safe disposal of high-level radioactive waste. The aim is to determine a site offering the highest possible degree of safety for a period of one million years.

The search starts out by considering the entire state territory and progressively narrows down based on a set of rules laid out in the Site Selection Act and the underlying ordinances.

As the implementer, the BGE develops proposals for subareas, regions and sites, and site-related exploration programmes and test criteria. The BASE supervises the search for a site and organises the participation of the public on the national and regional levels. In three consecutive phases, the search areas for the disposal site are narrowed down:

- Phase 1: Determination of siting regions for surface exploration
- Phase 2: Surface exploration and proposal for regions for underground exploration
- Phase 3: Underground exploration, siting proposal and decision on the site

At the end of each phase, the BGE proposals are examined by the BASE. Each phase is concluded by a parliamentary decision in the form of a federal act naming the siting regions, the sites for underground exploration, and finally the disposal site.

Currently, the site selection procedure is in its first phase. The BGE requested and collected data concerning the exclusion criteria and the minimum requirements defined in the Site Selection Act, such as boreholes, tectonic, mining, and hydrogeological data from the geological services of the Länder. Subsequently, the BGE applied geological weighting criteria to identify so-called "sub-areas". On this basis, the BASE convened the first formal participation format, the Subareas Conference. All stakeholders (i.e., citizens, scientists, members of NGOs, or local authorities) were able to discuss the findings with the BGE during three meetings, which were held between February and August 2021. After thorough debates with more than 4,000 registered participants, the Subareas Conference submitted its results to the BGE on 7 September 2021. The conference drew up extensive comments on the way that the BGE is conducting its duties. The BGE has to take these results into account in its ongoing work. Since then, there have been further developments, namely the submission of further documents by the BGE. In these documents, the BGE for the first time provided a more detailed estimate of the time required for the individual steps of the whole site selection procedure. According to this communication, the site selection procedure is not expected to be completed before the 2040s. The BASE as the supervisory authority has reviewed the work of the BGE mbH and published its statement in March 2023, which can be found here:

<https://www.base.bund.de/SharedDocs/Kurzmeldungen/BASE/EN/2023/0324-base-statement.html>

The BMUV has announced to start an evaluation process for the site selection procedure.

In order to accompany the progress of work of the BGE on its way to the proposal of site regions, the BASE, together with representatives from civil society and from the BGE, has elaborated a joint concept for public participation. This so-called "Planning team of the Repository Search Forum" (PFE) will continuously discuss the implementer's progress and periodically convene public discussion forums that are open to all interested stakeholders. The first "Repository Search Forum" organised by PFE took place on 20 May and 21 May 2022. The second Repository Search Forum is planned for November 2023. Designed as a prototype in an "Adaptive System", the participation concept will be continuously evaluated and adapted to the needs of the public.

In addition, the Site Selection Act stipulates the establishment of a pluralistically composed National Civil Society Board (*Nationales Begleitgremium* – NBG). The central task of the NBG is the conciliatory and independent monitoring of the site selection procedure, in particular the implementation of public participation in the site selection procedure. The NBG started its work in December 2016. The NBG

consists of recognized personalities and members of the public selected in a random-based selection process. Scientists, students, interested citizens – the board consists of a diverse spectrum of members.

Further information on the site selection procedure can be found at the BASE web page:

https://www.base.bund.de/EN/soa/siteselectionprocess/siteselectionprocess_node.html

The information platform of BASE containing all publicly available documents concerning the site selection procedure can be found here:

<https://www.endlagersuche-infoplattform.de/webs/Endlagersuche/EN>

The BGE interim report on subareas is available at:

<https://www.bge.de/en/sitesearch/sub-areas-interim-report/>

For more information on the NBG, please refer to:

<http://www.nationales-begleitgremium.de> (in German)

6. Nuclear Fuel and Waste Management

a) Disposal Facilities and Projects for Radioactive Waste

The Konrad mine is currently being converted into a disposal facility for radioactive waste with negligible heat generation. The plan approval decision (licence) for the Konrad repository was issued on 22 May 2002 and became unappealable on 26 March 2007.

The Morsleben mine was used as disposal facility for low- and intermediate-level radioactive waste from 1971 until 1998. The Federal Office for Radiation Protection (*Bundesamt für Strahlenschutz – BfS*) applied for the decommissioning of the Morsleben facility under nuclear law on 9 May 1997. The plan-approval procedure for the closing is currently ongoing.

In the Asse II mine low- and intermediate-level radioactive waste was stored from 1967 to 1978. According to the Atomic Energy Act, the Asse II mine shall be decommissioned immediately. Decommissioning is to take place once the radioactive waste has been retrieved from the facility.

For further information on the disposal projects, see:

<https://www.base.bund.de/EN/nwm/repositories/introduction/introduction.html>

b) Storage of Spent Nuclear Fuel

In Germany three central storage facilities are in operation at Gorleben, Ahaus, and Lubmin. On 1 August 2017, the operator responsibilities for the Gorleben and Ahaus storage facilities were transferred from the GNS (*Gesellschaft für Nuklear-Service mbH*) to the new, state-owned operator BGZ.

At the Gorleben Transport Cask Storage Facility (*TBL Gorleben*), nuclear fuel is stored in the form of spent fuel elements from light water reactors as well as vitrified high-level radioactive waste (HAW) from the reprocessing of German fuel elements. The Transport Cask Storage Facility Ahaus (*TBL Ahaus*) is a storage facility for the storage of nuclear fuels and other radioactive materials. The Storage Facility North near Lubmin (*Zwischenlager Nord – ZLN*) is a facility for the storage of spent fuel and vitrified HAW from the reprocessing of fuel elements in the Karlsruhe Vitrification Facility (*Verglasungseinrichtung Karlsruhe – VEK*). ZLN is operated by the Entsorgungswerk für Nuklearanlagen GmbH (EWN). As replacement for the storage in the ZLN, EWN applied on 29 May 2019 for a storage facility (ESTRAL) for the spent fuel and vitrified HAW stored in the ZLN. For more information on the central storage facilities, see:

https://www.base.bund.de/EN/nwm/interim-storage/central/central_node.html

In addition, twelve on-site storage facilities are in operation at the sites of the nuclear power plants. On 01 January 2019 the operator responsibilities for eleven of these storage facilities was transferred from the NPP operators to the BGZ (not yet for the Brunsbüttel storage facility, see below).

The storage of waste from reprocessing plants in Sellafield, Great Britain and La Hague, France, which is still to be returned to Germany, shall take place at four on-site storage facilities. On 29 September 2017 licence applications were filed by the operators of the on-site storage facilities Philippsburg, Biblis, Brokdorf, and Isar in this matter. On 19 December 2019 BASE issued the license for storage of up to seven Type B(U) transport and storage casks CASTOR® HAW28M with vitrified HAW from Sellafield at the storage facility in Biblis. Six transport and storage casks CASTOR® HAW28M with vitrified HAW from Sellafield arrived in Biblis on 4 November 2020. The other licensing procedures are

ongoing. The preliminary environmental impact assessment has already been completed for Philippsburg and Biblis.

The licence of the Brunsbüttel storage facility was revoked by the Federal Administrative Court in January 2015. The legal basis for the current storage of spent fuel at the Brunsbüttel storage facility is an unlimited, supervisory order from the competent authority of Schleswig-Holstein. In November 2015, the operator applied for a new licence for the facility. This licensing procedure is currently ongoing. For further information, see:

<https://www.base.bund.de/EN/nwm/interim-storage/decentralised/licence/kkb-en.html>

The *Jülicher Entsorgungsgesellschaft für Nuklearanlagen mbH* (JEN) operates a storage facility for spherical fuel elements from the former AVR experimental reactor in Jülich. The licence for the JEN storage facility was limited to June 2013. The licensing procedure for the storage of the fuel elements in Jülich for a short-term period is still ongoing. In 2016, a license was granted for the storage of these fuel elements in the TBL Ahaus. A license application for the transport of the fuel elements to Ahaus has been filed. For more information, see:

<https://www.base.bund.de/EN/nwm/interim-storage/decentralised/licence/kkj-en.html>

c) *Nuclear Fuel Fabrication and Reprocessing*

Currently, there are two front end Fuel Cycle Facilities in operation in Germany.

The Uranium Enrichment Plant is operated by Urenco Deutschland GmbH. It is located in Gronau in the north west of Germany. Natural uranium in form of uranium hexafluoride (UF₆) is enriched in centrifuge cascades to a maximum concentration of U-235 isotope of 6 percent by weight. The facility has a licenced capacity of 4500 tSW/a. The Fuel Fabrication Plant is operated by ANF Advanced Nuclear Fuels. It is located in Lingen in the north west of Germany and produces uranium fuel elements for major use in light water reactors with uranium-235 enriched up to 5 percent. The facility has a capacity for uranium conversion of 800 t/a.

The only German reprocessing plant in Karlsruhe (*Wiederaufarbeitungsanlage Karlsruhe – WAK*) is in decommissioning. The first decommissioning licence was granted in 1993. The 26th licence for decommissioning from 6 July 2018 includes the dismantling of equipment in the process cell of the Karlsruhe vitrification facility (VEK), belonging to the WAK decommissioning project. In 2021, the following three decommissioning license for the WAK were granted: The 27th license was granted on 4 March 2021, the 28th license on 1 June 2021, and the 29th license was granted on 14 October 2021. These licenses include additional amendments to dismantle the process building and support the entire dismantling of the WAK plant.

d) *Transports*

On 3 April 2018, licensing applications were submitted to the BASE for the transport of waste from the reprocessing plants in Sellafield, United Kingdom and La Hague, France to the on-site storage facilities in Biblis and Philippsburg. On 14 February 2020, the license for the transport from Sellafield to Biblis was granted and the transport proceeded in November 2020. In October 2022 the application for the transport from La Hague to Philippsburg, submitted in 2018, was revised by the applicant and a licensing application for the transport of waste from Sellafield to the on-site storage facility Isar was submitted in November 2022. Both are currently assessed by the BASE.

As part of the dismantling of the nuclear power plants, large surface contaminated components are planned to be shipped to external service companies for further dismantling. Three applications for associated transport licenses are currently assessed by the BASE: one application for the transport of two steam converters from the nuclear power plant in Lingen (KWL) to Sweden, one application for the transport of four steam generators from the Unterweser nuclear power plant (KKU) to Sweden, and one application for the transport of three lower parts of steam generators from Fessenheim in France via Germany, the Netherlands, and Belgium to Sweden.