

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety





Ministry of Energy, Agriculture, the Environment, Nature and Digitalization

Advance Reference Material IRRS Mission 2019

Germany







Ministry of the Interior and Europe



Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia





Ministry for the Environment, Climate Protection, Agriculture and Consumer Protection



Ministry for the Environment, Energy, Building and Climate Protection of the State of Lower Saxony



Federal Office for the Safety of Nuclear Waste Management

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1 Introduction

From 31st March to 12th April 2019, an Integrated Regulatory Review Service (IRRS) mission will take place in Germany. A preparatory meeting for the IRRS mission was held from 25th to 26th September 2018 and the Terms of References (ToR) of the mission were agreed and signed by the team coordinator Mr. Shah and the German Liaison Officer Mr. Elsner. The preparatory documents (advance reference material, ARM) according to section 9 of the ToR and Chapter 5 item 7.5 of the IRRS guidelines are presented and described in this report. In addition, the report presents a comprehensive description of the German nuclear regulatory system.

Chapter 2 of the report presents the scope and objective of the IRRS mission to Germany. The German nuclear regulatory system is established in Chapter 3. All involved authorities, as well as the German liaison officer and counterparts are introduced in Chapters 4 and 5, respectively. Chapter 6 gives an overview of the nuclear installations in Germany. Chapter 7 provides background information for the visit of the Neckarwestheim site.

Chapter 8 of the report addresses the self-assessment that has been carried out as preparation for the mission. The process that has been followed is presented as well as summary reports of the self-assessment results of the different modules. Due to the significant scope of the answers to the SARIS self-assessment questions the detailed answers are given only in electronic format of the ARM and not in the printed version. In Chapter 9 the resulting action plan is presented. Chapter 10 also introduces the two policy issues to be discussed during the mission.

Chapter 11 of the report lists the further documentation given in full text in the electronic version of the ARM, including the detailed self-assessment questionnaires, providing hyperlinks to the documents.

Chapters 12, Chapter 13 and Chapter 14 of the report present a list of abbreviations, a list of German organization and institutions, and organizational charts of the involved authorities, respectively.

2 Objectives and Scope of the Mission

On 1st June 2017, the German Federal Government requested the International Atomic Energy Agency (IAEA) to organise an IRRS mission to Germany in the first quarter of 2019 (mission dates: 31st March to 12th April 2019). The IAEA IRRS has been established to strengthen and enhance the effectiveness of the national regulatory framework for nuclear, radiation, radioactive waste and transport safety, whilst recognising the ultimate responsibility of each State to ensure safety in these areas. By inviting the IAEA to carry out an IRRS mission, Germany avows itself to its responsibility to protect humans and the environment in Germany and abroad against the risks involved in the peaceful use of nuclear power. After the IRRS Mission in 2008 which took place on a voluntary basis and the corresponding Follow-up Mission in 2011, the second IRRS Mission is now taking place in Germany.

Additionally, by European Council Directive, Germany is obliged to arrange for a periodic selfassessment of its national framework and competent regulatory authorities for nuclear installations at least once every 10 years. The European Council Directive for nuclear safety of nuclear installations <u>2014/87/EURATOM</u> amending Council Directive <u>2009/71/EURATOM</u> stipulates in Article 8e (1) that:

Member States shall, at least once every 10 years, arrange for periodic self-assessments of their national framework and competent regulatory authorities and invite an international peer review of relevant segments of their national framework and competent regulatory authorities with the aim of continuously improving nuclear safety.

The European Nuclear Safety Regulators Group (ENSREG) agreed in a Memorandum of Understanding with the IAEA that IRRS missions are a suitable mean to fulfil Article 8e (1) of European Council Directive <u>2014/87/EURATOM</u>. All member states of the EU are bound to this decision of ENSREG. Through the requested IRRS mission Germany fulfils its obligation with regard to the above-mentioned requirement of the European Council Nuclear Safety Directive <u>2014/87/EURATOM</u>.

Germany also requested IAEA to organise a separate Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) mission to Germany scheduled for 22nd September until 4th October 2019 in order to fulfil Article 14 (3) of the European Council Directive for safe management of spent fuel and radioactive waste 2011/70/EURATOM which stipulates that:

Member States shall periodically, and at least every 10 years, arrange for self-assessments of their national framework, competent regulatory authority, national programme and its implementation, and

invite international peer review of their national framework, competent regulatory authority and/or national programme with the aim of ensuring that high safety standards are achieved in the safe management of spent fuel and radioactive waste.

Due to the overlap of IRRS and ARTEMIS missions with respect to the regulatory framework, Germany decided to extend the scope of the requested IRRS mission to include the regulatory framework related to decommissioning of nuclear facilities and installations and radioactive waste management.

The objective of the IRRS mission to Germany is the continual improvement of the supervision and regulatory control of the safety of nuclear power plants and other nuclear installations in Germany. The aim is to obtain through the peer exchange on policy and regulatory issues new insight into the efficiency and effectiveness of the national framework and the competent nuclear regulatory authorities and to identify through this process opportunities for improvement.

The scope of the IRRS mission will cover the supervision of the safety of nuclear power plants, research reactors as well as fuel cycle and waste management facilities. The scope of the mission also includes the topics of special interest of decommissioning, emergency preparedness and response, and occupational radiation protection. The mission covers within IAEA's structured peer-review system all nine IRRS core modules with modules 5 to 9 focusing on nuclear power plants, research reactors, fuel cycle and waste management facilities, and decommissioning, as well as module 10 on emergency preparedness and response and partially module 11 with the focus on occupational radiation protection.

Germany is a republic with a federal structure and is composed of 16 federal states in German called Länder. This is laid down in the <u>Basic Law</u> for the Federal Republic of Germany (Grundgesetz (GG)). Due to this fact the German Regulatory Body will be represented by the competent federal and Länder licensing and supervisory authorities:

- The Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU)
- The Ministry of the Environment, Climate Protection and the Energy Sector Baden-Württemberg (UM BW)
- The Ministry of Energy, Agriculture, the Environment, Nature and Digitalization of the State of Schleswig-Holstein (MELUND)
- The Bavarian State Ministry of the Environment and Consumer Protection (StMUV)

- The Ministry for the Environment, Climate Protection, Agriculture and Consumer Protection of the State of Hesse (HMUKLV)
- The Ministry of the Interior and Europe of the State of Mecklenburg-Western Pomerania (IM MV)
- The Ministry for the Environment, Energy, Building and Climate Protection of the State of Lower Saxony (NMU)
- The Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia (MWIDE)
- The Federal Office for the Safety of Nuclear Waste Management (BfE)

The IRRS mission will mainly take place close to the Federal Ministry for Environment headquarter in Bonn. Due to the on-going fire safety renovation work the mission will not take place in the ministry it-self, but in a near-by hotel. The mission will include interviews with representatives of all involved organisations:

- Regulatory body (Federation and Länder)
- Federal Minister of BMU Ms. Schulze and the Minister of UM BW Mr. Untersteller
- Representatives of GRS and TÜV

A site visit to the Neckarwestheim (GKN) nuclear site in Baden-Württemberg will be organised. The GKN site has two nuclear reactors: GKN NPP Unit 1, which is in dismantling, and GKN NPP Unit 2, which is in operation. In addition, the on-site dry storage facility for spent fuel (GKN SZL), as well as the waste treatment centre (RBZ) and intermediate storage facility for medium and low-level waste (SAL), which both are expected to be in commissioning at the time of the visit, are located on the GKN site. During the site visit interviews with the licensee will be organised.

The IRRS mission also include a generic Policy Issue Discussion on two topics

- Safety culture of the Regulatory Body and Maintenance of competence and
- Informing the public about operational activities and changes at the sites of nuclear facilities.

3 The Regulatory System in Germany

The aim of the nuclear and radiation protection licensing and supervisory authorities of the Federation and the Länder is to monitor whether the operators of all nuclear installations and facilities in Germany ensure the required safety.

A system of checks and balances is in place between the Federation and the Länder in the context of a distribution of tasks (federal executive administration, i.e. execution by the Länder on federal commission). This system, which has existed for many decades, is based on trust and control between the Federation and the Länder and forms the basis for the continued existence of high safety requirements.

In Germany, the independence of regulatory decision-making at both federal and Länder level is ensured by a clear functional separation. The safety-related tasks of nuclear licensing and monitoring (supervision) as well as of radiation protection are generally performed by the competent authorities of the Länder on behalf of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), whereas the promotion of the energy sector including reactor safety research falls within the competence of the Federal Ministry for Economic Affairs and Energy (BMWi) (principle of separation). In addition, safety-related tasks of nuclear licensing and supervision are performed by the Federal Office for the Safety of Nuclear Waste Management (BfE) and the Federal Office for Radiation Protection (BfS), established as authorities within the portfolio of the BMU.

To simplify matters, the term "nuclear" licensing and supervisory authorities of the Federation and/or the Länder (i.e. under nuclear law) is used in the following even if the respective authority is usually also the licensing and supervisory authority under radiation protection law.

3.1 Constitutional Framework

Germany is a republic with a federal structure and is composed of 16 federal states, in German called Länder. This is laid down in the <u>Basic Law</u> for the Federal Republic of Germany. Together with the <u>Atomic Energy Act</u> (Atomgesetz (AtG)), the Basic Law forms the framework for the use of nuclear energy in the Federal Republic of Germany.

According to the <u>Basic Law</u>, the Federal Chancellor determines the competence of the supreme federal authorities by organisational decree. Accordingly, the responsibility for the nuclear safety of nuclear installations and radiation protection was transferred to the BMU. The <u>Basic Law</u> has assigned the legislative power for the peaceful use of nuclear energy to the Federation. As part of

the Federal Government, the BMU is involved in legislation (legislative power), while the Länder implement the Atomic Energy Act on behalf of the Federation (federal executive administration).

3.2 Responsibilities in the Federation and in the Länder

Competent nuclear regulatory authority of the Federation

In addition to responsibility for the nuclear safety of nuclear installations and radiation protection, the BMU is also responsible for the organisation, staffing and resources of the federal nuclear licensing and supervisory authority.

Directorate-General S "Nuclear Safety, Radiological Protection" of the BMU comprises three directorates. Directorate S I performs tasks in the field of nuclear safety. Directorate S II performs tasks in the field of radiation protection, including emergency preparedness and response. Directorate S III deals with tasks relating to nuclear waste management. With regard to the tasks of the BfE, S III is responsible for the technical supervision. It is also stated in the <u>Strategic Plan for the Directorate General RS</u> that the BMU "bears nationwide governmental responsibility for the effective protection of people, the environment and assets from nuclear hazards and risks as well as from harmful effects of ionising and non-ionising radiation". Aware of this responsibility, a high safety culture is to be maintained and further developed.

Competent nuclear regulatory authorities of the Länder

In the Länder, the highest Land authorities have been designated as competent nuclear licensing and supervisory authorities according to the <u>Atomic Energy Act</u>.

Analogous to the federal level, there is also an effective separation at the Länder level between the tasks of the nuclear licensing and supervisory authority and the competent authority for economic development. This ensures the effective independence of the nuclear licensing and supervisory authorities from the operators of nuclear installations and facilities in decision-making processes.

Within the framework of decisions on licences, the nuclear licensing and supervisory authorities of the Länder examine the fulfilment of the licensing requirements. The concrete form and implementation of the licensing procedure under the <u>Atomic Energy Act</u> are regulated in detail in the <u>Nuclear Licensing Procedure Ordinance</u> (Atomrechtliche Verfahrensverordnung (AtVfV)).

Within the framework of supervision, the respective Land nuclear authority monitors, with the assistance of authorised experts, in particular,

- compliance with the provisions of the <u>Atomic Energy Act</u>, the <u>Radiation Protection Act</u> (Strahlenschutzgesetz (StrlSchG)), the ordinances under nuclear and radiation protection law and other nuclear safety standards and guidelines,
- compliance with the provisions, obligations and ancillary provisions imposed in the licence notices, and
- fulfilment of supervisory orders issued.

In addition, the Land nuclear authority also monitors, with the assistance of authorised experts or through other authorities, among other things,

- compliance with the safety-relevant operating procedures,
- performance of in-service inspections and maintenance measures for safety-relevant components,
- the evaluation of special occurrences and the development and implementation of appropriate measures against recurrence of the event,
- the implementation of non-essential modifications to the installation or its operation,
- radiation protection monitoring of personnel in nuclear installations,
- the measures taken by the licensee for environmental monitoring of nuclear installations,
- compliance with the plant-specific authorised limits for the discharge of radioactive substances via air and water,
- the measures against disruptive action or other interference by third parties,
- the reliability of the applicant,
- the technical qualification and the maintenance of qualification of the responsible persons as well as of the knowledge of personnel otherwise engaged in the installation, and
- the quality assurance measures.

Distribution of responsibilities

The distribution of responsibilities between the Federation and the Länder provides for the licensing and supervisory authorities of the Länder administrative action on their own responsibility. The Länder thus have the competence for the subject matter and to execute duties.

In practice, the Länder carry out the tasks assigned to them on their own responsibility (see Fig. 3-1). However, the Federation has the right to issue directives within the framework of federal executive administration. The Federation only makes use of this option in exceptional cases as a last resort. Before it comes to that, BMU strives to clarify different opinions through consultations. This can usually be achieved. If, however, an agreement is not possible, the Federation can instruct the Länder to take concrete administrative action or prescribe a decision (instruction). In doing so, it takes over the competence in the subject matter.

Communication with the operator, which includes any legally binding action, is performed by the Länder (competence to execute duties).

The essential processes of nuclear supervision of the Federation and the Länder as well as their interfaces in connection with the safety of nuclear power plants in power operation and in post-operation are described in a <u>Handbook on Cooperation between the Federation and the Länder in</u> <u>Nuclear Law</u> (Handbuch über die Zusammenarbeit zwischen Bund und Ländern im Atomrecht). The essential tasks of the Federal Government and the Länder are described in Tab. 3-1.





 Tab. 3-1
 Shared responsibility between the Federation and the Länder

Key Regulatory Functions	Federal Level	Länder Level
Development of Guides and Regulations	Responsible	Participating
Regulatory Research	Responsible	Participating
International Cooperation	Responsible	Participating
Authorisation / Licensing	Supervising*	Responsible
Review and Assessment	Supervising	Responsible
Inspection and Enforcement	Supervising	Responsible

* Exceptions exist for: spent fuel storage facilities, existing disposal projects, the site selection process for a disposal for high level radioactive waste and for future disposal sites



Fig. 3-2 Shared responsibility between the Federation and the Länder

In the case of facilities for the safekeeping and disposal of radioactive waste, state supervision is regulated differently from the division of tasks between the Federation and the Länder. The nuclear waste management sector was reorganised in order to efficiently select a site for a disposal facility for high-level radioactive waste. Accordingly, the BfE was established in 2014 as the central licensing and supervisory authority in the field of waste management. The BfE is the competent supervisory authority for the site selection procedure. In addition, the BfE is the competent supervisory authority for the existing disposal projects for low- and intermediate level radioactive waste KONRAD and Morsleben repository for radioactive waste (Endlager für radioaktive Abfälle Morsleben (ERAM)). However, the responsibility for the Konrad disposal facility with regard to approval will rest with the Land authorities until commissioning by the nuclear supervisory authority. Thereafter, the responsibility for planning approval and licensing of the facility will be transferred to the BfE. The BfE is also responsible for the supervision of the Asse II mine as well as for the licensing of storage facilities for spent fuel and transports.

3.3 Committees and Organisations



Fig. 3-3 Structure of the regulatory body

Subordinate authorities of the Federation

Belonging to the BMU's portfolio are two subordinate authorities responsible for nuclear safety, radiation protection and nuclear waste management issues. Their tasks are defined in the corresponding establishment acts.

Federal Office for Radiation Protection (BfS)

The subordinate authority of the BMU in the area of radiation protection is the BfS. The two technical departments of the BfS deal with the statutory tasks in the areas of "Radiation Protection and Environment" and "Radiation Protection and Health". This includes, in particular, the effects and risks of ionising and non-ionising radiation, medical and occupational radiation protection, monitoring of environmental radioactivity as well as emergency preparedness and response.

Federal Office for the Safety of Nuclear Waste Management (BfE)

As a subordinate authority of the BMU, the BfE performs statutory tasks in the areas of licensing for storage and transport, nuclear safety, tasks related to the search for and selection of a site for a disposal facility for high-level radioactive waste (site selection procedure), in task-related research and in the planning approval and licensing of disposal facilities, including approvals under mining law and permits under water law as well as the supervision of disposal under nuclear and radiation protection law.

The BfS and BfE provide technical and scientific support to the BMU and also perform federal tasks in the areas mentioned above on behalf of the BMU.

Cooperation between the federal and Länder authorities (regulatory body) – Länder Committee for Nuclear Energy

In the federal German system, in which the tasks are shared between the Federation and the Länder, the coordination of tasks and joint action to increase nuclear safety has a very special role to play. To this end, the Federation and the Länder founded the "Länder Committee for Nuclear Energy" (LAA) already in 1958. The LAA is a permanent federal and Länder body composed of representatives of the nuclear licensing and supervisory authorities of the Länder and of the BMU (see process 12 "Länder Committee for Nuclear Energy" in the Handbook on Cooperation between the Federation and the Länder in Nuclear Law). It supports the Federation and the Länder in the execution of the Atomic Energy Act and Radiation Protection Act as well as in the preparation of amendments and the further development of legal and administrative provisions and of the substatutory rules and regulations. In particular, the LAA serves the mutual communication and exchange between the nuclear licensing and supervisory authorities of the Federation and the Länder as well as the coordination of activities. In the interest of a nationwide uniform enforcement of nuclear and radiation protection law, the competent nuclear licensing and supervisory authorities of the Länder and the Federation develop regulations in consensus for the uniform application of nuclear and radiation protection law. These are announced by the BMU in the Federal Gazette. The BMU chairs the LAA and manages its affairs. The Committee's decisions are usually made by mutual consent. The LAA has four technical committees for issues related to legal matters, nuclear safety, radiation protection as well as fuel cycle matters. Working groups for special tasks are assigned to the technical committees. If required, the technical committees may set up ad hoc working groups for special issues. The technical committees and the permanent working groups usually convene twice a year and more frequently if necessary. The General Committee convenes once a year. The

discussions in the LAA are an important instrument for the early and full involvement of the Länder and supplement the right of the Länder of participation in the legislative procedure of the Bundesrat.



Fig. 3-4 Structure of the Länder Committee for Nuclear Energy (LAA)

Advisory bodies

The BMU is regularly advised by the Reactor Safety Commission (RSK), the Commission on Radiological Protection (SSK) and the Nuclear Waste Management Commission (ESK). The RSK provides advice in matters of nuclear safety including matters with respect to the physical protection of nuclear installations. The SSK provides advice in matters of protection against ionising and nonionising radiation, and the ESK in matters of nuclear waste management. Independence, qualification and reflection of the technical-scientific range of opinions is to be ensured in the commissions. The members are obliged by statutes to express their opinion in a neutral and scientifically sound manner and are appointed by the BMU. The results of the commission's consultations are formulated in the form of general recommendations and statements on individual cases and published. For further information on the consultations of the RSK and on how the authorities deal with the results of the consultations, see process 11 in the Handbook on Cooperation between the Federation and the Länder in Nuclear Law.

Authorised experts

According to § 20 of the <u>Atomic Energy Act</u>, the authorities in charge may consult authorised experts in the licensing and supervisory procedures. These can be both independent experts and independent technical expert organisations (hereinafter referred to as "authorised experts"). The authorised experts are contractually obliged to be impartial and independent from the economic interests of the nuclear licensees to be assessed as well as to provide technical qualification and continuous maintenance of qualification for the personnel employed. Authorised experts are clearly mandated by the supervisory authorities and commissioned for specific activities. The authorised experts prepare test reports, statements and expert opinions. The authority's decision-making authority is not transferred to them. The nuclear licensing and supervisory authority is not bound by the results of the examinations of the authorised experts.

The BMU draws on the external expertise of several technical expert organisations. In particular, these are the Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH, Brenk Systemplanung GmbH, Physikerbüro Bremen and Öko-Institut e.V.

As the competent licensing and supervisory authority, the BfE commissions expert organisations such as the TÜV, e.g. within the framework of licensing procedures for the storage of spent fuel in storage and transport casks, and the Bundesanstalt für Materialforschung und –prüfung (BAM). In addition, the BfE is involved in the research coordinated by the BMU.

The nuclear supervisory authorities of the Länder usually seek advice from the major technical expert organisations of the TÜVs (TÜV = Technical Inspection Association, German: Technischer Überwachungsverein, i.e. TÜV Nord, TÜV Süd and TÜV Rheinland). As a rule, framework agreements exist between the nuclear licensing and supervisory authorities of the Länder and the TÜVs, which oblige TÜVs to perform certain tasks in the long term and to provide the necessary know-how including appropriately qualified personnel. This ensures that the relevant TÜV, as the technical expert organisation of the respective nuclear licensing and supervisory authority of the Land, is almost permanently present in the nuclear installation by carrying out individual inspections and test activities. In particular, the technical expert organisation can thus build up qualified knowledge of the entire plant from the various activities over a longer period of time. Authorised experts cannot take any sovereign measures, but they are contractually obliged to report immediately any facts or findings to the supervisory authority that require official action.

4 Involved Authorities

At the end of 2016 BMU and the nuclear regulatory authorities of the Länder agreed on the ministries and organisations to be involved in the IRRS mission to Germany with the aim to cover the full picture of the German regulatory system. Early in the self-assessment process, it was decided between BMU and the involved Länder authorities to distribute the responsibilities for the different thematic modules of the IRRS self-assessment system among the authorities. The following authorities are involved in the IRRS mission as follows:

Involved Authorities	IRRS module
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety	 Module 1 – module 4 Module 9 – module 11 Nuclear Power Plants
Baden-Württemberg MINISTRY OF THE ENVIRONMENT, CLIMATE PROTECTION AND THE ENERGY SECTOR	 Module 7 Module 8 Nuclear Power Plants (Aspects of Module 7 and 8)
SH 🗱 Ministry of Energy, Agriculture, the Environment, Nature and Digitalization	 Module 5 Module 6 Nuclear Power Plants (Aspects of Modules 5 and 6)
Bavarian State Ministry of the Environment and Consumer Protection	Research reactors

Involved Authorities	IRRS module
HESSEN Ministry for the Environment, Climate Protection, Agriculture and Consumer Protection	Decommissioning
Ministry of the Interior and Europe Mecklenburg	Decommissioning
Ministry for the Environment, Energy, Building and Climate Protection of the State of Lower Saxony	 Radioactive Waste management facilities (predisposal)
Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia	Fuel Cycle Facilities
Federal Office for the Safety of Nuclear Waste Management	 Radioactive Waste management facilities (disposal)

5 Liaison Officer and Counterparts

Liaison Officer Thomas Elsner Federal Ministry for the Environment, Nature Conservation and Nuclear Safety **Deputy Liaison Officer Kai-Jochen Weidenbrück** Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Module 1 – 11	Counterpart (lead)	Co-Counterpart
Responsibilities and functions	Sebastian Kuhn	Alexander Baginski
of the government	Federal Ministry for the Environment,	Federal Ministry for the Environment,
(Module I)	Nature Conservation and Nuclear Safety	Nature Conservation and Nuclear Safety
Global nuclear safety regime	Dr. Anke Krause	Gisela Stoppa
(Module II)	Federal Ministry for the Environment,	Federal Ministry for the Environment,
	Nature Conservation and Nuclear Safety	Nature Conservation and Nuclear Safety
Responsibilities and functions	Thomas Helling-Junghans	Alexander Baginski
of the Regulatory Body	Federal Ministry for the Environment,	Federal Ministry for the Environment,
(Module III)	Nature Conservation and Nuclear Safety	Nature Conservation and Nuclear Safety
Management system of the	Ursula Adenauer	Markus Pfaff
Regulatory Body	Federal Ministry for the Environment,	Federal Ministry for the Environment,
(Module IV)	Nature Conservation and Nuclear Safety	Nature Conservation and Nuclear Safety

Module	Counterpart (lead)	Co-Counterpart
Authorization	Dr. Hubertus von Raczeck	Philipp Genßler
(Module V)	Ministry of Energy, Agriculture, the Environment, Nature and Digitalization, Schleswig-Holstein	Ministry of Energy, Agriculture, the Environment, Nature and Digitalization, Schleswig-Holstein
Review and Assessment	Dr. Hubertus von Raczeck	
(Module VI)	Ministry of Energy, Agriculture, the Environment, Nature and Digitalization, Schleswig-Holstein	
Inspection	Thomas Wildermann	Theo Spermann
(Module VII)	Ministry of the Environment, Climate Protection and the Energy Sector, Baden-Württemberg	Ministry of the Environment, Climate Protection and the Energy Sector, Baden-Württemberg
Enforcement	Thomas Wildermann	Stephan Wanke
(Module VIII)	Ministry of the Environment, Climate Protection and the Energy Sector, Baden-Württemberg	Ministry of the Environment, Climate Protection and the Energy Sector, Baden-Württemberg
Regulations and Guides	Dr. Anke Krause	Dr. Patrick Bringel
(Module IX)	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
Emergency preparedness	Ralf Stegemann	Dr. Tobias Schlummer
and response (Module X)	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
Occupational radiation	Dr. Andrea Bock	Dr. Jörg Junkersfeld
exposure	Federal Ministry for the Environment,	Federal Ministry for the Environment,
(Module XI)	Nature Conservation and Nuclear Safety	Nature Conservation and Nuclear Safety

ARM

IRRS Mission Germany

Facilites/Activities	Counterpart (lead)	Co-Counterpart
Nuclear Power Plant	See module 5 – 9	
Research Reactors	Dr. Hans Kühlewind Bavarian State Ministry of the Environment and Consumer Protection	Dr. Ronzon Mallick Bavarian State Ministry of the Environment and Consumer Protection
Fuel Cycle Facilities	Siegfried Uwe Behrendt Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia	Dr. Christian Bolle Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia
Predisposal Facilities	Dr. Hilke Hattermann Ministry of the Environment, Energy, Building and Climate Protection of the State of Lower Saxony	Dr. Thomas Pissulla Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
Disposal Facilities	Dr. Lukas Schulte Federal Ministry for the Environment, Nature Conservation and Nuclear Safety	
Decommissioning	Dietlinde Petrick Ministry for the Environment, Climate Protection, Agriculture and Consumer Protection of the State of Hesse	Dr. Boris Brendebach Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

6 Nuclear Installations in Germany

As a legal basis for the operation of the German nuclear installations, the <u>Atomic Energy Act</u> was amended in 2002 with the aim to phase out the use of nuclear energy for the commercial generation of electricity in a controlled and structured manner. The Act laid down the electricity production rights for each nuclear installation. With the amendment of the <u>Atomic Energy Act</u> of 6th August 2011 (13th Atomic Energy Act amendment), further operation of eight nuclear installations for electricity generation (power operation) was terminated, whereas additional dates for the latest possible termination of power operation were fixed for the remaining nine nuclear installations. The last German NPP will shut down by the end of the year 2022.

Besides nuclear power plant several other nuclear facilities and installations are located in Germany such as research reactors, fuel enrichment, production and treatment facilities, storage facilities for spent fuel, heat generating and negligible heat generating waste, and disposal facilities.

Nuclear power plants

End of 2018, seven nuclear reactors for electricity generation - one BWR and six PWR - were in operation in Germany. The planned shut-down dates for these reactors, as laid down in the <u>Atomic Energy Act</u>, range from 2019 to 2022 (see Tab. 6-1). For some of the reactor the decommissioning license application has already been submitted to the competent licensing authority. In addition, two nuclear reactors were in post-operation (see Tab. 6-1). For these reactors the decommissioning license application has been submitted.

Tab. 6-2 lists the reactors that were licensed for decommissioning after the 13th Atomic Energy Act amendment in 2011. The decommissioning of NPPs can already begin with spent fuel in the spent fuel pool. Direct dismantling is the decommissioning strategy of choice with the final goal of a "green field". Decommissioning and dismantling are divided into two phases: In the first phase, all contaminated and activated parts are dismantled and further processed. In the second phase, after the site (or parts of it) has been released from nuclear regulatory control, conventional demolition of the remaining structures is carried out. Tab. 6-2 also lists the additional on-going NPP decommissioning projects, which already started before the 13th Atomic Energy Act amendment in 2011. These include experimental and demonstration reactors under decommissioning.

Tab. 6-3 lists the already completed decommissioning projects at the Kahl, Großwelzheim, and Niederaichbach sites.

Research reactors

In 2018, seven research reactors were in operation in Germany (see Tab. 6-4). The power level of these research reactors ranges from Milliwatts up to 20 MW_{th} . The latest research reactor that went in operation in 2004 is the FRM-II reactor in Garching.

Three research reactors are currently in post-operation (see Tab. 6-5). For these research reactors the decommissioning license application has been submitted. Seven research reactors are at different stages in the decommissioning process (see Tab. 6-6). In addition, 29 other research reactors of different types have already completely been decommissioned and dismantled in Germany.

Fig. 6-1 shows an overview of the German NPPs (in operation, in post-operation, under decommissioning and fully dismantled), as well as the three largest research reactors (power larger than 100 kW) in operation.

Name		Туре	Power (MW _e)	First Criticality	Planned Shutdown	Decom. application
	Philippsburg-2	PWR	1468	1984-12-13	2019	2016-07-18
	Grohnde	PWR	1430	1984-09-01	2021	2017-10-26
tion	Gundremmingen-C	BWR	1344	1984-10-26	2021	-
In operat	Brokdorf	PWR	1480	1986-10-08	2021	2017-12-01
	Isar-2	PWR	1485	1988-01-15	2022	-
	Emsland	PWR	1406	1988-04-14	2022	2016-12-22
	Neckarwestheim-2	PWR	1400	1988-12-29	2022	2016-07-18
ost- ation	Gundremmingen-B	BWR	1344	1984-03-09	2017-12-31	2014-12-11
ln p oper	Krümmel	BWR	1402	1983-09-14	2011-08-06	2015-08-24

Tab. 6-1	NPPs in	operation	and	post-operation
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Fig. 6-1 Overview of the German NPPs (in operation, in post-operation, under decommissioning and fully dismantled) and the larger three research reactors in operation

Name		Туре	Power (MW _e)	First Criticality	Final Shutdown	Decom. licensed
g after	Brunsbüttel	BWR	806	1976-06-23	2011-08-06	2018-12-21
	Grafenrheinfeld	PWR	1345	1981-12-09	2015-06-27	2018-04-11
ionin Act	Unterweser	PWR	1410	1978-09-16	2011-08-06	2018-02-05
nmiss iergy	Philippsburg-1	BWR	926	1979-03-09	2011-08-06	2017-04-07
lecon lic En n 201	Biblis-B	PWR	1300	1976-03-25	2011-08-06	2017-03-30
for d Atom	Bilbis-A	PWR	1225	1974-07-16	2001-08-06	2017-03-30
nsed 13 th endr	Neckarwestheim-1	PWR	840	1976-05-26	2011-08-06	2017-02-03
lice the am	Isar-1	BWR	912	1977-11-20	2011-08-06	2017-01-17
2011	Lingen	BWR	268	1968-01-31	1977-01-05	1985-11-21 ¹⁾ 2015-12-21 ²⁾
nt in	Gundremmingen-A	BWR	250	1966-08-14	1977-01-13	1983-03-30
rgy Act amendmer	Mehrzweck- forschungsreaktor	PWR (D ₂ O)	57	1965-08-14	1984-05-03	1987-11-17
	Mülheim-Kärlich	PWR	1302	1986-03-01	1988-09-09	2004-07-16
	THTR-300	HTR	308	1983-09-13	1988-09-29	1993-10-22
Ene	AVR	HTR	15	1966-08-26	1988-12-31	1994-03-09
3 th Atomic	Greifswald-5	WWER	440	1989-03-26	1989-11-30	1995-06-30
	Greifswald-2	WWER	440	1974-12-03	1990-02-14	1995-06-30
the 1	Greifswald-3	WWER	440	1977-10-06	1990-02-28	1995-06-30
efore	Rheinsberg	WWER	70	1966-03-11	1990-06-01	1995-04-28
ng be	Greifswald-4	WWER	440	1979-07-22	1990-06-02	1995-06-30
sioni	Greifswald-1	WWER	440	1973-12-03	1990-12-18	1995-06-30
decommis	Kompakte natriumgekühlte Kernanlage	FBR	21	1977-10-10	1991-08-23	1993-08-26
d for	Würgassen	BWR	670	1971-10-22	1994-08-26	1997-04-14
ense	Stade	PWR	672	1972-01-08	2003-11-14	2005-09-07
Ĩ	Obrigheim	PWR	357	1968-09-22	2005-05-11	2008-08-28
¹⁾ safe enclosure, ²⁾ dismantling						

Tab. 6-2 NPPs in licensed decommissioning

Name	Туре	Power (MW _e)	First Criticality	Final Shutdown	Released from Regulatory Control
Kahl	BWR	16	1960-11-13	1985-11-25	2010-05-17
Großwelzheim	SSR	25	1969-10-14	1971-04-20	1998-05-14
Niederaichbach	PTR (D ₂ O)	106	1972-12-17	1974-07-31	1994-08-17

Tab. 6-3 NPPs completely decommissioned

Tab. 6-4 Research reactors in operation

Name	Туре	Power (MW _{th})	First Criticality	
SUR Stuttgart (SUR S)	Homogeneous/SUR-100	10 ⁻⁷	1964-08-24 1969-06-12	
Forschungsreaktor Mainz (FRMZ)	TRIGA MARK-II (Pool)	0.1	1965-08-03	
SUR Ulm (SUR U)	Homogeneous/SUR-100	10 ⁻⁷	1965-12-01	
SUR Furtwangen (SUR FW)	Homogeneous/SUR-100	10 ⁻⁷	1973-06-28	
Berliner Experimentier-Reaktor II (BER-II)*	MTR (Pool)	10	1973-12-09	
Ausbildungsreaktor (AKR-2)	Homogeneous/SUR-type	2 x 10 ⁻⁶	1978-07-28 2005-03-22	
Hochflussneutronenquelle München/Garching (FRM-II)	Pool-type, compact core, D ₂ O moderator	20	2004-03-02	
*BER-II is scheduled to finally shut down at the end of 2019				

Tab. 6-5Research reactors in post-operation

Name	Туре	Power (MW _{th})	First Criticality	Final Shutdown	Decom. application
Geesthacht 1 (FRG-1)	MTR (Pool)	5	1958-10-23	2010-06-28	2013-03-21
Geesthacht 2 (FRG-2)	MTR (Pool)	15	1963-03-16	1993-01-28	2013-03-21
SUR Aachen (SUR AA)	Homog./SUR-100	10 ⁻⁷	1965-09-22	2008	2009-10-22

Name	Туре	Power (MW _{th})	First Criticality	Final Shutdown	Decom. licensed
Forschungsreaktor München (FRM)	MTR (Pool)	4	1957-10-31	2000-07-28	2014-04-03
Rossendorfer Forschungsreaktor (RFR)	WWR-SM (Tank)	10	1957-12-16	1991-06-27	1998-01-30
Forschungsreaktor 2 (FR-2)	Tank-type / D ₂ O	44	1961-03-07	1981-12-21	1986-07-03 1996-11-20 ¹⁾
DIDO (FRJ-2)	Tank-type / D ₂ O	23	1962-11-14	2006-05-02	2012-09-20
Forschungs- und Messreaktor Braunschweig (FRMB)	MTR (Pool)	1	1967-10-03	1995-12-19	2001-03-02 2005-07-28 ²⁾
SUR Hannover (SUR H)	Homog. / SUR-100	10 ⁻⁷	1971-12-09	2008	2017-09-04
Forschungsreaktor Neuherberg (FRN)	TRIGA MARK-III (Pool)	1	1972-08-23	1982-12-16	1983-05-30 1984-05-24 ¹⁾
¹⁾ safe enclosure ²⁾ released except interim storage					

Tab. 6-6 Research reactors under decommissioning

Installations of the fuel cycle and waste storage

In addition to NPP and research reactor, other nuclear installations such as nuclear fuel cycle facilities and facilities for the treatment and final disposal of radioactive waste are located in Germany.

Operational fuel cycle facilities are the uranium enrichment plant at Gronau, the fuel assembly fabrication plant in Lingen, and the pilot conditioning plant in Gorleben (see Tab. 6-7). Several other nuclear fuel cycle facilities are currently in decommissioning phase or have already been decommissioned and released from nuclear regulatory control (see Tab. 6-8).

Facilities and installations of radioactive waste management in Germany consist of spent fuel storage facilities, storage facilities for radioactive waste with negligible heat generation, disposal facilities for nuclear waste, as well as installations for the conditioning of radioactive waste.

Spent fuel from the operation of power and research reactors is stored in central storage facilities TBL Ahaus (TBL = transport cask storage facility), TBL Gorleben and the Nord storage facility in

Rubenow near Greifswald, in decentralised storage facilities (cask storage facility of the "Arbeitsgemeinschaft Versuchsreaktor (AVR) Jülich") and in decentralised storage facilities at twelve sites with nuclear power plants (see Tab. 6-9).

Radioactive waste with negligible heat generation from nuclear power plants and the nuclear industry is stored in buffer storage facilities are located at NPP sites (see Tab. 6-10) and in central and decentralised storage facilities (see Tab. 6-11). For waste from the use and handling of radioisotopes in research, industry and medicine, Land collecting facilities operated by the Länder are available for storage (see Tab. 6-12). Additional storage facilities of the nuclear and other industry, as well as examples of stationary installations for the conditioning of radioactive waste are listed in Tab. 6-13 and Tab. 6-14, respectively.

There are two disposal facilities for radioactive waste in Germany: the Morsleben disposal facility (ERAM) and the Konrad disposal facility (see Tab. 6-15). The ERAM disposal facility has been used in the past to dispose low and intermediate level radioactive waste. No further emplacement operations are planned for the ERAM disposal facility. In future, the Konrad disposal facility will be used for waste with negligible heat generation staring the operation in 2027.

From 1969 until 1978, low-level and medium-level waste was emplaced in the Asse II mine. On 1st January 2009, the former Federal Office for Radiation Protection assumed responsibility for the operation of the Asse II mine under atomic and mining law. The BfS was given the task to decommissioning the Asse II mine safely under atomic law. According to an amendment of § 57b <u>Atomic Energy Act</u> with the Asse Act of 24th April 2013, decommissioning is to start following the retrieval of the radioactive waste.

The sites of storage facilities for spent fuel and radioactive waste, as far as they have not been constructed at the locations of nuclear power plants that were in operation at the time of the construction of the storage facilities, as well as of facilities for conditioning and disposal are shown in Fig. 6-2.



Fig. 6-2 Sites of facilities of spent fuel and radioactive waste management (without on-site storage facilities and facilities covered by licences pursuant to § 7 <u>Atomic Energy Act</u>)

Name	Location	Purpose of the facility	License
GRONAU Uranium enrichment plant (UAG)	Gronau (NW)	Uranium enrichment	3. partial licence of 04.06.1985 (operation licence)
ANF fuel element fabrication plant Lingen	Lingen (NI)	Fabrication of mainly LWR fuel elements of low- enriched uranium dioxide	Operation licence of 18.01.1979
Pilot conditioning plant (PKA)	Gorleben (NI)	Repair of defective casks,	Acc. to § 7 <u>Atomic Energy Act</u> 1. partial licence of 30.01.1990 2. partial licence of 21.07.1994 (Subsequently imposed obligation of 18.12.2001) 3. partial licence: 19.12.2000 (includes operation licence)

Tab. 6-7 Operational fuel cycle facilities

Tab. 6-8Fuel cycle facilities in the process of decommissioning, or decommissioning completed
and released from nuclear regulatory control

Name	Location	Operator	Start of operation	End of operation	Status
HOBEG fuel fabrication Facility	Hanau (HE)	Oberg GmbH	1973	1988	Removed
NUKEM-A fuel fabrication facility	Hanau (HE)	RD Hanau GmbH (formerly Nukem GmbH)	1962	1988	Removed
Siemens fuel fabrication facility, uranium unit	Hanau (HE)	Siemens AG	1969	1995	Removed
Siemens fuel fabrication facility, MOX unit	Hanau (HE)	Siemens AG	1968	1991	Removed
Siemens fuel fabrication facility, Karlstein unit (SBWK)	Karlstein (BY)	Siemens AG	1966	1993	Continued conventional use
Karlsruhe reprocessing plant (WAK) including Karlsruhe vitrification plant (VEK),	BW	КТЕ	1971	1990	Dismantling ¹⁾
¹⁾ planned final status: removal					

Name		Cask storage locations licensed (occupied end of 2016)	Mass HM (tons)	Commissioning	Licensed until
	TBL Ahaus	420 (56), 329 casks ¹⁾	3960	June 1992	2036-12-31
rage ZL)	TBL Gorleben	420 (113)	3800	April 1995	2034-12-31
al sto es (Z	TBL / ZLN Rubenow	80 (74)	585	End of 1999	2039-10-31
Centra faciliti	AVR-Behälterlager Jülich	158 (152)	0,225	August 1993	2013-06-30 ²⁾
	SZL Bilbis	135 (91)	1400	May 2006	2046-05-18
	SZL Brokdorf	100(30)	1000	March 2007	2047-03-05
	SZL Brunsbüttel	80 (20)	450	Feb. 2006	n/a ³⁾
SZL)	SZL Grafenrheinfeld	88 (21)	800	Feb. 2006	2046-02-27
ities (SZL Grohnde	100 (30)	1000	April 2006	2046-04-27
facili	SZL Gundremmingen	192 (55)	1850	August 2006	2046-08-25
orage	SZL Isar	152 (42)	1500	March 2007	2047-03-12
te sto	SZL Krümmel	65 (41)	775	Nov. 2006	2046-11-14
On-si	SZL Lingen	125 (43)	1250	Dec. 2002	2042-12-10
	SZL Neckarwestheim	151 (77)	1600	Dec. 2006	2046-12-06
	SZL Philippsburg	152 (60)	1600	March 2007	2047-03-19
	SZL Unterweser	80 (35)	800	June 2007	2017-06-18

Tab. 6-9	Storage facilities for	or spent fuel and	l other heat generating was	te as of 31.12.2017
100.05	otorage raointies it	or sport ruor and	a outor near generaling was	10 43 01 01.12.2017

¹⁾ 305 casks of the CASTOR THTR/AVR type are arrange in a double stacked way that only 56 licensed positions are occupied in total

²⁾ The original license expired 2013. New licensing procedure is ongoing.

³⁾ The license was rejected by a court decision. New licensing procedure is ongoing.
Name of facility and site	Capacity according to licence	Licence	
NPP Biblis (Units A and B)	7,500 packages	§ 7 Atomic Energy Act,§ 7 RadiationProtection Ordinance	
NPP Brokdorf	560 m ³	§ 7 Atomic Energy Act	
NPP Brunsbüttel	2000 m ³ , 5,000 m ³ / 5,000 m ³ *)	§ 7 Atomic Energy Act, § 7 Radiation Protection Ordinance	
NPP Emsland	185 m ³	§ 7 Atomic Energy Act	
NPP Grafenrheinfeld	Raw waste: 200 m ³ Conditioned waste: 200 m ³	§ 7 Atomic Energy Act	
NPP Grohnde	280 m ³	§ 7 Atomic Energy Act	
NPP Gundremmingen Units B and C	300 m ³ conditioned waste 1,305 m ³ liquid waste	§ 7 Atomic Energy Act	
NPP Isar 1	4,000 m ³	§ 7 Atomic Energy Act	
NPP Isar 2	160 m ³	§ 7 Atomic Energy Act	
NPP Krümmel	1,700 m ³	§ 7 Atomic Energy Act	
NPP Neckarwestheim Units 1 and 2	3,264 m ³	§ 7 Atomic Energy Act	
NPP Philippsburg Units 1 and 2	3,775 m ³	§ 7 Atomic Energy Act	
NPP Unterweser	350 m ³	§ 7 Atomic Energy Act	
NPP Greifswald (Units 1 – 5)	140 20' Container	§ 7 Atomic Energy Act	
NPP Gundremmingen Unit A	1,678 m ³ conditioned waste 318 m ³ liquid waste	§ 7 Atomic Energy Act	
THTR Hamm-Uentrop	1,160 m ³	§ 7 Atomic Energy Act	
AVR Jülich	235 m ³	§ 7 Atomic Energy Act	
NPP Lingen	170 m ³	§ 7 Atomic Energy Act	
NPP Mülheim-Kärlich	43 m ³	§ 7 Atomic Energy Act	
NPP Obrigheim	3,300 m ³	§ 7 Atomic Energy Act	
NPP Rheinsberg		§ 7 Atomic Energy Act	
NPP Stade	100 m ³	§ 7 Atomic Energy Act	
NPP Stade	4,000 m ³	§ 7 Radiation Protection Ordinance	
NPP Würgassen	4,600 m ³	§ 7 Atomic Energy Act	
*) Hall I and II for keeping the waste ready for transport			

Tab. 6-10 Operational buffer storage facilities in nuclear power plants

Name of facility and site		Capacity according to licence	Licence
Central storage facilities	Gorleben waste storage facility, Lower Saxony	200-I, 400-I drums, type III concrete containers, type I-II cast-iron containers, type I-IV containers with a total activity of up to 5x1018 Bq	Handling licences according to § 3 Radiation Protection Ordinance ¹⁾ of 27 th October 1983, 13 th October 1987 and 13 th September 1995
	Ahaus waste storage facility, North Rhine- Westphalia	Konrad containers, 20' containers and facility components; total activity for storage area no. I limited to 1.0x1017 Bq	Handling licences according to § 7 Radiation Protection Ordinance of 9 th November 2009
	Unterweser waste storage facility, Lower Saxony	200-I and 400-I drums, concrete containers, sheet steel containers, cast-iron containers with a total activity of up to 1.85x1015 Bq	Handling licences according to § 3 Radiation Protection Ordinance ¹⁾ of 24 th June 1981, 29 th November 1991 and 6 th November 1998
	Storage facility of the EVU, Mitterteich, Bavaria	40,000 waste packages (200-I, 400-I drums or cast-iron containers)	Handling licences according to § 3 Radiation Protection Ordinance ¹⁾ of 7 th July 1982
	Zwischenlager Nord (ZLN), Rubenow/Greifswald, Mecklenburg-West Pomerania	165,000 m³	Handling licences according to § 3 Radiation Protection Ordinance ¹⁾ of 20 th February 1998
	Hauptabteilung Dekontaminationsbetriebe (HDB), Karlsruhe, Baden- Wuerttemberg	Handling (conditioning and storage) of radioactive residues and waste with contents of fissile material up to a total activity of 4.5x1017 Bq	Handling licence according to § 9 Atomic Energy Act of 25 th November 1983, superseded by licence according to § 9 Atomic Energy Act of 29 th June 2009
storage facilities in research institutions	Forschungs- und Messreaktor Braunschweig (FMRB)	Decommissioning waste from FMRB (174 m3)	§ 7 Atomic Energy Act
	Research reactor Garching	FRM: 100 m ³ FRM2: 68 m ³	§ 7 Atomic Energy Act
	Research centre Geesthacht	145 m2, 112 m2, 226 m2	§ 3 Radiation Protection Ordinance ¹⁾ , § 7 Radiation Protection Ordinance
	JEN mbH	11,470 drums and 780 Konrad containers Licence for storage of AVR fuel elements	§ 3 Radiation Protection Ordinance ¹⁾ §§ 6, 9 Atomic Energy Act ²⁾
	VKTA Rossendorf	2,270 m ³ (total gross storage volume)	§ 3 Radiation Protection Ordinance ¹⁾
¹⁾ as amended on 13 th October 1976 and 30 th June 1989, respectively			

Tab. 6-11 Storage facilities for radioactive waste with negligible heat generation

²⁾ new licence applied for

Tab. 6-12 Land collecting facilities

Name of facility and site	Capacity according to licence	Licence	
Land collecting facility Baden- Wuerttemberg, Karlsruhe	No capacity limit stated (capacity HDB: 78,664 m ³)	§ 9 Atomic Energy Act	
Land collecting facility Bavaria, Mitterteich	10,000 packages	§ 3 Radiation Protection Ordinance *)	
Land collecting facility Berlin, Berlin	800 m ³	§ 3 Radiation Protection Ordinance *)	
Land collecting facility Hesse, Ebsdorfergrund	400 m³	§ 6 Atomic Energy Act § 3 Radiation Protection Ordinance *)	
Land collecting facility Mecklenburg- Western Pomerania, Rubenow/Greifswald	20' containers	§ 3 Radiation Protection Ordinance *)	
Land collecting facility North Rhine- Westphalia, Jülich	9,000 200-l drums	§ 3 Radiation Protection Ordinance * ⁾ , § 9 Atomic Energy Act	
Land collecting facility Rhineland- Palatinate, Ellweiler	α+β/γ activity limited to: 1.6x10 ¹³ Bq	§ 9 Atomic Energy Act, § 3 Radiation Protection Ordinance *)	
Land collecting facility Saarland, Elm- Derlen	50 m³	§ 3 Radiation Protection Ordinance *)	
Land collecting facility Saxony, Rossendorf/Dresden	300 m ³	§ 3 Radiation Protection Ordinance *)	
Land collecting facility of the four north German coastal Federal States, Geesthacht	68 m² storage area	§ 3 Radiation Protection Ordinance *)	
Land collecting facility Lower Saxony, Leese	Hired storage capacity: 1,485 drums, 3,400 drums, max. 50 Konrad containers	§ 7 Radiation Protection Ordinance	
Central collecting point of the German Federal Armed Forces, Munster	1,600 m ³	§ 3 Radiation Protection Ordinance *)	
*) as amended on 13 th October 1976 or 30 th June 1989 respectively			

Name of facility and site	Capacity according to licence	Licence	
Nuclear industry			
Advanced Nuclear Fuels GmbH (ANF), Lingen	950 200-l drums	§ 7 Atomic Energy Act	
Siemens, Karlstein	5,300 m ³ (2,100 m3 according to § 9 Atomic Energy Act, 3,200 m3 according to § 3 Radiation Protection Ordinance *))	§ 9 Atomic Energy Act, § 3 Radiation Protection Ordinance *)	
Storage facility of DAHER NUCLEAR TECHNOLOGIES (formerly NCS), Hanau	1.: 1,250 Konrad containers 2.: 800 m2	 § 7 Radiation Protection Ordinance § 3 Radiation Protection Ordinance *) 	
Urenco, Gronau	Storage facility: 220 m ² ; up to 48 Konrad Type V containers; buffer storage facility 1: 150 200-I drums; buffer storage facility 2: 230 m ² , 84 200-I drums (double-stacked); 96 storage positions for "lost concrete shielding" (single-stacked)	§ 7 Atomic Energy Act	
Other industry			
Eckert & Ziegler Nuclitec GmbH, Leese	13,620 200-I drums	§ 7 Radiation Protection Ordinance	
*) as amended on 13 th October 1976 or 30 th June 1989 respectively			

Tab. 6-13 Storage facilities of the nuclear and other industries

Operator	Installation	Installation name	Installation description
operator	site		
GNS Gesellschaft für Nuklear-Service mbH	Jülich	PETRA drying installation	Drying of waste in 200-I drums, 280-I drums or 400-I drums
		FAKIR high-pressure hydraulic press	High-pressure compaction of waste to pellets with the aid of metal cartridges or 200-I drums, waste volume reduction by up to factor 10
	Braunschweig	Drying installation	Drying of drums up to the specified residual humidity
Eckert & Ziegler Nuclitec GmbH		Compacting installation	Compaction of 200-I drums and scrunch drums, pressing power \ge 30 MPa Capacity: 5,000 – 10,000 pressing sequences/a
		Decontamination cell	Decontamination of equipment parts (e.g. sandblasting); crushing of equipment parts (e.g. cutting, sawing), max. weight 1 Mg/piece
		Cementing installation	Immobilisation of waste water with fixing materials, immobilisation of ion-exchange resins with fixing materials
		Shredding installation	Crushing of waste, segregation of solid and liquid constituents, homogenisation, sampling
EWN Entsorgungswerk für Nuklearanlagen GmbH, formerly Energiewerke Nord GmbH	Rubenow (Greifswald)	FAKIR high-pressure hydraulic press	High-pressure compaction of radioactive waste in 180- I press drums and 200-I drums as well as loose waste with the aid of metal cartridges
		PETRA drying installation and drying chamber	Drying of solid and liquid radioactive waste in 200-l drums, 280-l drums, 400-l drums or 580-l drums
		Hydraulic shears	Cutting up of metals (scrap shear MARS with pre- compaction)
		Dismantling rooms	Dismantling of metals by use of thermal processes, e.g. autogenous cutting and plasma cutting
		Evaporation facilities	Processing of radioactive liquid waste; throughput up to 3 m ³ /h
		In-drum drying installation	Processing of evaporator concentrates; processing of up to eight 200-I drums simultaneously
		Chamber filtration installation	Separation of solids from radioactive liquids

 Tab. 6-14
 Examples of stationary installations for the conditioning of radioactive waste for own needs and third parties

Name of facility and site	Capacity according to licence	Licence	Geological host formation
Asse II mine Remlingen, Lower Saxony	Between 1967 and 1978 approx. 124,500 LLW waste packages	Licence according to § 3 Radiation Protection Ordinance as amended on 15 th October 1965	Rock salt
		Handling licence according to § 7 Radiation Protection Ordinance and acquisition of facts according to § 9 Atomic Energy Act (2011) Retrieval of waste planned according to Article § 57b Atomic Energy Act	
Konrad disposal facility Salzgitter, Lower Saxony	303 000 m ³ radioactive waste with negligible heat generation	Licence according to § 9b Atomic Energy Act, approval of the plan was granted on 22 nd May 2002, decision is final since 26 th March 2007	Coral oolite (iron ore) beneath a water-impermeable barrier from the cretaceous period
Morsleben disposal facility for radioactive waste (ERAM) Saxony-Anhalt	Disposal of 36,753 m ³ low and intermediate level waste in total, total activity of all radioactive waste emplaced in the order of magnitude of 10 ¹⁴ Bq, activity of alpha- sources in the order of magnitude of 10 ¹¹ Bq.	22 nd April 1986: Permanent operating licence granted. 12 th April 2001: A statement is made to the effect that no further radioactive waste will be accepted for disposal	Rock salt

Tab. 6-15 disposal facilities and other storage facilities for radioactive waste

7 Site Visit at Neckarwestheim (GKN)

At the GKN site, the following facilities are supervised by the competent nuclear supervisory and licensing authority, the Ministry of the Environment, Climate Protection and the Energy Sector Baden-Württemberg:

- GKN NPP Unit 1, which is in dismantling,
- GKN NPP Unit 2, which is in operation,
- the on-site dry storage facility for spent fuel (GKN SZL)
- the waste treatment centre (RBZ), which, at the time of the visit, is expected to be in commissioning, and
- the intermediate storage facility for medium a low level waste (SAL), which, at the time of the visit is expected to be in commissioning.

Licensee of the Neckarwestheim Nuclear Power Plants is the EnBW Kernkraft GmbH (EnKK). Since 1st January 2019, the licensee of the on-site storage facility for spent fuel (GKN SZL) is the Bundesgesellschaft für Zwischenlagerung mbH (BGZ). EnKK was the former licensee. Licensee of the RBZ is the Gesellschaft für nukleares Reststoffrecycling GmbH (GNR) a 100 % EnBW subsidiary. Licensee of the SAL is the EnKK. A total of around 700 employees work at the GKN site.

Location of GKN

The site (see Fig. 7-1) is located about 25 km north of Stuttgart on the right bank of the Neckar river on the large river loop open to the west between the town of Kirchheim and the town of Lauffen. The site, located in a former quarry near river kilometre 129, is bordered in the west, south and southeast by steep walls rising up to a height of 35 m. The river is also a natural barrier between the town of Kirchheim and the city of Lauffen. In the north, the boundary of the site is formed by the Neckarberg, and in the northeast by the Liebensteiner Bach. Towards the Neckar, there is an approximately 150 m wide passage in the west.



Fig. 7-1 Location of the GKN site

GKN I – PWR in decommissioning

Unit 1 (GKN I) was a KWU (Kraftwerk Union AG) 3-loop plant with three steam generators and reactor core with 177 fuel assemblies. The safety systems had largely a four-leg design with spatial separation (e.g. 4 emergency core cooling and residual heat removal systems, 4 emergency diesels).

The plant thermal output of 2,497 MW was converted in a total gross electrical output of 840 MW by a three-phase turbo generator and a separate turbo generator for railway electricity.

A reinforced concrete reactor building encloses safety-important plant equipment along with a large spherical steel shell that forms the former full-pressure containment. It encloses the primary cooling circuit with its components (including i.a. the reactor pressure vessel with connecting piping, the main cooling pumps and the steam generators) and the now empty spent fuel storage pool.

The power plant consists of structures for nuclear and conventional plant components, for cooling water chain installations and structures for general supply and administration. The installations inside also determine the safety significance of these structures. The plant essentially consists of the following buildings:

- reactor building (ZA),
- reactor building annulus (ZB)
- reactor auxiliary building with extension (ZC and 2ZC)
- switchgear building (0ZE)
- emergency power generating building (ZK)
- supplementary emergency power generating building (1ZK)
- emergency feed building (ZX)
- turbine building (ZF)
- cooling tower structure (0ZP)
- circulating water pump building (2ZM)
- vent stack (ZQ)

The location of the power plant buildings of Unit 1 is shown in the overview map (see Fig. 7-2).



Fig. 7-2 Location of Unit 1 (blue colour) at the site

Main access to the reactor building, reactor auxiliary building and switchgear building is provided centrally via the office and staff amenities building. The controlled area entrance is located in the reactor auxiliary building.

NPP Neckarwestheim Unit 1 entered commercial operation on 1st December 1976 and had generated about 200 million MWh gross electrical energy until 2011. The plant was in permanent shutdown from 2011 until 2017 and is now in decommissioning. In the post-operational phase, initial preparatory measures for dismantling such as primary coolant system decontamination and various permanent system shutdowns were carried out. The decommissioning and first dismantling licence for GKN I was issued on 3rd February 2017. Since 22nd April 2018 the plant has been free of fuel elements and fuel rods. In a letter dated 21st December 2017, the EnKK submitted the applications for the second and most likely the last dismantling licence for GKN I. The application subjects are the dismantling of the biologic shield, the spent fuel pool and the reactor pool, the reactor pressure vessel lower part including the core support.

Since 2017, when starting the use of the decommissioning licence, about 900 metric tonnes have been dismantled.

The total dismantling mass is estimated at 330,000 tonnes. Dismantling began at the time when spent fuel elements were still in the fuel pool in reactor building. Dismantling takes place in all areas

of the plant inside and outside of the controlled area. Previous main dismantling activities in the reactor building included

- dismantling of the core internals,
- clearance cutting of the steam generator, pressuriser,
- cutting of the main coolant lines,
- dismantling of the high-pressure safety injection pump room.

Upcoming dismantling measures for 2019 include the removal of the large components (steam generator, pressuriser) and the dismantling of the turbine building components.

The residual materials including radioactive waste resulting from the dismantling of plant components are subject to different waste management routes. Decontamination and disassembly of a small amount of contaminated and activated plant components takes place in the GKN I plant itself. It is planned that this work will mainly be carried out in the newly constructed waste treatment centre (RBZ) on site.

GKN II – PWR in operation

As one of three KONVOI plants manufactured by KWU, Unit 2 (GKN II) is the youngest reactor in Germany. The PWR plant with a reactor core with 193 fuel assemblies is a typical 4-loop plant with four steam generators and four-leg, spatially segregated safety systems (e.g. four emergency cooling and heat removal systems, four emergency diesels) and four additional emergency feedwater power diesels (SBO diesels).

From the thermal output of 3,850 MW a gross electric output of 1,400 MW can be generated by one high-pressure turbine section and two low-pressure turbine sections with the aid of a turbine generator. The cooling water supply is via a virtually full-closure cooling water system with a hybrid cooling tower, for which only a small volume of water has to be taken from the Neckar and treated.

The reactor building is a solid reinforced-concrete structure and along with safety-important equipment it also houses the containment, which is of steel. This containment is of full-pressure design and it encloses the primary cooling circuit with its components (including i.a. the reactor pressure vessel with connecting piping and the main cooling pumps and the steam generators) and the spent fuel pool for spent fuel assemblies.

On 15th April 1989, Neckarwestheim NPP Unit 2 commenced commercial power operation and by the end of December 2018 it had generated more than 328 million MWh (gross) of electrical energy. Licensee of the Neckarwestheim Nuclear Power Plant is the EnBW Kernkraft GmbH (EnKK). According to the statutory provisions in the <u>Atomic Energy Act</u>, the right to power generation of the GKN II plant expires at the latest on 31st December 2022. Already in 2016, the operator EnKK submitted an application for a decommissioning and dismantling licence to the competent licensing authority. The aim of EnKK is to hold a licence for decommissioning and dismantling already at the end of the operating life in order to keep the period of the post-operational phase as short as possible. A single licence is targeted for decommissioning and dismantling.

The power plant consists of structures for nuclear and conventional plant components, for cooling water chain installations and structures for general supply and administration. The installations inside also determine the safety significance of these structures. The plant essentially consists of the following buildings:

- reactor building (UJ), divided into containment interior (UJA) and annulus (UJB)
- reactor auxiliary building (UKA)
- switchgear building (UBA)
- emergency power generating and central water chiller building (UBP)
- emergency feed building (ULB)
- turbine building (UMA)
- structures for circulating water and service water (UR and UP/UQ, respectively)
- structures for cooling water (UG)
- supply systems building (UTA)
- central gas supply systems building (UTG)
- office and staff amenities building (operations building) (UY)

The location of the power plant buildings is shown in the overview map (see Fig. 7-3).





Main access to the reactor building, reactor auxiliary building and switchgear building is provided centrally via the office and staff amenities building. The controlled area entrance is located in the reactor auxiliary building.

Another building (UKT) for the storage of radioactive waste is assigned to GKN II. A drum storage facility for storing radioactive waste is located in the reactor auxiliary building of GKN II, as are equipment for processing radioactive waste. EnKK plans to have the majority of the radioactive waste resulting from the dismantling of GKN I and in the future of GKN II processed by GNR in the waste treatment centre (RBZ) in commissioning at the time of the visit.

GKN SZL – HAW on-site storage facility

The GKN SZL for the storage of transport and storage casks loaded with spent fuel from GKN I and GKN II is located at the plant site. Until 31st December 2018, the licensee was EnBW Kernkraft GmbH (EnKK). As of 1st January 2019, the licensing ownership was transferred to the Gesellschaft für Zwischenlagerung mbH (BGZ).

The GKN SZL (see Fig. 7-4) with the structural parts

- entrance building, consisting of entrance hall and social wing,
- two parallel storage tunnels running in an east-west direction with a connecting corridor,
- exhaust air structure, and
- escape structure

was applied for, licensed and constructed within the framework of a licensing procedure under building and nuclear law. The underground construction method was chosen for site-specific reasons. Within the framework of the procedure, a service life of 40 years for the purpose of storing spent fuel elements in transport and storage casks was applied for and has been licensed.

The GKN SZL is designed such that heat removal from the transport and storage casks is ensured in a passive manner (natural air convection) during normal operation and in the event of incidents. Due to the underground construction and the thickness of the concrete walls, the radioactive radiation emitted by the fuel elements is additionally shielded by the transport and storage casks.

Storage tunnel 1 has 73 storage spaces and storage tunnel 2 has 78 storage spaces. This means that the storage facility has a total of 151 storage spaces for transport and storage casks.



Fig. 7-4 Location of GKN SZL at the site

8 Summary of the Self-assessment

Self-assessment process

Preparations for the upcoming IRRS mission to Germany started with an information meeting between IAEA, the BMU, the authorities of the Länder and the BfE on 15th November 2016 providing all involved German nuclear regulatory authorities with general information on the scope of IRRS missions of the IAEA.

Following the information meeting in 2016, BMU and the nuclear regulatory authorities of the Länder determined which authorities will participate in the IRRS mission forming the German IRRS team. It was decided between BMU and the Länder authorities to distribute the responsibilities for the different thematic modules of the IRRS self-assessment system among the involved authorities in order to reduce the burden on the involved authorities while maintaining the presentation of the full picture of the German regulatory system (see Section 4).

To this end, a process has been developed which reflects the responsibilities at the federal and Länder levels and thus addresses all aspects of the German regulatory system for nuclear safety and nuclear waste management. In the BMU, Division S I 5 coordinated the work of all divisions, also involving the subordinate federal authority BfE in this process. The authorities of the two Länder Baden-Württemberg (UM BW) and Schleswig-Holstein (MELUND) assumed the lead and coordination of the self-assessment tasks of the participating Länder authorities. Coordination meetings were held on a monthly basis to consolidate the work at the federal and Länder levels. These served to coordinate the answers to the questions in the self-assessment between the Federation and the Länder as well as the BfE. Thus, an IRRS team consisting of approximately 50 persons was set up to carry out the self-assessment.

Parallel to the process described, GRS was commissioned by the BMU to carry out the first work on the preparation and conduction of the self-assessment. In particular, existing documents prepared in the context of international reporting obligations (CNS, Joint Convention) were used. The results of this preparatory work served as a basis for the first working meetings of the IRRS team.

The first meeting of the IRRS team was held on 13th June 2017 to discuss the IAEA-Guidelines and the further common approach keeping in mind that the self-assessments of the IRRS mission represents a comparison with relevant IAEA Standards. The Länder authorities responsible for core modules 5 - 8, as well as BMU responsible for core module 9 were tasked to include in their responses input from the installation specific questionnaires.

The first draft of the self-assessment was completed until 22nd December 2017, followed by a commenting period on the first draft by all involved authorities until 26th February 2018. The self-assessment draft was subsequently revised and finalized during six meetings of the IRRS team in March 2018. During these meetings, the answers of the self-assessment were discussed in-depth leading to the identification of findings and minor deviations.

The self-assessment process was completed with two more meetings of the German IRRS Team on 8th May and 26th June 2018. The self-assessment was completed by drafting brief reports on the self-assessment modules (Sections 8.1- 8.11). The action plan was established by abstraction and combination of whole aspects. In total, the self-assessment process including the team building was carried out in about 17 months resulting in the formulation of the action plan (see Fig. 8-1).



Fig. 8-1Scheme of the self-assessment process

Brief reports on the self-assessment

8.1 Module 1 – Responsibilities and Functions of the Government

Introduction

In Germany, there is an appropriate governmental, legal and regulatory framework which clearly allocates the responsibilities for nuclear safety and radiation protection and which complies with international obligations. The framework ensures an effective regulatory control of facilities and activities.

The Federal Republic of Germany is a federation. It consists of 16 Länder, which exercise limited sovereignty alongside the Federation. In this connection, the <u>Basic Law</u> divides the legislative powers and the execution of federal laws between the Federation and the Länder. For nuclear safety and radiation protection the consequences of this division of powers are as follows. Only the Federation has legislative power with respect to nuclear safety and radiation protection. This means that laws dealing with matters of nuclear safety and radiation protection are federal laws. Their execution, on the other hand, is divided between the Federation and the Länder. As a consequence, there are authorities in charge of nuclear safety and radiation protection at both federal level and Länder level.

Domestic law

Pursuant to clause 14 of Art. 73(1) <u>Basic Law</u> the Federation has exclusive legislative power with respect to the production and use of nuclear energy for peaceful purposes, the construction and operation of installations serving such purposes, the protection against the hazards arising from the release of nuclear energy or from ionising radiation, and the disposal of radioactive substances.

The domestic legal and regulatory framework created on this basis ensures nuclear safety now and in the future. The statutory basis for nuclear safety and radiation protection are the <u>Atomic Energy</u> <u>Act</u> and the ordinances issued under the <u>Atomic Energy Act</u>. In reaction to the reactor accident at Fukushima, the <u>Atomic Energy Act</u> stipulates that the use of nuclear energy for the commercial generation of electricity be terminated by 31st December 2022 at the latest and that orderly operation is to be ensured up until the of date termination. There are also regulations outside the <u>Atomic Energy</u> <u>Act</u> that ensure long-term nuclear safety. In the area of radioactive waste management, the Act

Amending the Act on the Search and Selection of a Site for a Disposal Facility for Heat-Generating Radioactive Waste (<u>Site Selection Act</u> (Standortauswahlgesetz (StandAG))) was passed in 2017. Through this procedure, the site with the best possible safety for a period of one million years is to be identified for a facility for the disposal of highly radioactive waste accrued domestically in the Federal Republic of Germany.

Domestic legislation and the execution of national laws must comply with the binding requirements of European Union law. For the nuclear safety of nuclear installations, this is <u>Council Directive</u> 2009/71/EURATOM of 25th June 2009 as amended by <u>Council Directive 2014/87/EURATOM</u> of 8th July 2014.; for the responsible and safe management of spent fuel and radioactive waste, these include <u>Directive 2011/70/EURATOM</u> dated 19th July 2011 and in the field of radiation protection <u>Directive 2013/59/EURATOM</u> of the Council dated 5th December 2013. These Directives have been fully transposed into German law. As a result of the transposition of <u>Directive 2013/59/EURATOM</u>, a new legal and regulatory framework for radiation protection has been created. In future, radiation protection will be regulated in the Act on the Protection from the Harmful Effects of Ionizing Radiation (<u>Radiation Protection Act</u>), which exists separately alongside the <u>Atomic Energy Act</u>.

The legal and regulatory framework created by German law covers all areas relevant for nuclear safety at the appropriate level (constitution, legislation, ordinance, substatutory regulations in the form of regulatory requirements, guidelines, directives, criteria, recommendations) and thus ensures nuclear safety in the long term. As mentioned, the Atomic Energy Act is the statutory basis for ensuring nuclear safety through regulatory control. Its legal purpose is to protect life, health and real assets against the hazards of nuclear energy and the harmful effects of ionising radiation (cf. § 1 No. 2 Atomic Energy Act). This leads to the following: Firstly, the Atomic Energy Act, and the ordinances issued thereunder such as the Nuclear Licensing Procedure Ordinance provide a licensing system for the erection, operation and decommissioning of nuclear installations and for the handling and transportation of nuclear fuels and other radioactive substances. Secondly, a license may only be granted if all licensing requirements, - including those ensuring nuclear safety - are fulfilled. Thirdly, the erection, operation and decommissioning of nuclear installations and the handling and transportation of nuclear fuels and other radioactive substances are subject to state supervision. The proportionality principle mandates that the regulatory control exercised by the licensing and supervisory authorities intensifies depending on the nuclear risks that are associated with the planned or licensed installation or activity.

Common feature of the licensing requirements of the different regulated activities under the <u>Atomic</u> <u>Energy Act</u> is that a license may only be issued if – among other things – the necessary precautions have been taken in the light of the state-of-the-art of science and technology to prevent damage resulting from the planned activity (i.e. from the erection and operation of a nuclear installation or the handling and transportation of nuclear fuels or other radioactive substances). The reference in the Atomic Energy Act to the necessary precautions in the light of the state-of-the-art of science and technology to prevent damage means two things. Firstly, it assures that the licensing process is based on the latest technical and scientific findings on safety precautions that are known at that time and that need to be taken into account for ensuring effective damage prevention (i.e. the current state of knowledge and the internationally recognised design basis). The latest technical and scientific findings are specified by legal ordinances (e.g. Radiation Protection Ordinance (Strahlenschutzverordnung (StrlSchV))) and by substatutory regulations in the form of regulatory requirements, guidelines, directives, criteria and recommendations. Secondly, having regard to the fact that the state of knowledge evolves and, therefore, newer technical and scientific findings occur over time, the reference to the state of the art in science and technology assures that supervisory authorities review licensed activities in the light of newer technical and scientific findings on safety precautions. After a license has been issued, the technical and scientific findings on safety precautions the license is based upon are valid until newer findings occur and the supervisory authority finds that these newer findings need to be taken into account as they ensure a more effective damage prevention. As a consequence, a license holder is obliged to ensure that the safety precautions that have been taken reflect newer technical and scientific findings that have occurred and that need to be taken into account as they ensure a more effective damage prevention.

The aforementioned substatutory regulations in the form of regulatory requirements, guidelines, directives, criteria and recommendations include for example the <u>Safety Requirements for Nuclear</u> <u>Power Plants</u> (Sicherheitsanforderungen an Kernkraftwerke (SiAnf)), their <u>Interpretations</u>, the Nuclear Safety Standards of the Nuclear Safety Standards Commission (KTA Safety Standards), the recommendations and statements of the Reactor Safety Commission (RSK), of the Nuclear Waste Management Commission (ESK) or of the German Commission on Radiological Protection (SSK) and the conventional technical specifications. These substatutory regulations are continually developed so as to maintain and improve nuclear safety requirements. This on-going development takes into account operating experience, findings from safety analyses of operational nuclear installations, technological developments, and findings from safety research.

Execution of law

With regard to the execution of law, Art. 83 <u>Basic Law</u> stipulates that the Länder shall execute federal laws in their own right insofar as the <u>Basic Law</u> does not provide or permit otherwise. Art. 87c <u>Basic</u> <u>Law</u> empowers the Federation to enact laws under clause 14 of Art. 73 (1) <u>Basic Law</u> that may, with the consent of the Bundesrat, provide that they shall be executed by the Länder on behalf of the

Federation (Bundesauftragsverwaltung). The Federation has made use of this empowerment through a provision in the <u>Atomic Energy Act</u>. § 24 (1) stipulates that the Länder shall execute the <u>Atomic Energy Act</u> and the ordinances thereunder on behalf of the Federation. The <u>Atomic Energy</u> <u>Act</u> also contains exceptions where execution by the Länder on behalf of the Federation does not apply. In those instances, the Federation executes the <u>Atomic Energy Act</u> and the ordinances thereunder through its own administrative authorities.

The execution of a law by the Länder on behalf of the Federation (as in the case of the Atomic Energy Act), falls within the scope of Art. 85 Basic Law, which mandates that the Länder execute the law in their own right (insofar there is no difference as to the execution of federal laws by the Länder under Art. 83 Basic Law). However, the Federation – other than in the case where Länder execute federal laws under Art. 83 Basic Law – exercises oversight as to the legality and expediency of execution. This includes the capacity of the competent highest federal authority to issue binding instructions to the competent Länder authorities as to the legality or expediency of execution. When the competent highest federal authority issues an instruction, it assumes the competence for the subject matter (i.e. the decision in the cause). The competent individual Land authority is obliged to carry out instructions by the BMU as instructed and remains responsible for the administrative action. Even if the competent highest federal authority has assumed the competence for the subject matter, the execution (i.e. the administrative action with external effect) remains irrevocably with the competent individual Land authority. The competent highest federal authorities are responsible for issuing binding instructions. The Federal Chancellor by means of her organisational powers has designated the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) as the competent highest federal authority for nuclear safety and radiation protection. Recipients of instructions are the competent Länder authorities.

For the fulfilment of its task, the BMU has a national strategy for nuclear safety, specified in the Strategic Plan for the General Directorate RS - Safety of nuclear installations, Radiological Protection, Nuclear Fuel Cycle dated 26th July 2017. Herein is specified the policy of the BMU as the competent highest federal authority for nuclear safety, radiation protection and radioactive waste management. Accordingly, the BMU bears overall national responsibility for the effective protection of the people, the environment and assets from nuclear hazards and risks as well as from the harmful effects of ionising and non-ionising radiation. The <u>Strategic Plan of the BMU</u> and the <u>Atomic Energy Act</u> as the statutory basis for ensuring nuclear safety through regulatory control highlight the mission of the BMU, which is to work towards best-possible nuclear safety, to ensure orderly operation up until the date of termination of the use of nuclear energy for electricity generation, to protect the population from the harmful effects of ionising and non-ionising radiation and the aster of the BMU, which is to work towards best-possible nuclear safety, to ensure orderly operation up until the date of termination of the use of nuclear energy for electricity generation, to protect the population from the harmful effects of ionising and non-ionising radiation, and to arrange responsible and safe radioactive waste management.

In addition, the BMU set out in a national program – as required by <u>Directive 2011/70/EURATOM</u> – Germany's strategy for the responsible and safe management of spent fuel and radioactive waste.

To ensure uniform execution of the <u>Atomic Energy Act</u> by the Länder and with a view to the characteristics of the execution of the <u>Atomic Energy Act</u> – the Länder execute it on behalf of the Federation (Bundesauftragsverwaltung), which means the BMU as the competent highest federal authority exercising oversight as to the legality and expediency of execution by the competent Länder authorities and being able to assume the competence for the subject-matter anytime – the Länder Committee for Nuclear Energy (LAA) has been established consisting of representatives from the Länder and the federal authority. The LAA – including its four specialist committees – serves to coordinate the execution of the <u>Atomic Energy Act</u> between the competent authorities in charge of nuclear safety at federal and Länder level. Furthermore, it aims at upgrading substatutory regulations in place to ensure the best-possible, damage prevention throughout Germany

In some cases, the <u>Atomic Energy Act</u> provides for execution of its provisions through federal authorities. In that case, federal authorities –such as the Federal Office for the Safety of Nuclear Waste Management or the Federal Office for Radiation Protection – execute the <u>Atomic Energy Act</u> or the ordinances thereunder in their own right. In the area of radioactive waste management, the BfE assumes assigned tasks such as the authority for licensing (storage under § 6 <u>Atomic Energy Act</u>, disposal) and supervision and/or oversight (disposal, site selection). Being Federal Offices in the portfolio of the BMU, the BfE and the BfS are subject to oversight by the BMU which extends to the legality and the expediency of the execution. Therefore, the BMU may issue binding instructions on the execution of law to the BfE or the BfS, which they have to carry out as instructed.

Effective independence of competent regulatory body

The effective independence of the competent regulatory body – composed of the competent federal and Länder licensing and supervisory authorities in charge of nuclear safety and radiation protection – is ensured in various ways.

To begin with, the effective independence is ensured by the constitutional principle in Art. 20 (3) <u>Basic Law</u> according to which the executive shall be bound by law and justice. Consequently, the federal and Länder licensing and supervisory authorities in charge of nuclear safety and radiation protection are bound in their actions by the <u>Basic Law</u> and by ordinary law – the <u>Atomic Energy Act</u> and the ordinances issued thereunder. The <u>Atomic Energy Act</u> obliges the competent licensing and supervisory authorities to protect life, health and real assets from the hazards of nuclear energy and the harmful effects of ionising radiation (cf. § 1 No. 2 <u>Atomic Energy Act</u>). The constitutional principle enshrined in Art. 20 (3) <u>Basic Law</u>, according to which the executive shall bound by law and justice,

ensures that the regulatory body is able to perform its functions free from undue influence and is therefore a key element for ensuring that the decision-making process of the regulatory authority is based on nuclear safety considerations only.

In addition, the federal and Länder licensing and supervisory authorities in charge of nuclear safety and radiation protection are functionally separated from all other governmental bodies and organisations that, as part of the overall energy policy or energy industry promotion, deal with matters related to the use or promotion of nuclear energy, such as for electricity generation (Trennungsgrundsatz – principle of separation). The principle of separation is another key element to ensure the effective independence of the regulatory body in all matters of nuclear safety.

At federal level, the functional separation is ensured by an organisational decree of the Federal Chancellor pursuant to Art. 64 of the Basic Law. According to Art. 64 Basic Law, the Federal Chancellor exercises the organizational power to assign the respective tasks - and thus the responsibilities – to the individual ministries. In exercising her organisational powers, the Federal Chancellor has designated the BMU as the competent highest federal authority for nuclear safety and for radiation protection. In contrast to this, the Federal Chancellor has assigned responsibility for the use or promotion of nuclear energy, such as for electricity generation, to other ministries in order to ensure the effective independence of the BMU from any undue influence in its regulatory activities. The BMWi is responsible for energy policy matters regarding the use of nuclear energy, such as for electricity generation, and the Federal Ministry of Education and Research (BMBF) is responsible for the promotion of basic research in the field of nuclear energy. Since the BMU, BMWi and BMBF are functionally separate from one another and, in accordance with sentence 2 of Art. 65 Basic Law, each Federal Minister manages his or her ministry independently and in their own responsibility, the BMWi and the BMBF have no authority to issue instructions to the BMU. Likewise, the BMU is not entitled to ask these ministries for instructions. This ensures that safety-related decisions cannot be affected by any conflicts of interest. The BMU is solely committed to nuclear safety and to radiation protection. Functional separation is also ensured at Länder level. Through organisational arrangements, the Länder ensure that the licensing and supervisory authorities in charge of nuclear safety and radiation protection are functionally separated from all other governmental bodies and organisations that as part of the overall energy policy or energy industry promotion deal with matters that are related to the use or promotion of nuclear energy such as for electricity generation.

The effective independence of the federal and Länder licensing and supervisory authorities is further strengthened by the power of the BMU, within the scope of Art. 85 <u>Basic Law</u> (Bundesauftragsverwaltung), to issue binding instructions to the Länder authorities on the execution

of the law. Should in a specific case the BMU and a Land authority have different views as to the execution of provisions of the <u>Atomic Energy Act</u> or the ordinances issued thereunder (or the <u>Radiation Protection Act</u> that is to be applied alongside the <u>Atomic Energy Act</u>), the BMU has the power to make the ultimate decision on the subject matter (the subject matter can vary from a legal issue to considerations of expediency of execution) and may issue a binding instruction to the Land authority detailing on how to execute the law in that very specific case. As explained, the BMU is the competent highest federal authority for nuclear safety and radiation protection due to the organisational decree of the Federal Chancellor pursuant to Art. 64 <u>Basic Law</u>. As such it is functionally separated from all other governmental bodies or organisations – BMWi, BMBF – that, as part of the overall energy policy or energy industry promotion, deal with matters that are related to the or the use or promotion of nuclear energy. Therefore, the power of the BMU to issue binding instructions to the Länder authorities ensures that regulatory decisions are made independently and thereby ensures that the regulatory decision-making process itself is based on nuclear safety considerations only.

In cases where the Federation executes the <u>Atomic Energy Act</u> and the ordinances issued thereunder (or the <u>Radiation Protection Act</u> that is to be applied in the future alongside the <u>Atomic Energy Act</u>) through its own administrative authorities, such as the BfE or the BfS, the BMU as the competent highest federal authority for nuclear safety and radiation exercises oversight as to the legality and expediency of execution. Should in a specific case the BfE or the BfS and the BMU have different views to the execution of a law, the BMU has the power to make the ultimate decision on the subject matter (the subject matter can vary from a legal issue to considerations of expediency of execution) and may instruct the BfE or BfS on how to execute the law in that very specific case. The BfE and BfS are obliged to carry out instructions by the BMU as instructed. The BMU's authority to issue instructions again ensures independent safety-related decision-making.

In conclusion, the German regulatory system ensures that the competent federal and Länder licensing and supervisory authorities make thorough and sound decisions in an effectively independent manner which are based on nuclear safety considerations only. The consultation of authorised experts pursuant to § 20 <u>Atomic Energy Act</u>, the debate of technical and legal issues in joint Federal-Länder committees (such as the LAA) and the joint preparation of regulations contribute to the regulatory bodies' safety-related decision making, thus strengthening its effective independence.

Responsibility for safety

According to § 7c (1) <u>Atomic Energy Act</u>, the responsibility for nuclear safety lies with the license holder of the nuclear installation. The responsibility of the licence holder cannot be delegated to any other person. The responsibility of the license holder also extends to activities of contractors and subcontractors which could impair the nuclear safety of the license holder's installation. Furthermore, the licence holder of a nuclear installation is also the person responsible for radiation protection according to § 69 <u>Radiation Protection Act</u>.

As part of its supervisory responsibilities pursuant to § 19 <u>Atomic Energy Act</u>, the competent nuclear supervisory authorities are authorised to verify compliance by the licence holders with the licensing requirements, the provisions of the <u>Atomic Energy Act</u> and the provisions of ordinances issued thereunder (or the <u>Radiation Protection Act</u> that is to be applied in the future alongside the <u>Atomic Energy Act</u>).

Building up and maintaining competence

The licensing and supervisory authorities in charge of nuclear safety and radiation protection are provided with the competence and the resources necessary to fulfil their statutory obligation for the regulatory control. The licensing and supervisory authorities have a sufficient number of qualified and competent staff, who perform their regulatory functions in an efficient manner. The licensing and supervisory authorities are given the necessary financial resources to fulfil their statutory obligation for the regulatory control.

An employment prerequisite for specialist staff at the licensing and supervisory authorities in charge of nuclear safety and radiation protection is a completed university-level degree in a field that is relevant to the licensing and supervisory authorities' functions. New staff is trained in skills for special tasks (nuclear specialist knowledge, administrative knowledge etc.) – if required – in an introductory phase through courses and through practical collaboration within the authorities. New staff takes part in the intra-organisational knowledge transfer within the nuclear licensing and supervisory authorities.

The specialist training of employees – also long-standing employees – is done mainly through participation in seminars run by the expert organisation GRS and through participation in national and international specialist events. For the appointment of authorised experts by the nuclear licensing and supervisory authorities pursuant to § 20 <u>Atomic Energy Act</u>, guidelines specify aspects of training, professional knowledge and skills that need to be met.

The financial resources at federal and Länder level are allocated by the annual budget plans. The budget plans allocate the financial resources which the licensing and supervisory authorities in charge of nuclear safety and radiation protection need for the fulfilment of their tasks. They budget the annual expenditure, for example for the appointment of authorised experts pursuant to § 20 <u>Atomic Energy Act</u>.

Licences for the operation of nuclear installations may only be granted if it is assured that the persons responsible for the erection and management of the installation and for the supervision of its operation have the requisite qualification. In addition, it must be assured that all other persons who are otherwise engaged in the operation of the installation have the necessary knowledge concerning the safe operation of the installation, the possible hazards, and the protection measures to be taken. The requirements for the proof of the requisite qualification or the necessary knowledge are specified in numerous guidelines (e.g. Guideline concerning the proof of the technical qualification of nuclear power plant personnel, Guideline for the maintenance of technical qualification required in radiation protection).

There are state educational institutions where qualified professional training is offered. In addition to professional training by public institutions, the nuclear power plant operators founded the so-called "Power Plant School" in 1957 to accommodate the needs of power plant staff. There are also relevant training opportunities in Germany at various universities and technical colleges, for example in the area of nuclear and reactor technology at the University of Stuttgart. Officially recognised radiation protection courses are run for example at both university and non-university institutes, associated in the Association of radiation protection training facilities (Qualitätsverbund Strahlenschutzkursstätten (QSK)).

In order to maintain the necessary expertise in the areas of nuclear technology and radiation protection, the Alliance for Competence in Nuclear Technology (Kompetenzverbund Kerntechnik (KVKT)) of German research institutes was founded in March 2000 in association with the Energy Research unit of the Helmholtz Association of German Research Centres (HGF), which brings together the research facilities in the area of nuclear safety. The Alliance for Competence in Nuclear Technology is tasked with the national coordination of tasks in the area of reactor safety and disposal research and contributes to maintaining the competence through analysing the training situation and future staffing needs.

8.2 Module 2 – Global Safety Regime

Introduction

By means of intensive international, multilateral and bilateral cooperation, Germany contributes actively to the continual national and international improvement of regulatory supervision and licensing systems, international regulations, the safety of nuclear installations and the improvement of the exchange of information about storage and disposal as well as about operational nuclear installations and those under decommissioning.

Germany actively participates in the further development of the Global Nuclear Safety and Security Network (GNSSN)-Web-Platform and supports as a member or observer all existing regional networks such as the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies (FORO), the Forum of Nuclear Regulatory Bodies in Africa (FNRBA) and the Asian Nuclear Safety Network (ANSN).

International obligations and arrangements for international cooperation

Germany is represented in international organisations, the International Atomic Energy Agency (IAEA) and the Organisation for Economic Co-operation and Development/Nuclear Energy Agency (OECD/NEA), which promote nuclear safety, and has a permanent seat on the committee for the development of the IAEA regulations.

To strengthen international collaboration and to set international standards, the international community has created various multilateral agreements in the field of nuclear safety and safeguarding for the protection of the international transportation of nuclear material, for questions of liability, for early reporting and mutual support in nuclear accidents and requirements for nuclear safety as well as requirements for safety in the treatment of spent fuel assemblies and radioactive waste.

With Germany's accession to and ratification of international conventions, these have to be implemented in national law. Particularly emphasised here are the <u>Convention on Nuclear Safety</u> (<u>CNS</u>), the <u>Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (JC)</u>, and the <u>Convention on Early Notification of a Nuclear Accident</u>.

At European level, Germany has established multilateral cooperation as a member of ENSREG (European Nuclear Safety Regulators Group), WENRA (Western European Nuclear Regulators Association) and HERCA (Heads of the European Radiological Protection Competent Authorities). Additionally, under <u>EU Directive 2009/71/EURATOM</u>, amended by <u>Directive 2014/87/EURATOM</u>, Germany is obliged to implement themed Topical Peer Reviews every six years and an IRRS-mission to review the national nuclear supervisory authorities every ten years.

Germany has concluded bilateral agreements with eight of its nine neighbouring countries for the exchange of information about nuclear installations close to borders. With Belgium, France, the Netherlands, Austria, Switzerland and the Czech Republic, common commissions and/or expert groups have been established in which the neighbouring Länder can participate alongside the BMU. Thanks to these types of agreement, at regional level at the sites of nuclear installations lying close to the German border, a direct information and data exchange takes place between the civil protection authorities responsible for these installations or the organisations for the assessment of the radiological situation.

Exchange of operating experience and of experiences in the field of licensing and supervision

The procedures implemented by the nuclear licensing and supervisory authorities in order to gather, process, evaluate and share safety-relevant operating experience from German nuclear installations have proven to be effective. In addition, Germany has developed corresponding processes (see Handbook on Cooperation between the Federation and the Länder in Nuclear Law).

In Germany, reportable events (<u>Nuclear Safety Officer and Reporting Ordinance</u> (Atomrechtliche Sicherheitsbeauftragten- und Meldeverordnung (AtSMV)) are systematically recorded and evaluated by the licensees of nuclear facilities, who define actions to remedy such events and prevent the recurrence of similar events. Independently of the official reporting procedure under the <u>Nuclear Safety Officer and Reporting Ordinance</u>, the operators of nuclear installations classify reportable events according to the IAEA's seven-stage International Nuclear and Radiological Event Scale (INES). The licensing and supervisory authorities, together with the expert organisations, maintain appropriate databases for the systematic recording and assessment of reportable events.

German expertise and operating practice are discussed at international level within the framework of international working groups, bilateral working meetings and commissions. Events occurring in German nuclear installations are in particular presented to the relevant IAEA and OECD/NEA bodies (such as the Working Group on Operating Experience (WGOE)) and are reported to the International Reporting System for operating experience (IRS) or the Incident Reporting System for Research Reactors (IRSRR) or the Fuel Incident Notification and Analysis System (FINAS).

No nation can be considered in isolation in terms of nuclear safety. For this reason, Germany has become party to all international agreements on nuclear safety, the safety of waste management, relief efforts and information as well as liability, and is intensively engaged both in multilateral and bilateral cooperation.

The safety-related knowledge gained in this way is shared by German experts with all bodies and committees at international level and serves in particular for the further development of the international safety standards of the IAEA and WENRA. Germany contributes actively to the worldwide improvement of nuclear safety.

8.3 Module 3 – Responsibilities and Functions of the Regulatory Body

The system of the licensing and supervisory authorities in Germany ensures that these carry out their tasks comprehensively and effectively and can make decisions independently of any undue influence.

Actual independence of the competent regulatory body

The effective independence of the competent regulatory body – composed of the competent federal and Länder licensing and supervisory authorities in charge of nuclear safety and radiation protection – is ensured in various ways.

§ 20 (3) <u>Basic Law</u> binds the administration to statute and law. Consequently, the federal and Länder licensing and supervisory authorities in charge of nuclear safety and radiation protection are bound in their actions by the <u>Basic Law</u> and by ordinary law – the <u>Atomic Energy Act</u> and the ordinances issued thereunder. The <u>Atomic Energy Act</u> obliges the competent licensing and supervisory authorities to protect life, health and real assets from the hazards of nuclear energy and the harmful effects of ionising radiation (cf. § 1 No. 2 <u>Atomic Energy Act</u>). The constitutional principle enshrined in Art. 20 (3) <u>Basic Law</u>, according to which the executive shall bound by law and justice, ensures that the regulatory body is able to perform its functions free from undue influence and is therefore a key element for ensuring that the decision-making process of the regulatory authority is based on nuclear safety considerations only.

In addition, the federal and Länder licensing and supervisory authorities in charge of nuclear safety and radiation protection are functionally separated from all other governmental bodies and organisations that, as part of the overall energy policy or energy industry promotion, deal with matters related to the use or promotion of nuclear energy, such as for electricity generation (Trennungsgrundsatz – principle of separation). The principle of separation is another key element to ensure the effective independence of the regulatory body in all matters of nuclear safety.

At federal level, the functional separation is ensured by an organisational decree of the Federal Chancellor pursuant to Article 64 of the <u>Basic Law</u>. The Federal Chancellor, in exercising his organisational powers according to Art. 64 <u>Basic Law</u>, has designated the BMU as the competent highest federal authority for nuclear safety and radiation protection. In contrast, the Federal Chancellor has assigned the competencies for the energy policy matters regarding the use of nuclear

energy, including electricity generation, to the BMWi and the funding for basic research in the field of the scientific use of neutrons to the BMBF. This functional separation of individual ministries rules out any conflict of interests. The BMU is solely committed to nuclear safety and it can fulfil this duty without any undue external influence. Functional separation is also ensured at Länder level. Through organisational arrangements, the Länder authorities ensure that the licensing and supervisory authorities in charge of nuclear safety and radiation protection are functionally separated from all other governmental bodies and organizations that as part of the overall energy policy or energy industry promotion deal with matters that are related to the use or promotion of nuclear energy such as for electricity generation.

The effective independence of the federal and Länder licensing and supervisory authorities is further strengthened by the power of the BMU, within the scope of Art. 85 Basic Law (Bundesauftragsverwaltung), to issue binding instructions to the Länder authorities on the execution of the law. Should in a specific case the BMU and a Land authority have different views as to the execution of provisions of the Atomic Energy Act or the ordinances issued thereunder, the BMU has the power to make the ultimate decision on the subject matter (the subject matter can vary from a legal issue to considerations of expediency of execution) and may issue a binding instruction to the Land authority detailing on how to execute the law in that very specific case. As explained, the BMU is the competent highest federal authority for nuclear safety and radiation protection due to the organisational decree of the Federal Chancellor pursuant to Art. 64 Basic Law. As such it is functionally separated from all other governmental bodies or organisations - BMWi, BMBF - that, as part of the overall energy policy or energy industry promotion, deal with matters that are related to the or the use or promotion of nuclear energy. Therefore, the power of the BMU to issue binding instructions to the Länder authorities ensures that regulatory decisions are made independently and thereby ensures that the regulatory decision-making process itself is based on nuclear safety considerations only.

In cases where the Federation executes the <u>Atomic Energy Act</u> and the ordinances issued thereunder through its own administrative authorities, such as the BfE or the BfS, the BMU as the competent highest federal authority for nuclear safety and radiation exercises oversight as to the legality and expediency of execution. Should in a specific case the BfE or the BfS and the BMU have different views to the execution of a law, the BMU has the power to make the ultimate decision on the subject matter (the subject matter can vary from a legal issue to considerations of expediency of execution) and may instruct the BfE or BfS on how to execute the law in that very specific case. The BfE and BfS are obliged to carry out instructions by the BMU as instructed. The BMU's authority to issue instructions again ensures independent safety-related decision-making.

In conclusion, the German regulatory system ensures that the competent federal and Länder licensing and supervisory authorities make thorough and sound decisions in an effectively independent manner which are based on nuclear safety considerations only. The consultation of authorised experts pursuant to § 20 Atomic Energy Act, the debate of technical and legal issues in joint Federal-Länder committees (such as the LAA) and the joint preparation of regulations contribute to the regulatory bodies' safety-related decision making, thus strengthening its effective independence. To ensure uniform execution of the Atomic Energy Act by the Länder and with a view to the characteristics of the execution of the Atomic Energy Act - the Länder execute it on behalf of the Federation (Bundesauftragsverwaltung), which means the BMU as the competent highest federal authority exercising oversight as to the legality and expediency of execution by the competent Länder authorities and being able to assume the competence for the subject-matter anytime - the Länder Committee for Nuclear Energy (LAA) has been established consisting of representatives from the Länder and the federal authority. The LAA - including its four specialist committees - serves to coordinate the execution of the Atomic Energy Act between the competent authorities in charge of nuclear safety at federal and Länder level. Furthermore, it aims at upgrading substatutory regulations in place to ensure the best-possible, damage prevention throughout Germany. This also ensures that safety-related decisions made by the competent licensing and supervisory authorities of the Federation and the Länder is based on nuclear safety considerations only.

The provisions relevant to the implementation of the administration procedures stipulate regulations that rule out any undue influencing of the competent licensing and supervisory authorities of the Federation and the Länder so as to ensure that decisions are based on nuclear safety considerations only. If there is any concern in the context of safety-related decision-making by a federal authority that a person with decision-making powers is not free of a conflict of interests, this person is excluded by an act of law according to § 20 of the Federal Administrative Procedure Act (Verwaltungsverfahrensgesetz (VwVfG)) from taking part in the decision-making or can according to § 21 Federal Administrative Procedure Act be excluded from it. The Administrative Procedure Acts of the Länder also offer through the Federal Administrative Procedure Act already upheld exclusion grounds for people with decision-making powers so as to avoid and exclude any conflicts of interest in the context of regulatory decision-making. Likewise, based on these stipulations, authorised experts appointed according to § 20 Atomic Energy Act in the licensing and supervisory procedure can be excluded from the licensing and supervisory procedure.

Staffing and funding of the Regulatory Body

The licensing and supervisory authorities of the Federation and the Länder in charge of with nuclear safety and radiation protection employ an appropriate number of technically and legally trained

specialists, who have the required experience and knowledge in the field of nuclear safety. The selection of best candidates basically guaranteed in Art. 33 (2) <u>Basic Law</u> ensures that when specialist staff are appointed, the licensing and supervisory authorities in charge of nuclear safety and radiation protection select the applicants that have the best qualifications, experience and specialist skills for the fulfilment of their tasks. The qualification of the staff who undertake the tasks of the licensing and supervisory authorities of the Federation and the Länder in charge of nuclear safety and radiation protection is highly valued, balanced in terms of age structure and experience, and appropriate to the tasks. An employment condition for technical staff is a university degree in the relevant discipline. Newly recruited staff members take part in the knowledge transfer of the nuclear licensing and supervisory authorities. They receive training on the basis of individual plans. Each individual on-the-job training plan comprises different training and further qualification measures, the introduction to special fields of work and guidance for independent acting. Depending on the intended area of work and already available knowledge, junior staff are trained in all relevant technical and legal areas.

This ensures that newly employed personnel are trained to fulfil their nuclear safety related tasks independently. For staff of the BMU, the relevant standard is the Further training concept for employees at the BMU, dated 24th October 2016. This regulates both the further training and therefore the retention of skills of long-term employees. Employees of the licensing and supervisory authorities in charge of nuclear safety and radiation protection are legally obliged to have further training. This arises for federal civil servants from § 61 (2) Federal Civil Servants Act (Bundesbeamtengesetz (BBG)), which obliges civil servants of the federal government to take part in measures towards official qualifications to maintain or develop their knowledge and skills. The Civil Servants Acts of the Länder contain equivalent obligations for civil servants in the Länder. These also apply to employees in public service. This ensures that long-standing and experienced employees of the nuclear licensing and supervisory authorities keep their technical qualification continuously up to date.

Sufficient financial resources for the competent nuclear licensing and supervisory authorities is allocated at federal level according to Art. 110 <u>Basic Law</u> by the annual federal budget plan. Sufficient financial resources for the competent nuclear licensing and supervisory authorities at Länder level is allocated through the annual budget plans of the Länder. The budget plans allocate the financial resources which the licensing and supervisory authorities in charge of nuclear safety and radiation protection need for the fulfilment of their tasks. They budget the annual expenditure, for example for the appointment of authorised experts pursuant to § 20 <u>Atomic Energy Act</u>.

State supervision

The erection, operation, decommissioning and dismantling of nuclear installations and the handling and transportation of nuclear fuels and other radioactive substances are subject to state supervision. This means that the competent supervisory authority in charge of nuclear safety and radiation protection verifies whether the holder of a license under the <u>Atomic Energy Act</u> or its legal ordinances continues to fulfil the licensing conditions. The competent supervisory authorities hold comprehensive powers to carry out these checks. Thus, the competent supervisory authority according to § 19 <u>Atomic Energy Act</u> has the power to enter nuclear installations and sites where radioactive substances are found at any time and to undertake all necessary tests there. They can demand the required information from the persons responsible or employed there. Through the corresponding application of § 36 of the Product Safety Act, the persons responsible or employed there are obliged to tolerate the tests, to give information and documentation, and to provide the necessary workforce and aids for the realisation of the tests.

The competent nuclear supervisory authorities can, according to § 20 <u>Atomic Energy Act</u>, consult authorised experts to support these tasks. These – like personnel of the competent authorities – have powers according to § 19 para. 2 <u>Atomic Energy Act</u> to enter nuclear installations at any time and to undertake all necessary tests there for the fulfilment of their tasks and to demand the required information from the persons employed there.

The <u>Atomic Energy Act</u> provides the competent licensing and supervisory authorities with various different powers to enforce the purpose of the <u>Atomic Energy Act</u>, and the ordinances issued thereunder. According to § 17 (1) <u>Atomic Energy Act</u>, a licence may be linked to conditions – even subsequently – to fulfil the legal purposes of the <u>Atomic Energy Act</u>. Furthermore, a licence can be revoked under certain conditions. According to § 17 (5) <u>Atomic Energy Act</u>, a licence has to be revoked if this is required because of a significant endangerment of employees, third parties or the general public and if a remedy cannot be provided by means of subsequent conditions within an appropriate timescale. According to sentence 1 of § 19 (3) <u>Atomic Energy Act</u>, the competent Regulatory Body can arrange that the licensee remove a condition that contravenes the <u>Atomic Energy Act</u> including its legal ordinances, the provisions of the licence or a subsequent licence conditions. This also includes the power according to sentence 2 of § 19 (3) <u>Atomic Energy Act</u> to order the temporary or permanent cessation of the operation of a nuclear installation or the handling of radioactive substances.

Communication with licensees

The nuclear licensing and supervisory authorities have established formal and informal mechanisms of communication with the licensees on all safety-related issues.

The responsibilities for regulatory tasks and thus also for the relevant communication with the licensees are regulated in the <u>Atomic Energy Act</u>.

The Länder are responsible for communicating with the licensees on specific safety issues in within the scope of Art. 85 <u>Basic Law</u> (Bundesauftragsverwaltung). They are supported in this by the authorised experts consulted according to § 20 <u>Atomic Energy Act</u>. The relationship between the nuclear licensing and supervisory authorities of the Länder and the licensees is professional and constructive. At all interacting hierarchical levels, objective communication is maintained during supervisory visits and technical discussions. The most important objectives of communication for the nuclear licensing and supervisory authorities are to continuously improve the safety of the nuclear installation concerned and to learn from identified weaknesses and faults in the nuclear licensing and supervisory regulatory decisions are taken in an appropriate manner. This can only be achieved if the working relationship and discussions are characterised by a climate of trust, despite the necessary formal distance between the licensee and the nuclear licensing and supervisory authorities. A strict focus on the topic, openness and transparency in all important decisions as well as strict independence and neutrality are the key to such a trustful relationship.

The nuclear licensing and supervisory authorities regularly carry out inspections and reviews (together with or by the authorised experts consulted in accordance with § 20 <u>Atomic Energy Act</u>), covering all safety-relevant issues of the nuclear installations. Inspections on site (e.g. plant-walk-downs together with or by the consulted authorised experts) are an important supervisory instrument of the competent authorities to gain information independently from the licensee about the situation and the processes in a nuclear installation. A further important part of communication between the licensee of a nuclear installation and the supervisory authority takes the form of regular reporting (e.g. monthly reports from the nuclear power plant operator on operational events). According to § 19a <u>Atomic Energy Act</u>, the licensee has to carry out a safety review and assessment of the installation. Furthermore, according to the <u>Nuclear Safety Officers and Reporting Ordinance</u>, licensees are obliged to report to the supervisory authorities any accidents, incidents or other events significant to technical safety.
Information of the general public

The general public is informed in different ways by the nuclear licensing and supervisory authorities. These include public relations work (press statements, conferences, on-site meetings open to the media), publications in the Federal Gazette or online, and responding to enquiries from the public. Legal obligations for informing the general public arise for example from § 24a (1) Atomic Energy Act. Accordingly, the competent authorities inform the general public in the field of nuclear safety at least about the proper operation of nuclear facilities as well as about any reportable events and during accidents. Further legal obligations for informing the general public arise from the federal and Länder environmental information laws. If requested, all bodies of public administration are obliged to publish environmental information. The provisions of the environmental information laws specify the information to be given to the population about protection measures and recommendations for behaviour during possible nuclear accidents and other radiological emergencies under the Radiation Protection Act that came into effect on 1st October 2017 – cf. § 105 Radiation Protection Act. Accordingly, the competent federal bodies publish the federal emergency response plans according to standards in the environmental information laws. Furthermore, the competent federal and Länder bodies inform the population in a suitable way in accordance with standards applicable to the general provisions about the principle terminology for radioactivity and the effects of radioactivity on people and the environment, about the emergencies considered in the emergency response plans and their consequences for the population and the environment and about planned measures for warning and for the protection of the population during possible emergencies. In addition, they give the population recommendations for their behaviour during possible emergencies. According to § 105 Para. 4 Radiation Protection Act, this information and the recommendations for behaviour have to be updated at regular intervals and, on the occasion of any changes, have to be published unprompted in updated form. They must be available to the public at all times.

The legislator has established especially high standards of information regarding the site selection for a disposal facility for high-level waste. For example, the BfE, being the authority responsible for monitoring the implementation of the site selection procedure according to the regulations of the <u>Site</u> <u>Selection Act</u>, informs the public comprehensively and systematically about the site selection procedure and hosts an online information platform where significant documents relating to the site selection procedure are published.

8.4 Module 4 – Management System for the Regulatory Body

Introduction

The supreme authorities of the Länder (ministries) carry out the task of supervising nuclear power plants and other nuclear facilities and installations on behalf of the Federation (federal executive administration). With regard to this task, the BMU as the competent authority for nuclear safety and radiation protection exercises supervision of legality and expediency of the actions of the Länder. Furthermore, the BMU has the legal and technical supervision of its subordinate authorities, the BfS and the BfE.

Principles of operative action

All authorities have comprehensive internal regulation systems, which include comprehensive stipulations regarding structural and procedural organisation, planning and conducting of activities, quality assurance, documentation and availability of information, staff qualifications including training and further education, the role of management personnel in general, and internal control and monitoring measures. The management system of each authority represents the sum of relevant regulations for the individual authority.

All authorities have the objective of ensuring that the particular management system guarantees the undertaking of tasks to fulfil requirements with particular consideration of safety aspects. All systems are checked for effectiveness through processes within the authority and adaptations are made where needs for improvement are identified.

Regardless of the overriding commonalities, there are differences between the implemented management systems. Such differences can arise because of the different tasks or competencies or because of the general structure of the regulation system within the authority. Some authorities have presented their stipulations primarily in instructions for the staff or work instructions, other authorities have introduced management system manuals, quality management manuals, or supervisory manuals. Internal monitoring structures are sometimes divided into different bodies, despite this the management at all levels plays an important part in all authorities.

Similarities and also some of the differences between the particular management systems in the authorities are presented hereafter. Two showcases for management systems are illustrated:

- the licensing and supervisory authority of the Land of Baden-Württemberg and
- the management system currently under preparation for the newly founded BfE.

Structural and procedural organisation

At the BMU, its subordinate authorities and at the Länder authorities, the organisational structure is shaped in accordance with organisational principles in the form of directorate-generals, and, if applicable directorates and divisions and/or special sections. The heads of each organisational unit – Director-General, Heads of Directorate, Heads of Division or Heads of Section - represent the management personnel within this organisational structure.

The organizational structure of the authorities as a part of the management system is based on the main features of governmental administration. This includes commitment to statute and law, the provision of resources to fulfil requirements, the stipulation and monitoring of objectives, the clear allocation of responsibilities and competencies, clear regulations for work organisation, uninterrupted traceability and testability of actions through documentation and archiving, competent staff administration, training and further qualification, transparent and target-oriented internal and external communication, cooperative leadership style, and much more. Furthermore, the organisational units responsible for nuclear regulation/supervision have created as required supplementary regulations for their processes.

Priority of safety is one of the basic principles for the work of the nuclear licensing and supervisory authorities. This principle is implemented in the mandate of the authorities and is concretised in supervisory and licensing practice. A process for the development and strengthening of a common understanding of the safety culture within the supervisory and licensing authorities has been started.

Management systems of the authorities

The structure of the authorities' management systems can be described in all authorities as a hierarchical system of internal regulations. Superordinate regulations apply usually to the entire organisation and are supported, depending on the task, by subdivided and usually ever more detailed stipulations. The responsibility for the maintenance and release of documents in which the regulations are stipulated is regulated as well as the accessibility of the regulations. Stipulations are made to ensure that the management system documents are up to date. Included are documents that form the mission statement of the authority. The mission statement presents the orientation

framework for the authorities' tasks and interacts with further stipulations on the central activity framework that presents the basis for the activities of employees and also forms the basis for a high safety culture within the authority. At certain intervals, checks are made that the superordinate regulations are up to date in a process characterised by reflection phases and these are revised with consideration of new insights as required at certain intervals.

To offer specific help to the staff in carrying out their tasks, there are work instructions and/or process descriptions in the lower levels of the document structure. The knowledge of the employees responsible is taken into account in the compilation of work instructions or process descriptions. Based on the specific tasks of the nuclear supervisory authorities of the Länder and the resulting process structures, the authorities of the Länder have put together specific regulations for the Land that contain organisational stipulations for conducting of supervisory activities and preparations for nuclear emergency preparedness and response. These regulations are documented for example in an organisation manual (OHB), an oversight manual (AHB), an emergency manual (SHB) or an alarm manual. For the Federation/Länder interface in the context of supervisory activity, a Handbook on Cooperation between the Federation and the Länder in Nuclear Law has been developed.

All management systems of the authorities follow the approach of continual improvement. Relevant processes, deadlines or objectives are planned with the participation of employees (Plan); tasks are executed on this basis (Do). Regular checks determine whether actions correspond to planning and their results are assessed (Check). Where a need for improvement or a deviation is recognised, measures are introduced for improvement (Act). Generally, this PDCA process is adopted in all authorities and leads to a continual improvement of the management system, where new insights are systematically taken into consideration.

With regard to the BfE, the pending establishment phase of the office has to be emphasised. Right at the start of the uptake of managing its tasks, documents existed concerning the management system, such as

- the rules of procedures with significant regulations for internal measures,
- the organisation chart,
- and a schedule of responsibilities including competencies and responsibilities for the individual employee.

It was also decided very early to develop an integrated management system including e.g. quality management and environmental management. The responsibility for the maintenance of the central management system was allocated to a staff section directly reportable to the Vice President of the

BfE. To give employees guiding principles for their activities during the establishment phase of the office, the "Principles for a common organisational culture" were compiled, with their content discussed with the employees. At a later date, when the establishment of the office will be more advanced, the operational principles are to be replaced by a policy/mission statement, which is compiled in dialogue with all employees. The tasks of the BfE have been described in so called "Product profiles", which indicate objectives and quality criteria. Results from task planning are incorporated in the coordination process with the BMU. Currently, all further documents of the BfE management system are compiled and a continual process for improving the management system is being built up.

Managers/resource management

The managers at all levels have a role model function with regard to safety (leadership for safety) and their obligations towards safety (commitment to safety). They are aware of their role model function and their responsibility for the effectiveness and performance of the management system. The actions of the managers demonstrate to all employees that safety is granted the highest priority in the actions of the authority. In addition, employees are taken on, instructed and supported in such a way that they can contribute to the effectiveness of the management system. In meetings and through daily actions and decisions, they communicate the significance of the safety culture of the authority and promote appropriate action by their employees. Here, the work of the management personnel and the arising dealings with employees focus in particular on the formation of a value structure (communication, criticism, self-criticism, quality, effectiveness, transparency, collaborative work environment, team-oriented). The corresponding actions for the management and staff of the authorities therefore contribute to the improvement of the safety of nuclear installations and the safety culture of the licensee's personnel.

The responsibility of the management at all levels is implemented by an established structure of communication with their staff, promoting regular meetings to share information and discuss any matter of concern. Furthermore, occasion-related meetings will be held e.g. in the form of consultations, target-setting meetings, cooperation meetings and appraisal interviews, IT-supported information provision and training plans. During the appraisal interviews, managers communicate their expectations regarding the action of the employees and determine individual tasks/goals for the coming year. In addition to reviewing the achievement of objectives and discussing personal development needs, any existing obstacles to safety-oriented supervisory practice are deliberated and adequate corrective actions as well as general suggestions for improvement concerning the organisation are discussed. It is also intended that mutual feedback on employee performance as well as manager's behaviour is given. Through several measures such as the open-door policy, the

development of safety policies, guidelines for cooperation/employee meetings and management training, the individual authorities are going to strengthen the communication culture between management and staff on the one hand. On the other hand, the safety culture itself will be promoted at a stronger level.

To establish and maintain consistently safety-related actions, a management culture promoting this practice is applied taking into account that everyone has a role in safety. This includes that the heads of divisions closely accompany the supervisory activities of their staff. As the managers themselves take part in supervisory activities, they know about the actions of their staff, the topics, and any possibly arising practical problems and issues. The impressions immediately arising in this way on site and the possibility for immediate intervention by management personnel in the safety improvements by the licensee demonstrate directly safety-oriented actions and the role model function of the managers. In addition, regular or occasion-related meetings create an exchange between managers and staff, which enables the management personnel to make targeted use of the employees and to prioritize and shape safety-related activities. To maintain this mutual exchange of information, the organisational units generally implement regular meetings at which an exchange about abnormalities and findings in supervisory or licensing activities takes place. In the context of the co-signing of documents or the acknowledgement of (supervisory) records, the management personnel receive not only knowledge of that particular process but are also able to obtain a holistic impression of the supervisory actions of the organisational unit and the safety performance of the nuclear facility or installation.

Documents of the management system

The management system and all associated records are documented. The "handling and management of records" ("control of records") is stipulated for the authorities in the regulations for the governmental administration of document preparation, record-keeping, registration, and archiving. The documents of the management systems are usually in electronic format in the individual authorities and are distributed to all employees e.g. via the intranet. The preparation, editing, checking, implementing and provision of the management system documents is organised in an authority-specific way. At the BMU for example, documentation and/or the filing of documents is generally effected in accordance with the provisions of records management, which is regulated in the <u>rules of procedure of the BMU</u> (Geschäftsordnung BMU (GO-BMU)). The currently valid edition is available to all involved; this ensures that the documents are easy to find, and outdated documents are not used unintentionally.

Knowledge of the organisation

In order to fulfil the defined requirements for knowledge maintenance at the BMU, the subordinate authorities, the Länder authorities, technical support organisations and other technical-scientific institutions for nuclear safety, all authorities and institutions follow regulations regarding the competence of employees and the documentation of knowledge.

Furthermore, a web-based "Portal for Nuclear Safety" has been introduced for the authorities and other user groups as an instrument of knowledge management. The portal is operated and administered by Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH on behalf of the BMU. It features knowledge pages on selected topics as well as collaboration pages, for example with the documents pertaining to meeting of Federation/Länder bodies as well as areas in which documents and events from research and development projects financed by the BMU and other federal government departments are documented (so called project pages). For the knowledge aspects, collections of documents and important specialist information for nuclear authorities and technical support organisations are identified, prepared and electronically structured to make them accessible.

Long-term documentation for the field of nuclear disposal safety (storage and disposal) is undertaken by the BfE. All respective data significant to this area shall remain accessible for future generations. The precise structuring of this task is currently being planned.

8.5 Module 5 – Authorization

Introduction

A significant legal objective of the <u>Atomic Energy Act</u> is to protect life, health and real assets against the hazards of nuclear energy and the harmful effects of ionising radiation (number 2 of § 1 <u>Atomic Energy Act</u>, cf. Modules 1 and 3).

To achieve the comprehensive protection required by law, the use of nuclear energy and the use of radioactive substances are subject to comprehensive preventive controls by the Regulatory Body in the form of various licensing and plan approval obligations. The particular licenses and/or plan approvals and the competent Regulatory Body for these are stipulated according to the type of installation and activity in different provisions at the levels of laws and ordinances.

Observance of the stipulations of the respective licences or plan approvals is then overseen by the Regulatory Body in the context of nuclear oversight (compliance control) (see Modules 6, 7 and 8).

General

The Regulatory Body issues a license or plan approval only when it has been ensured that the applicant and the acting persons responsible are trustworthy and possess the required qualifications. As well, precaution against harm and damage caused by the action or installation applied for and protection against malicious acts must be in place and the fulfilment of legal compensation obligations must be ensured.

The fulfilment of the licensing requirements must be demonstrated by the applicant. These are verified comprehensively by the Regulatory Body within the particular licensing or plan approval procedure (see Module 6).

The Regulatory Body appoints authorised experts for support. Irrespective of this, the responsibility and decision-making remain with the Regulatory Body.

The participation of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in the licensing procedure according to § 7 <u>Atomic Energy Act</u> is regulated particularly in the <u>Handbook on Cooperation between the Federation and the Länder in Nuclear Law</u>.

Licensing and plan approval requirements

In the following, the legal foundations, the licensing and plan approval requirements and the current competent authorities for the most important licensing and/or plan approval requirements are listed:

- § 6 <u>Atomic Energy Act</u> "Licence for the storage of nuclear fuel" A license according to § 6 <u>Atomic Energy Act</u> is to be issued if the licensing requirements stipulated in § 6 (2) <u>Atomic Energy Act</u> are fulfilled. According to § 23d <u>Atomic Energy Act</u>, the licensing authority is the BfE.
- § 7 Atomic Energy Act "Licensing of installations"

According to § 7 <u>Atomic Energy Act</u>, the erection, operation or holding of a stationary installation for the production, treatment, processing or fission of nuclear fuel, an essential modification of the installation or its operation and also the decommissioning and dismantling require a licence. A licence may only be granted if the licensing requirements specified in § 7 (2) <u>Atomic Energy</u> <u>Act</u> are met. New licences for the erection and the operation of installations for the fission of nuclear fuel for the commercial generation of electricity and for facilities for the reprocessing of irradiated nuclear fuel will not be issued any more in Germany.

According to § 24 (2) <u>Atomic Energy Act</u>, licensing authorities are the supreme Länder authorities stipulated by the Länder governments. (Ministries).

• § 9 <u>Atomic Energy Act</u> "Treatment, processing and other utilisation of nuclear fuel outside installations requiring a licence"

According to § 9 <u>Atomic Energy Act</u>, the treatment, processing or other use of nuclear fuel outside the installation specified in § 7 <u>Atomic Energy Act</u>, e.g. the use of nuclear fuel in a laboratory for research purposes, requires a licence. A license may only be granted if the licensing requirements specified in § 9 (2) <u>Atomic Energy Act</u> are met.

According to § 24 (2) <u>Atomic Energy Act</u>, licensing authorities are the supreme Länder authorities stipulated by the Länder governments. (Ministries).

• § 9b Atomic Energy Act "Approval procedure"

According to § 9b <u>Atomic Energy Act</u>, the erection, operation and decommissioning of facilities for the safekeeping and disposal of radioactive waste as well as the significant modification of such facilities or their operation require plan approval or licensing. Plan approval and/or a licence for a disposal facility may be issued only if alongside the nuclear licensing requirements, all other licensing requirements in other affected legal areas are fulfilled.

The BfE is responsible according to § 23d <u>Atomic Energy Act</u> for the issuing of plan approvals or licences according to § 9b <u>Atomic Energy Act</u> and their revocation. According to § 58 <u>Atomic Energy Act</u>, other competencies apply on an interim basis. Therefore, the responsibility for the

Konrad disposal facility remains with the supreme Land authorities put in charge by the Land government of the respective Land until the approval of commissioning by the nuclear supervisory authority and, in the case of the Morsleben Disposal Facility for Radioactive Waste (ERAM), until the enforceability of the decommissioning plan approval. The licensing responsibility for the Asse II mine remains the responsibility of the supreme Land authority in accordance with § 57b (9) <u>Atomic Energy Act</u>.

To specify a site for a disposal facility for high-level waste, a participative, science-based, transparent, self-questioning and learning site selection procedure is first to be carried out. Through a three-phase procedure, including comprehensive participation of the general public, the site is to be found that ensures the best possible safety for a period of one million years. Once the site has been identified, a licensing procedure will follow.

According to § 4 <u>Site Selection Act</u>, the competent licensing and supervisory authority and facilitator for public participation is the Federal Office for the Safety of Nuclear Waste Management (BfE).

 § 7 <u>Radiation Protection Ordinance</u> "Handling of radioactive substances requiring a licence" According to § 7 <u>Radiation Protection Ordinance</u>, the handling of radioactive substances requires a license unless this activity is already included in one of the licences according to §§ 6, 7, 9 or 9b <u>Atomic Energy Act</u>, In particular, this category includes Land collection facilities, storage facilities for radioactive waste with negligible heat generation, storage facilities for radioactive waste at research centres, and conditioning plants.

A licence may only be granted if the licensing requirements specified in § 9 (1) <u>Radiation</u> <u>Protection Ordinance</u> are met.

In the future, this authorisation requirement will be continued in number 3 § 12 (1) <u>Radiation</u> <u>Protection Act</u> with the licensing requirements listed in § 13 <u>Radiation Protection Act</u>.

The authorities stipulated under Länder law are competent for the issuing of licenses under § 7 Radiation Protection Ordinance.

Substatutory requirements for the fulfilment of licensing requirements

The substatutory guidance instruments put the licensing requirements in detail in concrete terms (see Module 9). Examples here are the <u>Safety Requirements for Nuclear Power Plants</u>, the <u>Guidelines for decommissioning</u>, <u>safe containment and for the dismantling of installations or parts of installations under § 7 Atomic Energy Act</u>, the guidelines of the Nuclear Waste Management Commission, the Reactor Safety Commission and the German Commission on Radiological Protection, the statements of the consultancy bodies of the BMU, the KTA Safety Standards and the DIN standards. These also ensure fulfilment at the current state of the art in science and technology.

In cases for which no substatutory regulations exist, reference is made to regulations from other areas – if transferable – and these are applied and/or issues are regulated case-by-case in individual licences.

Process of the licensing procedure

The licensing and/or plan approval procedures have to be carried out for installations according to §§ 6, 7, 9b Atomic Energy Act in accordance with the Nuclear Licensing Procedure Ordinance. This stipulates the application process with the submission of documents, public participation, the opportunity to divide the process into several licensing steps (partial licences) and the observation of other licensing requirements (e.g. for non-radioactive emissions and for discharges into water bodies). Furthermore, according to the Environmental Impact Assessment Act (Gesetz über die Umweltverträglichkeitsprüfung (UVPG)), in certain cases an environmental impact assessment has to be carried out. In some cases, the Nuclear Licensing Procedure Ordinance is not applicable. Then, a nonformal licensing procedure is carried out in accordance with the general provisions of the Administrative Procedure Act of the Federation and the Länder.

The requirement for an environmental impact assessment as part of a nuclear licensing procedure can arise from § 6 of the law <u>Environmental Impact Assessment Act</u>, if the project is listed among projects requiring an EIA in Appendix 1, No. 11 to the <u>Environmental Impact Assessment Act</u>. An EIA obligation can also arise for listed projects or modification projects because of a general preliminary test under §§ 7 or 9 <u>Environmental Impact Assessment Act</u> if its findings establish that the project could have considerable detrimental environmental effects. The environmental impact assessment is an inclusive part of a licensing procedure. It includes the implementation of a public participation procedure and supports the preparation of the decision about the admissibility of the project as regards effective protection of the environment.

In the course of public participation, the documents listed in § 6 <u>Nuclear Licensing Procedure</u> <u>Ordinance</u> have to be made available within a deadline of two months. Citizens can express objections in writing and on the record. These are discussed in debates with the Regulatory Body and optionally with the applicant. The objections have to be acknowledged in the context of issuing the license.

Citizens can lodge an appeal to the decisions of the licensing authority, depending on the form in which the licensing procedure has been implemented, or lodge a complaint directly with the administrative court.

Restrictions, obligations, revocation

According to § 17 <u>Atomic Energy Act</u>, all licences and general approvals according to the <u>Atomic Energy Act</u> to ensure the protection purposes listed in § 1 <u>Atomic Energy Act</u> can be restricted and subject to obligations. Obligations may be imposed subsequently too. In addition, licences may also be withdrawn or revoked if the conditions listed in § 17 (2) or (3) are met. Licences have to be revoked if § 17 (4) or (5) applies, i.e. if no proper financial security is provided or if there is a significant risk to workers, third parties or the general public and if remedial action cannot be taken within a reasonable time. The corresponding application of § 17 <u>Atomic Energy Act</u> is also provided for in the future <u>Radiation Protection Act</u>.

Licence-free facilities and activities

Non-essential modifications of nuclear installations or their operation do not require a licence but are reported to the nuclear supervisory authority in the context of nuclear supervision. If necessary, they require regulatory approval and are subject to accompanying controls by the nuclear supervisory authorities and/or by the TSO appointed according to § 20 <u>Atomic Energy Act</u>. These obligations of the licensee are based on the stipulations in the respective licence. A graded approach has been considered here.

The licence-free handling and possession of very small quantities of nuclear fuel is regulated in § 8 <u>Radiation Protection Ordinance</u>. In the future, this provision will be continued on the basis of the <u>Radiation Protection Act</u>.

8.6 Module 6 – Review and Assessment

Introduction

The responsibility for nuclear safety rests with the licensee. The licensee therefore takes primary responsibility for the required reviews and assessments of the nuclear installation.

Both before and after the issuing of a licence under nuclear or radiation protection legislation, the Regulatory Body performs comprehensive reviews and assessments of all relevant information within the framework of its supervision according to § 19 <u>Atomic Energy Act</u>.

General (generic issues)

The reviews and assessments carried out by the Regulatory Body comprise all installations and activities from which nuclear risks can arise.

The purpose of these reviews and assessments is to protect life, health and real assets against the hazards of nuclear energy and the harmful effects of ionising radiation (§ 1 No. 2 <u>Atomic Energy</u> <u>Act</u>).

Before issuing a licence, the Regulatory Body carries out extensive reviews and assessments within the particular licensing procedure. The documents to be reviewed and assessed are specified in the nuclear regulations (see Module 5).

Even after the licence has been issued, the licensed installation or activity still remains subject to comprehensive supervision by the Regulatory Body according to § 19 <u>Atomic Energy Act</u> until its release from nuclear or radiation protection legislation. The reviews and assessments carried out by the Regulatory Body are focused in particular on:

- adherence to the provisions, obligations and other incidental provisions of the licensing notices,
- adherence to the provisions of the <u>Atomic Energy Act</u>, the <u>Radiation Protection Act</u>, associated ordinances and other technical safety codes and guides and
- adherence to supervisory orders.

Reviews and assessments are carried out by the Regulatory Body in a systematic and methodic manner. The scope and frequency arise from the nuclear regulations, from the stipulations of the licenses and from findings of the continuous supervision carried out by the Regulatory Body.

Depending on the subject and the objective, reviews and assessments are generally carried out using deterministic methods but also using probabilistic methods (e.g. safety reviews according to § 19a <u>Atomic Energy Act</u>).

The assessment standards arise from the nuclear regulations. They additionally follow the safety significance of the objects to be reviewed and assessed (proportionality principle).

The findings of the reviews and assessments, the participants (including participating authorities and consulted authorised experts) and the resulting regulatory decisions are documented, and the associated documents and reports are archived according to the standards of official procedures.

The applicant and/or licensee is informed about the findings of supervisory reviews and assessments. The findings are not systematically made available to the public. However, the public is regularly informed, e.g. about reportable events, issues of particular significance important authority decisions.

The Regulatory Body ensures comprehensive reviews and assessments with a corresponding structure and workflow organisation and retains the required qualified staff for this and disposes of the necessary technical resources.

Authorised experts in accordance with § 20 <u>Atomic Energy Act</u> are usually consulted as part of the reviews and assessments to provide expert support. These authorised experts are consulted by way of contracts specifying the modalities and requirements, for example with regard to the qualifications required from them.

On behalf of the Regulatory Body, the authorised experts carry out i.a. independent calculations, review design drawings, inspection plans and other documents, and prepare expert opinions and expert statements. The final assessment and decision, however, rests with the Regulatory Body.

The intensive involvement of authorised experts in the licensing and supervisory procedure has a quality assurance effect and therefore increases safety. Particularly for more complex reviews and assessments, the decision on the issue is based not only on appraisals by personnel of the authority but also on a prior independent safety assessment by external authorised experts.

Nuclear power plants

Additional explanations relating to the reviews and assessments carried out in nuclear power plants are given hereafter. The corresponding information essentially also applies to other nuclear installations.

Collaboration between the federal and Länder authorities in the case of power reactors with operating licences and in the framework of nuclear procedures is described in the <u>Handbook on</u> <u>Cooperation between the Federation and the Länder in Nuclear Law</u>.

Information sources

The information subject to regulatory review and assessment after a licence has been granted comes primarily from the following sources:

- From the findings gained in the context of supervision according to § 19 <u>Atomic Energy Act</u> (regulatory inspections, records and reports by the licensee).
- From applications by the licensee for non-essential modifications of the facility or its operation.
- From the safety reviews that have to be carried out every ten years by the licensee according to § 19a Atomic Energy Act.
- From events occurred in German installations that have been reported to the Incident Registration Centre.
- From information notices prepared by GRS on behalf of the Federation. The information notices also contain information on safety-related matters that have occurred worldwide.

Non-essential modifications (Modification procedures)

Essential modifications to an installation or its operation require licensing in accordance with § 7 <u>Atomic Energy Act</u>. They are subject to comprehensive reviews and assessments by the Regulatory Body (see <u>Module 5</u>) in the context of the licensing procedure (see <u>Module 5</u>).

However, also non-essential modifications to an installation or its operation that do not require licensing are reviewed and assessed by the Regulatory Body in the context of supervision according

to § 19 <u>Atomic Energy Act</u>. The scope of the review and assessment follows their safety significance. The supervisory authorities are supported in this by authorised experts consulted according to § 20 <u>Atomic Energy Act</u>.

A differentiation is made between the following categories:

- Category 1: Non-essential modifications with increased safety significance. Approval procedure: The supervisory authorities must give their approval before the implementation of the planned modification.
- Category 2: Non-essential modifications with medium safety significance: Clearance procedure: Before the implementation of the planned modification, there must be an assessment and positive statement from the authorised experts consulted by the supervisory authorities according to § 20 <u>Atomic Energy Act</u>.
- Category 3: Non-essential modifications with low safety significance (not in all Länder): Notification procedure: The supervisory authority of the Land must be notified of the modification and the classification confirmed by the appointed authorised expert.
- Category 4: Non-essential modifications without safety significance (other modifications). The licensee carries out the modifications under his own responsibility.

Besides technical modifications and modifications of operational documents, organisational modifications are also subject to the modifications procedure. Depending on the modification measure, other authorities such as building authorities, trade control or environmental protection agencies are also involved. The nuclear regulations are taken into account in all modifications of the installation or its operation.

Review, assessment and continuous improvement of nuclear installations according to § 19a <u>Atomic</u> Energy Act

According to § 19a <u>Atomic Energy Act</u>, anyone who operates a nuclear power plant or any other nuclear installation pursuant to number 1 of § 2 (3a) <u>Atomic Energy Act</u> (e.g. a storage facility for spent nuclear fuel) must carry out a review and assessment of the nuclear safety of the respective installation every ten years and on this basis continuously improve the nuclear safety of the

installation. This so-called periodic safety review supplements the continuous review in the framework of nuclear supervision according to § 19 <u>Atomic Energy Act</u>.

The periodic safety review (PSR) to be carried out by the licensee every ten years according to § 19a <u>Atomic Energy Act</u> is an important source of information for the supervisory authority. The PSR allows the latter to review and assess in a holistic manner whether the plant has fully complied with

- the requirements of the licences
- any additional orders, where appropriate, and
- the relevant requirements of the nuclear regulations

up to this point in time. It can also be examined and assessed whether the plant will comply in the foreseeable future.

Waste management facilities

According to § 9h <u>Atomic Energy Act</u> in connection with § 19a (3) and (4) <u>Atomic Energy Act</u>, operational disposal facilities and the Asse II mine have to be subjected to a review and assessment of nuclear safety every ten years. Based on the stipulations in the permanent operating licence for the Morsleben Disposal Facility for Radioactive Waste, overall safety reviews take place at this disposal facility at every five years. For the Konrad disposal facility, reviews according to § 9h <u>Atomic Energy Act</u> in connection with § 19a(3) (4) <u>Atomic Energy Act</u> have not yet been carried out as this facility is still under construction. Nuclear supervision authorities are currently involved in the review and approval of the construction measures.

Also in the case of the disposal projects, the systems, structures and components (SSC) are classified according to their safety significance These safety classes are referred to as quality assurance areas (QSB).

In the field of the site selection for a disposal facility for high-level waste, the Federal Office for the Safety of Nuclear Waste Management (BfE) has to monitor according to the <u>Site Selection Act</u> in particular the execution of the site selection procedure. The BfE also assesses the proposals and research findings of the project delivery organisation. It accompanies the siting process from a scientific point of view and checks that the siting process is carried out as stipulated by the <u>Site Selection Act</u>.

8.7 Module 7 – Inspection

Legal basis/introduction

In Germany, inspections of nuclear installations and of storage and disposal facilities are conducted by the competent supervisory authorities on the basis of the <u>Atomic Energy Act</u>. The corresponding inspections in this respect are carried out by the respective competent Länder licensing and supervisory authorities. There are no special resident inspectors, working primarily in individual facilities or installations.

The <u>Atomic Energy Act</u> empowers the inspectors to enter all locations necessary for the fulfilment of their tasks, to demand information from persons employed at the installations and to order measures to remove hazardous conditions. The nuclear supervisory authorities have established procedures, guidelines and methods to carry out their tasks. These internal regulations are used during the supervision of nuclear installations and activities as well as of storage facilities and disposal facilities. The methods applied by the inspectors are for the most part identical. The inspection frequency and scope are governed by the hazard potential of the installation or activity.

Alongside supervisory inspections, comprehensive technical checks are carried out by authorised experts. This consultation of external authorised experts by the competent supervisory authority is likewise regulated in the <u>Atomic Energy Act</u>. Authorised experts are consulted on the basis of clear mandating and guidance by the supervisory authority (see <u>Module 7</u>, Question 1, "Legal commission and powers").

Inspection programmes

The competent supervisory authorities perform their inspections on the basis of an inspection programme for installations and activities within their responsibility. The inspection programmes are an important part of regulatory supervision. Inspection programmes typically include the following areas of inspection:

- operational management,
- security
- modification procedures

- fire protection
- maintenance and spare part procurement
- documentation
- in-service inspections
- civil engineering
- quality assurance
- radiation protection
- technical qualification of the personnel
- emergency response

The supervisory authorities pursue a holistic approach for all aspects of Man-Technology-Organisation and therefore focus on the entire installation and all activities. Furthermore, national and international findings are taken into account (see <u>Module 7</u> Question 1 "Inspection programmes and areas"). The inspection programmes of the federal and Länder supervisory authorities are similar in their outlines. They differ only in the details. Aspects of safety culture are considered.

The licensing and supervisory authorities consult a considerable number of authorised experts to carry out technical checks. In their work for the licensing and supervisory authorities, authorised experts must prevent any possible conflicts of interests – simultaneous work for the operator in the same matter is therefore ruled out. The rights and obligations of the consulted authorised experts are stipulated in detail in framework contracts by the competent authorities. The type and scope of the technical checks to be carried out within the authorised experts' routine are to be stipulated in advance in the regulations approved or provided by the licensing and supervisory authorities (e.g. operating manuals, test manuals, modification procedures etc.). They comprise in particular reviews of operator activities on safety-relevant components of the installation, for example in the case of modifications, maintenance measures and in-service inspections.

The authorities must be informed by the authorised experts if any anomalies arise during the technical checks. Only the authorities can decide on the further supervisory procedure and whether (sovereign) measures for enforcement actions or sanctions have to be put in place (see <u>Module 8</u>, Question 1.1).

Frequency of inspections

In Germany, there are no legal stipulations regarding the frequency for supervisory inspections for the different types of installations and activities subject to nuclear supervision. Each competent supervisory authority decides independently about the frequency of reviews for installations and activities. The supervisory authority adopts a graded approach, i.e. the review frequency is governed by the safety significance and/or the hazard potential of the particular facility or activity.

In Germany, a high review frequency of operator activity ensues from the consultation of authorised experts. For a nuclear power plant in power operation, on average at least one authorised expert or one authority employee can be found at the installation on every workday.

Inspectors

The federal and Länder supervisory authorities in Germany generally pursue a consistent training programme. Inspectors usually have a technical Bachelor, Master or PhD and are prepared for independent work through training sessions, by accompanying experienced inspectors, and through training on the job. The further training/qualification of inspectors as well as consistent execution of the nuclear regulations is ensured through participation in national and international committees.

Types of inspections

For the most part, supervisory authorities conduct planned inspections that are announced in advance. A small number of inspections are unannounced and may take place at night or at the weekend. Additional reactive inspections are carried out following reportable events or safety-relevant findings. Inspections are usually carried out by a single inspector. In special cases, team inspections are carried out or external authorised experts support the inspectors.

The technical checks by the technical support organizations (TSOs), however, take place at fixed dates throughout the year and are oriented towards operator activities. Some Länder supervisory authorities have made additional contractual agreements for the checking of nuclear power plants with a TSO to perform additional plant-walk-downs or checks of stipulated areas (e.g. ventilation, operational management). The scheduling of these additional checks is announced to the licensee in advance.

Conduct of an inspection

Inspections are prepared specifically by the inspector using the respective applicable internal specifications. The documents important for this (e.g. documentation of the installation, operating manual) are made available to the inspectors. For specific technical issues, the preparation of a supervisory visit can also include consultation of external authorised experts. During the inspection, the inspector is usually accompanied by a site employee.

Important inspection methods are plant-walk-downs, inspection of operational documentation, and meetings/interviews with personnel and management personnel on different management levels.

After completion of the inspection, the licensee is given oral feedback on the results. If there have been any findings, arrangements are made for the ongoing supervisory procedure in agreement with the organisational unit in charge at the supervisory authority. Each inspection is formally recorded (see <u>Module 7</u>, Question 1, Section "Planning and implementation of regulatory inspections").

Evaluation of inspection findings as part of the integrated oversight

The findings of the inspections, together with results from review and assessment and available information from other processes, are assessed by the supervisory authority to create an overall picture for each site/installation. This assessment forms the basis for the further development and updating of regulatory supervision.

In cases where weaknesses are identified at the licensee's installation, the licensee is asked to identify the causes and to provide remedial actions or improvements, and to present these in a written report to the competent nuclear supervisory authority. This report by the licensee is then the subject and starting point for further supervisory activities.

8.8 Module 8 – Enforcement

Introduction/legal basis

The primary legal objective of the supervision of nuclear installations is to protect life, health and real assets against the hazards of nuclear energy and the harmful effects of ionising radiation. To enforce the applicable provisions and to ensure this objective, sanctions and measures for corrective action against infringements are stipulated in the <u>Criminal Code</u> (Strafgesetzbuch (StGB)), the <u>Atomic Energy Act</u>, and the nuclear ordinances (see <u>Module 8</u>, Question 1).

The competent nuclear supervisory authorities can order that a licensee eliminates a condition that contradicts the provisions of the <u>Atomic Energy Act</u>, the legal nuclear ordinances, the provisions of the licence or a subsequent licence condition, or from which the effect of ionising radiation could pose risks to life, health or real assets. Depending on the specific circumstances of the individual case, the competent supervisory authorities has the right to order that

- protection measures must be taken and what these are,
- the construction, operation or decommissioning and dismantling may continue only in a restricted way or in accordance with certain conditions, or
- the construction, operation or decommissioning and dismantling has to be temporarily suspended until the cause of an event has been found and the required corrective measures to prevent any repetition have been adopted.

If licensing conditions or supervisory orders are not adhered to, the competent supervisory authorities enforces adherence, if necessary also by means of coercive administration measures.

Under defined prerequisites, the <u>Atomic Energy Act</u> intends that the nuclear licensing authorities can stipulate subsequent licensing conditions to ensure safety (see <u>Module 8</u>, Question 1.1, Section "Enforcement actions – subsequent licensing conditions").

If a nuclear installation poses a significant hazard to employees or the public, e.g. through issues that have not been recognised or sufficiently considered during the licensing procedure, and if these issues cannot be removed through suitable measures within a suitable period of time, the nuclear licensing authorities must revoke the licence. Revocation is also possible if licensing requirements later cease to exist or the licensee infringes any legal provisions or administrative decisions. The <u>Atomic Energy Act</u> and the associated ordinances regulate infringements that are punished with fines of up to € 50,000 against the acting person. Fines can also be implemented against legal entities (see <u>Module 8</u>, Question 1, Section, "Principles and legal frameworks").

To prosecute violations, sanctions are stipulated in <u>Criminal Code</u>, <u>Atomic Energy Act</u> and in the nuclear ordinances (see <u>Module 8</u>, Question 1.1, Section "Enforcement policy").

Enforcement actions are sovereign measures. Only the competent nuclear licensing and supervisory authority can take them. The authorized experts consulted by the authority cannot take any enforcement actions. They are, however, contractually obliged to report immediately to the competent supervisory authority any facts and findings that could require immediate authority action (see <u>Module 8</u>, Question 1.1, Section "Selection of enforcement actions").

Enforcement policy of the nuclear supervisory authority

Because of the high-risk potential of nuclear power plants, the planning, erection, operational startup, operation, post-operation, decommissioning and dismantling of nuclear power plants are subject to very intensive and close state supervision. In accordance with this, it is the objective of the Regulatory Body in Germany to recognize prohibited conditions, deviations or infringements in advance or at a very early stage (without any severe effects arising), to request their removal and to enforce this predominantly with non-formal measures of corrective intervention. If non-formal measures of corrective intervention are ineffective, legally possible (formal) measures such as obligations, orders, infringement procedures or criminal proceedings are instigated. For further details see <u>Module 8</u> "Enforcement".

A good safety culture on the part of the licensee and his trustworthiness under atomic law generally allow the expectation that provisions from

- the Atomic Energy Act and associated ordinances,
- from issued licences and their particular conditions or incidental provisions and,
- from written operational regulations (such as the safety specifications, operating manual, operational, quality or engineering procedures etc.)

will be adhered to. The licensee will also react appropriately to any non-conformity identified either internally or by the supervisory authority, that he will implement the required immediate measures as necessary, inform the competent supervisory authority to the required extent about the nonconformity, and develop and implement suitable measures to prevent any repetition, as well as adequately checking the effectiveness of these.

In case that the licensee does not comply, the competent supervisory authorities use corrective intervention, coercive power and sanctions to enforce these measures. The application of these measures follows a graded approach, i.e. the choice of enforcement actions by the supervisory authority is oriented by the safety significance.

Essential elements of the enforcement policy are already arranged in the legal framework such as in the <u>Atomic Energy Act</u> and the <u>Radiation Protection Act</u> and ordinances, such as the <u>Radiation</u> <u>Protection Ordinance</u>. Furthermore, federal and Länder supervisory authorities have further specified the implementation strategy in further internal administrative regulations, e.g. in management systems, supervision concepts or oversight manuals.

Enforcement actions that can be adopted by the Regulatory Body consist of the following escalation levels:

- verbal communication of a complaint (also by phone),
- written communication of a complaint,
- the implementation of subsequent licence conditions
- verbal and written orders for specific protection measures for hazard prevention, e.g. to suspend temporary the construction, operation, decommissioning and dismantling,
- fines and
- the revocation of the licence.

The competent nuclear supervisory authorities have described these different enforcement actions and their application accordingly in internal regulations.

The enforcement can also include criminal prosecution if the corresponding requirements are fulfilled. Infringements and criminal offences are also included in the <u>Atomic Energy Act</u> and its associated ordinances as well as in the <u>Criminal Code</u>.

The competent nuclear supervisory authorities take enforcement actions for corrective intervention in the required scope depending on the safety significance. When selecting the required measures for corrective intervention, the principle of proportionality must always be observed. The inspectors from the supervisory authorities have the power to issue orders on-site for the removal of unlawful or hazardous conditions.

The selection of an appropriate enforcement action is based primarily on its safety significance and the type and scope of non-compliance, as well as on further criteria specified by the supervisory authority (see <u>Module 8</u>, Question 1.1, Section "Selection of enforcement actions"). This procedure ensures that recognised deviations are categorised by their safety significance and that measures for corrective intervention and sanctions are applied in a graded approach in such a way that a lawful and safe condition of the nuclear installation is achieved and/or restored.

8.9 Module 9 – Regulation and Guides

Generic issues

Supported by the BfE and the Länder, the BMU continuously monitors developments in the field of nuclear safety by actively participating in the work of (inter-) national, multi-national and bilateral committees and institutions. The results of the work of these committees and working groups as well as the research programmes funded on a national level by the Federation, international regulations, research and development projects and specialist contacts are incorporated in the continuous improvement of the requirements for the safety of nuclear installations according to the state of the art in science and technology.

The regulatory pyramid shown below shows the legal requirements of nuclear and radiation protection law and their binding nature as well as the national authorities or institutions that issue these requirements.



Fig. 8-2 German regulatory pyramid

The Federal Republic of Germany is a federally structured state. The enforcement of federal laws is in principle the responsibility of the Länder unless other processes have been stipulated by law. The legal framework for the legislator and the Regulatory Body (federal and Länder authorities) ranges from generally binding laws, ordinances and administrative provisions to substatutory regulations (see Fig. 8-2). In addition, international treaties and the law of the European Union are taken into account, which are transferred into national law. The Handbook on Nuclear Safety and Radiation Protection (RS Handbook; <u>https://www.bfe.bund.de/DE/bfe/gesetze-regelungen/rsh/rsh_node.html</u>) presents all mandatory and substatutory regulations valid in Germany in the areas of nuclear safety, disposal, transport of radioactive materials and protection against ionising and non-ionising radiation.

The Länder Committee for Nuclear Energy (LAA) is a federal and Länder body consisting of representatives from the licensing and supervisory authorities of the Länder and the BMU. It is responsible for the preparatory coordination of their activities in the implementation of the <u>Atomic Energy Act</u> and for the preparation of amendments and the further development of legislation and administrative regulations as well as of the substatutory guidance instruments (Process 12 Länder Committee for Nuclear Energy (LAA), <u>Handbook on Cooperation between the Federation and the Länder in Nuclear Law</u>).

Basic Law

The <u>Basic Law</u> lays down provisions on the competences of the Federation and the Länder with regard to the use of nuclear energy. Accordingly, the Federation has exclusive legislative competence in this area. The Länder, as the competent licensing and supervisory authorities, execute nuclear law on behalf of the Federation (federal executive administration). Against this background, the Federation has the oversight as to the legality and appropriateness of execution and may assume the competence for a particular subject matter, if deemed necessary. In any case, the Länder remain responsible for any administrative action towards external parties (so-called exercising competence).

Nuclear and Radiation Protection Law

The <u>Atomic Energy Act</u> was promulgated on 23rd December 1959 following the Federal Republic of Germany's declared renunciation of nuclear weapons and has since been amended several times. With the amendment of 2002, the purpose of the <u>Atomic Energy Act</u> has been changed to end the use of nuclear energy for the commercial generation of electricity. Up to that point in time the orderly operation of nuclear power plants has to be ensured as well as the protection of life, health and real assets from the hazards of nuclear energy and the harmful effects of ionising radiation. It also has to be ensured that any damage caused is compensated. According to § 7 (2), the <u>Atomic Energy Act</u> requires precautionary measures to be taken against damage arising from the construction and operation of nuclear installations. The precondition for a license is compliance with the state of the art in science and technology.

The <u>Radiation Protection Ordinance</u> and, from 31st December 2018, the new <u>Radiation Protection</u> <u>Act</u>, accompanied by an updated <u>Radiation Protection Ordinance</u>, provide the legal groundwork for the handling of radioactive substances. These laws and ordinances are based on the <u>EURATOM</u> <u>Basic Standards on Radiation Protection</u> (Directive 2013/59/EURATOM), which provide the framework for radiation protection within the EU.

The <u>Radiation Protection Act</u> also regulates the monitoring of radioactivity in the environment both continuously and in case of events with significant radiological effects.

The ever-evolving nuclear and radiation protection legislation substantiates these fundamental requirements set out in the <u>Basic Law</u>. It contains a comprehensive and interlinked set of standards that guarantees complete sovereign control and oversight of all practices and installations for the peaceful use of nuclear energy. The German regulations, in particular the substatutory guidance instruments, are regularly updated on the basis of the state of the art in science and technology.

Regulations and guides for nuclear power plants, research reactors and fuel cycle facilities

Based on the results of the IRRS mission in 2008 and the IRRS follow-up mission in 2011, a joint <u>Handbook on Cooperation between the Federation and the Länder in Nuclear Law</u> was developed and published, which applies to the area of nuclear power plants with operating licences and outlines the relationship between federal oversight and the nuclear supervisory authorities of the Länder.

According to § 7 <u>Atomic Energy Act</u>, the erection, operation or maintenance of a stationary installation for the production, treatment, processing or fission of nuclear fuel, a substantial modification of the installation or its operation as well as its decommissioning and dismantling requires a licence (see <u>Module 5</u>). For installations in accordance with § 7 <u>Atomic Energy Act</u>, an operating licence may only be granted if the licensing requirements specified in § 7 (2) <u>Atomic Energy Act</u> are met. In doing so, the precautionary measures against damage must be determined plant-specifically by the competent nuclear licensing and supervisory authority of the Land according to the state of the art in science and technology. New licences for the construction and the operation of facilities for the fission of nuclear fuels for the commercial production of electricity and for facilities for the reprocessing of irradiated fuel assemblies will not be issued any more in Germany.

Within the framework of these precautionary measures, further protection goals in accordance with the state of the art in science and technology must be observed, such as avoiding unnecessary radiation exposure and the principle of minimisation (§ 8 <u>Radiation Protection Act</u>).

Regarding protection and precautionary measures in nuclear installations, there are e.g. the <u>Radiation Protection Ordinance</u>, which was replaced by the new <u>Radiation Protection Act</u> and a new <u>Radiation Protection Ordinance</u>, the <u>Nuclear Licensing Procedure Ordinance</u>, the <u>Nuclear Safety</u> <u>Officer and Reporting Ordinance</u>, the <u>Nuclear Trustworthiness Verification Ordinance</u> or the <u>Nuclear Financial Security Ordinance</u>.

In the field of nuclear safety and radiation protection, the BMU releases publications, after consultation with the Länder, in the form of requirements, directives, guidelines, criteria and recommendations (such as the <u>Safety Requirements for Nuclear Power Plants</u>). The BMU publications describe the view of the federal nuclear licensing and supervisory authority and, if the relevant decisions have been taken in the LAA, also the view of the Länder nuclear licensing and supervisory authorities with respect to general nuclear safety issues. They provide guidance to the Länder nuclear licensing and supervisory authorities in connection with the execution of the <u>Atomic Energy Act</u>. This procedure also ensures that execution in the different Länder follows comparable standards as far as possible. In order to identify potentially required changes to the national regulations, the requirements are reviewed regularly (every five years) to ensure that they are up to date.

The <u>Safety Requirements for Nuclear Power Plants</u> apply to installations that are used for the fission of nuclear fuels for the commercial generation of electricity and, mutatis mutandis to research reactors. In order to identify potentially required changes to the national regulations, the requirements are reviewed regularly to ensure that they are up to date. In the case of the <u>Safety</u> <u>Requirements for Nuclear Power Plants</u>, such a review is carried out every five years (Process 22, <u>Handbook on Cooperation between the Federation and the Länder in Nuclear Law</u>).

Generic findings from the discussions among the advisory commissions (RSK, SSK and ESK) are incorporated in the BMU's further development of the regulations. The BMU consults its commissions on important topics concerning licensing and supervisory procedures for existing or decommissioned nuclear installations and nuclear installations in the process of decommissioning, the development of regulations, or safety research. The commissions can also provide advice on their own initiative. Depending on the issue at hand, the nuclear licensing and supervisory authorities of the Länder, authorised experts, licensees of nuclear installations or industry representatives participate in the commissions' consultations. The results of the commissions' consultations are statements or recommendations which the commissions themselves publish on their websites following approval by the BMU. The nuclear licensing and supervisory authorities of the Länder assess the decisions (recommendations and statements) of the commissions under their own responsibility in the nuclear licensing and supervisory authorities of provide advices. They are statements or provide advices and statements or recommendations and statements or the process of the licensing and supervisory authorities of the licensing the nuclear licensing and supervisory authorities of the licensing approval by the BMU. The nuclear licensing and supervisory authorities of the licensing in the nuclear licensing and supervisory authorities of the licensing in the nuclear licensing and supervisory procedures, in particular with respect to plant-specific relevance. They

decide whether, and if so, what action is required in the specific case and, if necessary, initiate corresponding measures (e.g. Process 11 Discussion among the Reactor Safety Commission (RSK) and dealing with the results of its discussions, <u>Handbook on Cooperation between the Federation</u> and the Länder in Nuclear Law).

The KTA Safety Standards specify i.a. the safety requirements of the higher-level regulations (<u>Safety</u> <u>Requirements for Nuclear Power Plants</u> and their <u>Interpretations</u>) or render these more precise. The existing regulatory texts are reviewed at least every five years, similar to the <u>Safety Requirements</u> for Nuclear Power Plants, to see if they are still up to date and are modified accordingly, if required.

In addition, the conventional technical rules apply, as is the case for the construction and operation of all technical installations, in particular the system of national standards of the German Institute for Standardization (DIN), regulations of the Association for Electrical, Electronic and Information Technologies (Verband der Elektrotechnik Elektronik Informationstechnik e.V.(VDE)) and also international standardisation according to ISO and IEC, unless the nuclear regulations contain more specific requirements.

The safety-related regulations for power reactors can also be applied analogously to research reactors. The application of these regulations depends on the hazard potential of the respective research reactor and is performed by the nuclear licensing and supervisory authorities of the Länder in a graded approach.

The <u>Atomic Energy Act</u> and the <u>Nuclear Safety Officer and Reporting Ordinance</u> refer to "nuclear installations", so that these regulatory texts are applicable both to nuclear power plants and to research reactors and any nuclear fuel cycle facilities. The <u>Nuclear Safety Officer and Reporting</u> <u>Ordinance</u> defines separate reporting criteria for research reactors (Annex 3). For further general details on licensing issues see <u>Module 5</u>.

Regulation and guides for pre-disposal and disposal (waste management) facilities

According to the purpose of the <u>Atomic Energy Act</u> stated in number 2 of § 1 <u>Atomic Energy Act</u>, the fundamental protection goal, which is to protect life, health and real assets against the hazards of nuclear energy and the harmful effects of ionising radiation, also applies to facilities for the storage of nuclear fuels (storage facilities) and facilities for the disposal of radioactive waste. Installations intended for the disposal of radioactive waste are subject to the same protection goals as nuclear power plants and storage facilities.

While a plan approval order/a licence can only be granted for facilities for the disposal of radioactive material if the requirements specified in § 7 (2) <u>Atomic Energy Act</u> are met, the storage of nuclear fuels according to § 6 <u>Atomic Energy Act</u> is subject to the licensing requirements specified in § 6 (2) <u>Atomic Energy Act</u>.

In the field of nuclear waste disposal, the law on the further development of the law on the search and selection of a site for a disposal facility for heat-generating radioactive waste (<u>Site Selection Act</u>; see the Questions on Disposal) was passed in 2017. The site selection procedure regulated in this Act is intended to lead to the choice of the site with the best-possible safety over a period of one million years for a facility for disposal in the Federal Republic of Germany where the high-level waste produced in Germany will be emplaced. This is to be done by means of a participative, science-based, transparent, self-reflecting and learning procedure.

In the field of nuclear power plants, the BMU publishes announcements in the form of requirements, directives, guidelines, criteria and recommendations after consultation with the Länder (see 9.2). Regarding the field of storage, the statements made in the resolutions (statements and recommendations) essentially apply accordingly. In the field of disposal, existing rules from the field of nuclear power plants are applied in part - insofar as applicable – analogously to the existing disposal facility projects. The BfE consults authorised experts when assessing which requirements from the field of nuclear power plants can be applied to the field of disposal and when determining how far the state of the art in science and technology has advanced.

With respect to the disposal of high-level waste, the fundamental safety functions set out in the <u>Safety Requirements for the Disposal of Heat-Generating Radioactive Waste</u>, published by the BMU in 2010, are currently being specified. These safety requirements will be reviewed with regard to advancements in the state of the art in science and technology and will be replaced by an ordinance based on § 26 of the <u>Site Selection Act</u>, which is currently being prepared.

In Germany there are currently two licensed disposal facilities for non-heat-generating and low and intermediate-level waste: the Konrad mine (under construction) and the Morsleben disposal facility for radioactive waste (ERAM). A disposal facility for high-level waste does not yet exist in Germany.

Regulations and guides for radiation sources facilities

The <u>Radiation Protection Ordinance</u> and, from 31st December 2018, the new <u>Radiation Protection</u> <u>Act</u>, accompanied by an updated <u>Radiation Protection Ordinance</u>, provide the legal basis for the handling of radioactive substances. These laws and ordinances are based on the <u>EURATOM Basic</u> <u>Standards on Radiation Protection</u> (Directive 2013/59/EURATOM), which provide the framework for radiation protection within the EU.

Radiation protection law contains regulations that serve to protect people and the environment from damage caused by ionising radiation of man-made and natural origin. The regulations cover both the protection of the population and the protection of workers. They include requirements and limit values applicable to the use of and exposure to radioactive substances and ionising radiation of man-made and natural origin. They require organisational and physical-technical protective measures as well as medical monitoring of occupationally exposed persons.

Radiation protection must generally be included in the planning of activities in planned exposure situations at an early stage. Depending on the individual case, the planning may also be subject to reviews performed by the nuclear supervisory authority.

Regulation and guides for decommissioning activities

The decommissioning of an installation in accordance with § 7 para 1 <u>Atomic Energy Act</u>, the safe enclosure of the finally decommissioned installation and the dismantling of the installation or parts of installations require a licence according to § 7 (3) <u>Atomic Energy Act</u>. The licensing requirements set out in § 7 (2) <u>Atomic Energy Act</u> apply accordingly. Insofar as operators are paying parties according to sentence 1 of § 2 (1) of the <u>Disposal Fund Act</u>, their installations have to be decommissioned and dismantled immediately.

With regard to the fundamental safety functions, radiation protection law regulations do not differentiate between the operation of a plant and its decommissioning. Decommissioning is defined as a planned exposure situation within the meaning of § 2 (2) <u>Radiation Protection Act</u>. In this situation, the following radiation protection principles apply:

- the principle of justification (§ 6 Radiation Protection Act),
- the principle of avoiding unnecessary exposure and reducing the dose (§ 8 <u>Radiation Protection</u> <u>Act</u>) and
- the principle of dose limitation (§ 9 Radiation Protection Act).

For further explanations see Module 11.

An installation according to § 7 (1) <u>Atomic Energy Act</u> or parts of an installation can only be released from nuclear supervision in accordance with the corresponding licence as set out in § 7 (3) <u>Atomic</u>

<u>Energy Act</u> (see Module 5). Marginally activated or contaminated substances can be released from nuclear supervision by way of a clearance.

The <u>Guide to the decommissioning, the safe enclosure and the dismantling of facilities or parts</u> thereof as defined in § 7 of the Atomic Energy Act of 23rd June 2016 (Official Section of the Federal Gazette, 19th July 2016 B7), which has been agreed between the Federation and the Länder, contains proposals for a suitable procedure for the decommissioning, the safe enclosure and the dismantling of installations or parts thereof as defined in § 7 <u>Atomic Energy Act</u> with respect to the application of the substatutory regulations. For further explanations see Question 2 in the <u>Module</u> <u>"Regulations of decommissioning of installations"</u>.

The responsibility of the Regulatory Body (nuclear oversight) ceases upon release of the former operator from nuclear and radiation protection supervision.
8.10 Module 10 – Emergency Preparedness and Response (EP&R)

Basic responsibilities (structure and regulations of the EP&R system)

The Federal Republic of Germany's EP&R system is characterised by the federal structure of the state. Emergency preparedness and response function as an interplay of federal, Länder and municipal authorities, the police, fire brigades, the recognised aid organisations (including the Technical Relief Agency "Technisches Hilfswerk"), hospitals and, last but not least, the license holders or operators of nuclear installations.

According to the <u>Basic Law</u>, the federation has the exclusive legislation for protection against dangers arising from the release of nuclear energy or from ionising radiation (number 14 of Article 73 (1) <u>Basic Law</u>, cf. <u>Module 1</u>). The execution of the federal laws regarding nuclear safety and radiation protection as part of the emergency preparedness and response in Germany is the responsibility of the Länder on behalf of the federation (federal executive administration, Article 85 <u>Basic Law</u>). For licensing and supervision, the federal regulations are specified by additional ordinances. Immediate emergency response in connection with civil protection measures. For planning in the vicinity of nuclear installations central federal requirements have to be taken into account (e.g. emergency planning zones, dose and contamination values for the protection of the population). In addition to civil protection, other legal areas and administrative areas are affected. Here, too, fundamental plans exist at federal level; these are specified by plans at Land level (see <u>Module 10</u>, Question 1).

The BMU is the competent supreme federal authority and National Competent Authority (NCA) in an international context. In the area of emergency preparedness and response (EP&R), the BMU is also supported and advised by the subordinate federal agencies, the BfS and the BfE as well as by GRS.

At Land level, the supreme Land authorities designated by the Land governments are responsible for nuclear licensing and supervision as well as for civil protection (see <u>Module 10</u>, Question 1.1).

The operator or the license holder is responsible for on-site emergency preparedness (technical and organisational aspects) and his own interface with off-site emergency preparedness. In this context, he is controlled by the supervisory and licensing authority responsible under Land or federal law.

On-site emergency preparedness is primarily addressed in the NPP Module, but aspects of it are also discussed in this summary for the purpose of a comprehensive presentation.

The emergency preparedness and emergency protection of nuclear installations are regulated in Germany in the statutory and substatutory regulations.

Following the implementation of <u>Directive 2013/59/EURATOM</u>, the legal framework for radiation protection and in particular for "radiation protection in emergency situations" has been restructured. On 1st October 2017, the provisions of the <u>Radiation Protection Act</u> on the emergency management system of the federal and Länder governments, the protection of emergency workers and the monitoring of environmental radioactivity as well as consequential changes in the Food and Feed Code and other federal laws came into force. The other provisions of the <u>Radiation Protection Act</u>, the <u>Atomic Energy Act</u> also contains regulations on emergency response, which are consistent with those of radiation protection. The powers and duties to issue statutory ordinances contained in the <u>Radiation Protection Ordinance</u>. This is done within the framework of the Amending Ordinance for the Further Modernisation of Radiation Protection Law, which came into force om 31st December 2018.

The provisions of the <u>Radiation Protection Act</u> apply in principle to any emergency situation in which ionising radiation will or may result in significant adverse effects on man, the environment or real assets. The obligations of operators or radiation protection supervisor as described in the <u>Radiation</u> <u>Protection Act</u> regarding emergency preparedness and response apply to all activities defined in § 4 <u>Radiation Protection Act</u>. These comprise i.a. the construction, operation, decommissioning and dismantling of nuclear installations or plant components pursuant to § 7 <u>Atomic Energy Act</u>, the processing or other use of nuclear fuel according to § 9 <u>Atomic Energy Act</u>, the construction, operation and decommissioning of facilities for the safe storage and disposal of radioactive waste according to § 9b <u>Atomic Energy Act</u>, and the construction and operation of facilities for the generation of ionising radiation.

The requirements for off-site emergency preparedness are primarily geared to severe nuclear power plant accidents and are graded accordingly for installations with a lower damage potential (*graded approach*). Here, it is the responsibility of the competent Land authority to determine the scope of the necessary emergency planning (§ 101 <u>Radiation Protection Act</u> and §§ 49 and 50 <u>Radiation Protection Ordinance</u> (old)). §§ 93-112 <u>Radiation Protection Act</u> specify i.a. the tasks of the federal and Länder governments in the planning phase and in emergencies.

The <u>Radiation Protection Act</u> provides for the preparation of coordinated emergency response plans of the Federation and the Länder, which represent the processes and responsibilities during the emergency response (§§ 97-101 <u>Radiation Protection Act</u>). These emergency response plans are currently being prepared. The general federal emergency response plan, which is presented by the BMU, will contain i.a. a catalogue of reference scenarios including optimised protection strategies to be considered in emergency planning (see <u>Module 10</u>, Questions 3.6 and 4.2). In addition, special federal emergency response plans are being prepared which describe the emergency response in the affected legal areas and in administrative areas outside radiation protection. In principle, the authorities that perform emergency response tasks in everyday business in the implementation of federal laws also retain this responsibility and competence in the case of radiological emergencies (so-called interlinking approach, see <u>Module 10</u>, Questions 1 and 3.6).

The Länder also establish general and specific emergency response plans that will put the federal plans in concrete terms and complement them as far as the Länder are responsible for planning or implementing protection measures. The civil protection authorities also prepare off-site emergency response plans for nuclear installations with a high risk potential or check the existing plans for any updating needs. These plant-specific off-site emergency response plans regulate i. a. the interfaces between on-site and off-site emergency response or the interaction of the operator with the authorities (see Module 10, Questions 1.1, 1.2, 2.4, 3.2 and 3.5).

Tasks and duties of the licensee in connection with on-site emergency preparedness

According to § 7c (3) <u>Atomic Energy Act</u>, the licensee is obliged to provide adequate procedures and precautions for on-site emergency preparedness. In the case of incidents and accidents, the licensee is responsible for ensuring that the dangers to man and the environment are kept as low as possible. On-site emergency preparedness is implemented through technical and organisational measures that are taken in nuclear installations to control an event or limit its impact (see <u>Module 10</u>, Questions 2.1 to 2.4 and <u>NPP Module</u>, Questions 24.2 and 37).

The measures are divided into preventive and mitigating measures. The overriding objectives of preventive measures are to achieve and maintain a condition of the installation that cannot lead to any hazardous effects, and to avoid accidents involving severe fuel damage. The mitigating measures serve for the limitation of damage in case of any imminent or actual core damage. For the planning of emergency protection measures by the license holder, the Reactor Safety Commission and the Commission on Radiological Protection have formulated the <u>General guidelines for</u> <u>emergency planning by nuclear power plant operators</u> (SSK/RSK, BAnz AT 13th May 2015 B5). Here, lessons learned from the reactor accident at Fukushima were also integrated.

The license holder describes the different operating modes in the operating manuals (BHB) of the nuclear installation. In the case of nuclear power plants, these are specified as normal operation, abnormal operation and accidents. The starting point for the occurrence of an emergency in a nuclear installation is usually a disruption of normal operation. The measures to be taken in each case by the operator for the first three operating states are defined in the BHB. If the measures provided in the BHB are no longer sufficient to transfer the system to the safe state and if a beyond-design-basis accident looms ahead, the emergency manual (NHB) has to be consulted. In the NHB, emergency procedures are described to allow the operator to control a design extension condition. The transition from BHB to NHB is regulated in the BHB, e.g. in the alarm order, and guided by radiological or plant-specific criteria.

For nuclear power plants (NPP), there have for some years been even more elaborate preconceived procedures beyond the NHB, which the operator has to take into account should conditions involving core meltdown arise. These mitigating measures, which were derived from results of the Level 2 PSA investigations, are written down in the manual for mitigating emergency measures (Handbuch Mitigativer Notfassmaßnahmen (HNM), see Severe Accident Management Guideline (SAMG)).

In addition, the operator is obliged to carry out self-monitoring of the discharges of his installation in accordance with the <u>Directive for Emission and Immission Monitoring of Nuclear Facilities</u> (REI) (GMBI 2006, no. 14-17, p. 254) and to ensure compliance with the prescribed limits. Monitoring also has to be guaranteed in emergencies. The variables to be measured and the necessary measuring methods are defined here. Further information on measured variables and measuring methods can be found in the Basic Recommendations for the Remote Monitoring of Nuclear Power Plants (GMBI. 2005, No. 51, p. 1049). According to number 3 of § 7c (2) <u>Atomic Energy Act</u> and § 53 <u>Radiation Protection Ordinance</u> (old), the operator is obliged to provide the personnel necessary for adequate damage control in safety-relevant events and to take care that this personnel receives continuous training. This also applies to the technical infrastructure and aids.

The operator's emergency response arrangements are monitored and controlled by the nuclear licensing and supervisory authorities.

Note on disposal facilities: As with other nuclear installations, the BfE, as the competent licensing authority, is already examining the safety concepts for dealing with incidents and corresponding onsite emergency planning in the course of the licensing procedure. The relevant guidelines and recommendations specified by the Regulatory Body for the area of disposal facilities have been considered, e.g., in the licensing of the Konrad mine disposal facility in the planning approval decision, partly as supplementary documents. This licence, in turn, forms the basis for the assessments of the nuclear regulatory review. For example, the emergency plan of the Konrad facility provides measures that must be taken in the event of any imminent danger, bodily injury, fire, accidents during the handling of radioactive waste packages, or other damage to reduce the risk, give help and restore safety.

Alarm notification and information flow

The operator has to report accidents, incidents or other events related to nuclear safety to the supervisory authority. The information obligations are regulated in the <u>Nuclear Safety Officer and</u> <u>Reporting Ordinance</u>, including the applicable deadlines. The alarm regulations of the BHB also stipulate that upon reaching plant-specific and/or radiological criteria, the operator has to recommend that the competent civil protection authority of the Land trigger an early warning or an emergency alert. The decision on what alarm should be raised in line with the recommendation is taken by the subordinate civil protection authority after an appropriate assessment of the situation. In this context, the <u>Criteria for alerting the disaster control authority by the operators of nuclear facilities</u> set out by SSK and RSK (RSK/SSK 2013, BAnz AT 9th October 2014 B1) must be respected. The nuclear licensing and supervisory authority receives the relevant information in the same way and to the same extent.

The information obligations of the nuclear licensing and supervisory authority towards the neighbouring Länder and the federal authorities are set out in the <u>Guide to informing the public in</u> <u>nuclear emergencies</u> (SSK, BAnz, 8th October 2008) and other Land-specific regulations.

The notification of the Federal Radiological Situation Centre (RLZ) at the BMU is carried out by the reporting office of the Land via the Joint Reporting and Situation Centre of the Federation and the Länder (GMLZ). Parallel to this, the current draft of the new <u>Radiation Protection Ordinance</u> also provides for direct alerting of the RLZ by the radiation protection supervisor (operator).

The RLZ (see below) is responsible for the fulfilment of the international information and reporting obligations.

Information of the population and recommendations for action

According to § 105 <u>Radiation Protection Act</u>, federal and Länder authorities have to inform the population about risks as well as about protective measures and behavioural recommendations in case of possible emergencies. The information obligations of the federal and Länder authorities towards the population in emergencies are regulated in § 112 <u>Radiation Protection Act</u>.

The operator has to inform the population exclusively about what is going on at the installation (causes, condition of the installation, processes, etc.) and in particular not with regard to officially ordered disaster control measures. The information of the public must be timely, clear, understandable and correct. The <u>Guideline for the information of the public in case of nuclear</u> <u>accidents</u> provides detailed and comprehensive guidance on how operators should communicate with the public.

Protection goals and early protection measures

For emergency exposure situations, a general reference value of 100 mSv applies to the effective dose of the population within the first year following the occurrence of the emergency (§ 93 <u>Radiation</u> <u>Protection Act</u>). This reference value can be lowered by fast-track legislation depending on the situation, but even below the reference value, the dose burden should be kept as low as possible by means of suitable protection measures. As part of the Amending Ordinance (see above) an emergency dose level ordinance also establishes dose levels (intervention levels) that serve as radiological criteria for the adequacy of the early protective measures evacuation, sheltering and iodine thyroid blockade (ITB). In addition, according to § 94 (2) <u>Radiation Protection Act</u>, directly measurable and applicable dose rates or contamination values (e.g. for foodstuffs and feedstuffs, non-food products or vehicles) may be determined, especially by fast-track legislation to be issued in an emergency (Operational Intervention Levels, OILs). The dose criteria and OILs are each consistent with the general reference value.

Based on the lessons learned from the nuclear accident at Fukushima, the emergency planning zones for early protection measures in the vicinity of NPPs were extended. Evacuations now have to be prepared within a radius of about 20 km around a nuclear power plant. Iodine tablets are stored for adults up to the age of 45 years within a radius up to 100 km around a NPP and for children/adolescents up to 18 years and for pregnant women on the entire federal territory. For installations with a lower hazard potential, these planning specifications may be graded or declared unnecessary with the approval of the licensing authority.

Protection of the emergency services

The protection of emergency services and personnel for critical infrastructure is comprehensively regulated in §§ 113-117 <u>Radiation Protection Act</u>. This includes the briefing and training of the emergency services, a staggered system of reference values, and the allocation of responsibilities.

Exercises and quality assurance

According to § 102 <u>Radiation Protection Act</u>, the authorities and organisations involved in emergency response are obliged to carry out emergency exercises on a regular basis. This obligation also applies to those bodies responsible for the training and further qualification of emergency services. The exercises take place with changing participants. Depending on the scenario, this includes not only the operator, but also the authorities responsible for emergencies and aid organisations as well as foreign authorities and institutions in cross-border scenarios. In Schleswig-Holstein, for example, a distinction is made between on-site emergency exercises (several times a year), unannounced emergency exercises involving the nuclear licensing and supervisory authority (once a year) and civil protection exercises (approximately every 5 years). The types of exercises and their frequencies are similar to those carried out in all other Länder with NPPs that are still in operation. For the evaluation of these exercises and to ensure the feedback of experience, the nuclear licensing and supervisory authorities often use external authorised experts.

Pursuant to § 103 <u>Radiation Protection Act</u>, the emergency plans must be regularly reviewed and, if necessary, adjusted to the state of the art in science and technology or a changed legal situation. In addition to findings from the emergency exercises or the national and international exchange, experiences from real emergencies in Germany or abroad are also taken into account. This also applies to the regulations for on-site emergency protection. Compliance with the applicable higher-level regulations as well as the adherence to and safety-related development of the written operational rules of the respective nuclear installations are monitored by the nuclear licensing and supervisory authorities.

Tasks of federal and Länder authorities in emergency response

The BMU has set up a federal Radiological Situation Centre (RLZ) in accordance with § 106 <u>Radiation Protection Act</u>. The RLZ is a merger of the three main players BMU, BfS and GRS. Here, the BMU provides the head office of the RLZ and is supported by the BfS in off-site situation assessment and presentation and by GRS in the assessment and presentation of the on-site (plantinternal) situation. The RLZ receives further support from the crisis team of the SSK and the GMLZ (alerting and distribution of information) as well as from numerous other federal scientific and technical institutions.

The tasks of the RLZ consist in the recording, presentation and assessment of the radiological situation, in the area of communication and coordination (protective measures, information of the population, and preparation of recommendations for action). The RLZ coordinates the emergency

response within the Federation and with the Länder as well as internationally, as long as no other responsibility has been specified.

For supra-regional and regional emergencies, the evaluation of the radiological situation by all federal and Länder authorities is always based on one radiological situation report. Emergencies related to events in NPPs are generally classified as supra-regional, and the same applies to emergencies in foreign plants. The general federal emergency plan provides for each given planning scenario a classification as a supra-regional, regional or local emergency.

In the case of supra-regional emergencies, the RLZ draws up the radiological situation report according to § 108 <u>Radiation Protection Act</u> and distributes it to the Länder, the GMLZ and to the bodies responsible for information exchange abroad, in the EU, and to international organisations. In accordance with § 107 <u>Radiation Protection Act</u>, the Länder provide any relevant information at their disposal (including the supervisory recording and assessment of the condition of the installation and its further development). Together with the radiological situation report, the RLZ provides radiological assessment bases for the adequacy of protective measures to the Länder authorities responsible for disaster control. However, decisions on the implementation of early protection measures are the responsibility of the disaster control authorities of the Länder. The decision on other protective measures is in principle the responsibility of the federal or Länder authorities which, on the basis of the legislation applicable to such measures, are in charge in the day-to-day running of their affaires or in other emergency situations for the prevention of dangers to human health, the environment, or public safety (§ 109 <u>Radiation Protection Act</u>).

As for events with a regional impact, the Land in which the emergency has occurred is basically responsible for providing the radiological situation report. However, in general or on a case-by-case basis, the Land may delegate this task to the RLZ in agreement with the BMU, or the RLZ may assume this task in individual cases (§ 108 (2) <u>Radiation Protection Act</u>).

Depending on the safety and radiological significance of the event, crisis management teams will be set up at the competent Länder authorities. These include the specialist advisory staff of the nuclear licensing and supervisory authority, the disaster response unit of the lower civil protection authority, the Interministerial Management Staff, and the senior management of the supreme civil protection authority of the Land.

The criteria for convening these staff units and the tasks and responsibilities are individually regulated for each Land in the civil protection laws and plans. The nuclear licensing and supervisory authority has the task of providing technical advice to the above-mentioned staff units if a nuclear accident occurs.

Even in the case of emergencies with supra-regional effects in which the RLZ is responsible for providing the radiological situation report, the tasks of the specialist advisory staff of the nuclear licensing and supervisory authorities of the affected Länder remain unchanged insofar as all available information about the situation and situation reports have to be transmitted to the RLZ for further use. The advisory mandate of the nuclear licensing and supervisory authority within the civil protection organisation of the respective Land continues to apply. (§§ 106-111 <u>Radiation Protection Act</u>).

In general, the following documents amongst others are consulted for the determination of the radiological situation and for the recommendation of measures for the protection of the population:

- <u>Basic radiological principles for decisions on measures for the protection of the population</u> against incidents involving releases of radionuclides (SSK, BAnz AT 18th November 2014 B5),
- General guidelines for emergency response in the vicinity of nuclear installations (SSK, BAnz AT 4th January 2016 B4),
- Guidance for the expert advisor for radiation protection of disaster control management in case of nuclear emergencies, including the explanatory report (SSK, Volumes 37 and 38),
- <u>General guidelines for emergency planning by nuclear power plant operators</u> (SSK/RSK, BAnz AT 13th May 2015 B5),
- <u>Guideline concerning emission and immission monitoring of nuclear installations</u> (REI) (GMBI 2006, Nr. 14-17, S. 254).

8.11 Module 11 – Occupational Radiation Protection

Background

Occupational radiation protection concerns many fields of work in Germany; besides nuclear engineering, these include applications of ionising radiation in medicine and veterinary medicine, industry and research, and the protection of flight crews. The new radiation protection law additionally places greater emphasis on the protection of employees against radon.

In total, there are currently (in 2016) around 440,000 people in Germany for whom an official dose is calculated, of which around 18,000 are employed in nuclear engineering, 320,000 in medicine and veterinary medicine, 62,000 in industry and research, and 43,000 are monitored as flight crew members. The average annual dose for monitored flight crew members was around 2 mSv per person; for 13 % of other monitored persons, an official dose value above 0 mSv has been calculated and for these, the average official annual dose was around 0.6 mSv per person. Some people are also monitored for incorporations – in 2016 this amounted to around 1,800 persons, where for fewer than 100 persons doses were determined with an average value of 0.6 mSv.

Legal and regulatory framework conditions

The legal basis for protection against the harmful effects of ionising radiation is currently provided by the <u>Radiation Protection Ordinance</u> and, from 31st December 2018, the <u>Radiation Protection Act</u> with a new <u>Radiation Protection Ordinance</u>. These follow the <u>EURATOM Standards for Radiation</u> <u>Protection</u> (Directive 2013/59/EURATOM), which stipulate the framework for radiation protection in the EU and refer to the ICRP recommendations. German radiation protection law regulates both the protection of the population and the protection of employees.

Essential for activities according to the <u>Radiation Protection Ordinance</u> are the radiation protection principles of justification, avoidance of unnecessary exposure and dose reduction as well as dose limitation. These principles lead to an obligation to optimise radiation protection in terms of the ALARA (As Low As Reasonably Achievable) principle as well as particular manifestations of these principles for special fields of work.

Alongside the legal provisions, there are specifications of the requirements in the General Administrative Provisions, guidelines and other special provisions. For example, these set out

detailed regulations on dosimetry or on the required qualifications for internal radiation protection experts.

General responsibilities

In Germany, the responsibility for the protection of employees from ionising radiation lies with the licensee, with the licensee also being the radiation protection executive (SSV). The appointment and duties of the radiation protection executive are listed in the radiation protection legislation. For example, the SSV is obliged to monitor the occupational radiation exposure so that the stipulated dose limits are not exceeded. The SSV is also someone who has persons under his or her supervision who are exposed occupationally while carrying out jobs at an external facility or installation in which activities requiring a licence take place.

The licensee is obliged to adhere to all applicable provisions of radiation protection legislation and requirements of the licence.

The licensee ensures that the persons under his or her supervision follow the corresponding arrangements at the installations. Furthermore, the responsibilities in connection with adherence to all protection provisions between the holder of a licence for activities in external facilities according to § 25 <u>Radiation Protection Act</u> and the SSV at the external facility are established by a delimitation contract before the start of any activities.

All persons who are permitted to access controlled areas have to be given prior instructions about the working methods, the possible hazards and other relevant aspects before their first access and then annually.

Also, persons intended as emergency workers during emergencies have to be instructed and trained appropriately regarding the health risks and the protection and monitoring measures to be taken. This also applies to persons who play a part in decisions regarding tasks and measures for emergency workers or for the instruction of emergency workers in emergency situations.

To fulfil these requirements, the SSV must either have the required qualifications themselves or must transfer these tasks to internal radiation protection supervisors with the required qualifications in radiation protection. Because of the central significance of these radiation protection supervisors for radiation protection, these persons are awarded special employee protection by the new radiation protection legislation.

General requirements for employees

According to the provisions of occupational safety legislation, employees must comply with their obligations as regards their own safety and that of other persons. Those employed in the controlled area have to be instructed about the correct behaviour in the controlled area in their workplace before their first entry, and the SSV and/or the internal radiation protection supervisor must ensure that the provisions in the radiation protection instructions establish behavioural rules relevant in connection with radiation protection for those working in the controlled area. Furthermore, the correct behaviour for those working in the controlled area and/or those handling radioactive substances outside of the controlled area is verified by qualified personnel.

Requirements for radiation protection programmes

The radiation protection executive/radiation protection supervisor is obliged to compile radiation protection instructions that list the radiation protection measures that are relevant in the installation. These protection measures have to be implemented both organisationally and technically. Furthermore, the SSV/ radiation protection supervisor is obliged to work together with the works council or the staff council and to notify them on the important matters of radiation protection.

In activities requiring licensing or notification, radiation protection legislation differentiates between supervised areas, controlled areas and exclusion areas, depending on the possible extent of radiation exposure. Exclusion areas are parts of controlled areas. Controlled areas and exclusion areas have to be isolated and clearly marked. A demarcation of supervised areas is not obligatory.

According to relevant guidelines, the radiological state of a controlled area is monitored by regular checks of the local dose rate and the surface and room air contamination. In addition to this, a monitoring programme is compiled by the SSV/radiation protection supervisor that includes all frequently accessed areas of the installation, traffic routes, and workplaces.

In Germany, the protection of persons who are occupationally exposed has to be ensured in advance through structural and technical measures or through suitable working procedures. The SSV ensures that the potential for improvements in radiation protection is regularly investigated. Furthermore, the radiation protection executive stipulates criteria for the requirements of special protection measures, such as special protection measures to avoid incorporations or the spreading of contamination.

The body dose has to be determined for persons who stay in controlled areas. The principles for calculating the body dose of persons occupationally exposed are stipulated in the <u>Guideline for the</u> <u>determination of body doses from external and internal radiation exposure</u>. The procedures

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described there serve to monitor occupational exposure and to verify that the limits for the body dose are not exceeded.

Pregnant women are permitted access to controlled areas only if the competent radiation protection executive or the internal radiation protection supervisor permits this and ensures through suitable monitoring measures that the aforementioned dose limit is adhered to and that this is documented. The <u>Radiation Protection Ordinance</u> stipulates that as soon as a woman informs her employer that she is pregnant or breastfeeding, her working conditions should be arranged in such a way that internal occupational radiation exposure is not possible.

In Germany, persons under 18 may not be subjected to any occupational exposure to ionising radiation above 1 mSv per year. Exceptions are permitted with the agreement of the competent authority for persons between 16 and 18 who are undergoing vocational training.

Monitoring programmes and technical services

The requirements for monitoring, recording and controlling occupational exposure and for the medical monitoring of persons occupationally exposed are stipulated in the radiation protection legislation. Based on § 19 <u>Atomic Energy Act</u>, the competent authority has sufficient powers to enforce adherence to the regulations. This includes the verification of licensees' monitoring programmes. Furthermore, the individual official monitoring of the exposure of occupationally exposed persons is carried out by dosimetry services designated by the authorities. The required measurements of the body activity or the activity of excretions are also to be taken by dosimetry services designated by the authorities. The results of the measured values are entered into the central dose register. Anomalies are reported by the dosimetry services to the competent authority. These regulations apply to all persons, apart from patients, who stay in controlled areas. The dosimetry services must provide proof to the authorities that they have qualified staff and a quality management system (§ 169 <u>Radiation Protection Act</u>).

If it is ensured when staying in a controlled area that an effective dose of 1 mSv or organ doses higher than 50 mSv for the skin and in future 15 mSv for the eye's lens cannot be reached in a calendar year, then the competent authority can permit exceptions from the obligation for individual dose determination.

Alongside the determination of the whole-body dose by measuring the personal dose, further suitable procedures are permitted, for example the measurement of local dose rate or its calculation from the properties of the radiation source. Based on the exposure conditions, the competent authority can determine that one of these procedures is to be used additional to or instead of the measurement of

the personal dose. The sub statutory regulations contain detailed provisions for determining exposure and are referred to by the competent authority, including in the licensing procedure and during supervision.

The results of measurements and determinations of body doses have to be recorded immediately and kept until the monitored person has or would have reached the age of 75, at least for 30 years after the end of the corresponding employment. If there is a change in the employment relationship, the results of the determination have to be reported on request to the new employer. Regardless of this, these data have to be stored permanently in the central dose register at the Federal Office for Radiation Protection. From 31st December 2018 on, an individual identification number will be used for this.

The Federal Office for Radiation Protection summarises the reported data for the persons in the dose register, evaluates them and reports to the competent authority if it deems this to be necessary in terms of the results of the assessment.

In case that a worker has been exposed to radiation while working simultaneously for several employers, a radiation exposure record is required to ensure that adherence to the limits of the <u>Radiation Protection Ordinance</u> is guaranteed on the basis of overall exposure from all application areas. This radiation passbook is currently being revised and will in future follow the pattern of a European radiation passbook, so that the use of a radiation passbook throughout Europe is simplified.

For a person occupationally exposed to radiation with a possible exposure of more than 6 mSv in a calendar year, it is stipulated that they undertake tasks in the controlled area only if they have been examined by the physician authorised by the competent authority within one year before starting to undertake these tasks and if the SSV has a certificate from this physician to confirm that no health concerns form an obstacle to the undertaking of these tasks. This examination has to be repeated every twelve months. On the recommendation of the authorised physician, the competent authority can reduce this period. For persons exposed occupationally with a possible effective dose of more than 1 mSv in a calendar year, the occupational health precautions are undertaken only on the special instruction of the competent authority.

Apart from the provisions of the radiation protection legislation, further regulations apply to the layout of work spaces. For example, it is stipulated in the workplace ordinance what the employer must consider when setting up and operating workplaces in terms of safety and the protection of the health of employees.

Conclusion and necessary actions

The requirements of the Basic Safety Standards (GSR Part 3) have been fulfilled with regard to occupational radiation protection. The revised regulations of German radiation protection legislation have the effect that the sub statutory regulations also have to be adjusted. The better protection against dismissal of internal radiation protection supervisors emphasises the significance of radiation protection for the protection of employees.

1. Responsibilities and Functions of the Government				
QID	Action	Reference		
2 and 3.2	Staff analysis/Training/Competence – staff management is the responsibility of the individual licensing and supervisory authorities of the Federation and the Länder. The staff of the licensing and supervisory authorities of the Federation and the Länder who undertake tasks in the field of nuclear safety are obliged to acquire, maintain and develop their knowledge and skills in this field. This obligation arises from § 61(2) <u>Federal Civil Servants Act</u> , which obliges civil servants of the federal government to take part in measures towards official qualifications for the maintenance or development of their knowledge and skills. This is implemented in the processes of all licensing and supervisory authorities. This obligation applies in the same way to civil servants of the Länder and employees in public service.	Safety Standards Series No. SSR-5; Requirement 1 Safety Standards Series No. GSR Part 1; Requirement 2		
	 1.1 Depending on their competencies/responsibilities and against a background of changing tasks in the field of nuclear safety the licensing and supervisory authorities of the Federation and the Länder assess necessary staffing needs. 1.2 The licensing and supervisory authorities of the Federation and the Länder assess the skills required on the basis of their future tasks, the programme and concept for skills development and for staff skills and competence retention. As needed regulations for staffing level, training and further training measures for personnel are implemented in the management system of the authorities. 	M3, Question 2.1, 3 and 3.1 M4		

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2. The Global Safety Regime		
QID	Action	Reference
1 and 2	Germany contributes actively to the worldwide improvement of nuclear safety by conveying its safety-related findings through participation of German experts in all bodies at international level. This is achieved mostly through representatives from the supreme federal authorities. Staff from the licensing and supervisory authorities of the Federation and the Länder often have expertise that is not available at the BMU as such but which is of great interest internationally.	Safety Standards Series No. GSR Part 1 (Rev. 1); Requirement 14
	2.1 More active participation of all licensing and supervisory authorities of the Federation and the Länder in the fulfilment of international duties by the BMU in order to contribute the entire range of German expertise internationally.	

QID	Action	Reference
2, 4.8, 4 1	The competent licensing and supervisory authorities of the Federation and the Länder carry out their tasks in a way that ensures their effective independence.	Safety Standards Series No. GSR Part 1
7.1	3.1 Personnel of a licensing and supervisory authority of the Federation or the Länder or their authorised experts that participate in an administrative procedure may not be prejudiced under § 21 <u>Federal Administrative Procedure</u> <u>Act</u> . In case of a change of employment of NPP staff and/or licensee to an authority, care must be taken that there is no conflict of interests in the person of the applicant. Related general provisions/ processes are reviewed in the licensing and supervisory authorities of the Federation and the Länder and are further developed as required.	(Rev. 1); Requirement 17
	3.2 Further development of the information of the public by the licensing and supervisory authorities of the Federation and the Länder as set out in the obligations arising from <u>Atomic Energy Act</u> and <u>Site Selection Act</u> .	

4. Mar	4. Management System for the Regulatory Body		
QID	Action	Reference	
1, 2.1	There are extensive parallels regarding the management systems of the nuclear licensing and supervisory authorities of the Federation and the Länder. The ascertainable differences are in the specifics of the mandatory undertaking of tasks as well as in the organisational and financial parameters of the individual authorities. As a consequence, the management systems of the licensing and supervisory authorities of the Federation and the Länder have different statuses as regards the documentation of the management system and their processes.	Safety Standards Series No. GSR Part 2; Requirement 2 3.1-3.3 Safety Standards	
	 4.1 The licensing and supervisory authorities of the Federation and the Länder develop a joint understanding of safety culture. 4.2 Depending on the area of responsibility and on a case by case basis, the licensing and supervisory authorities of a safety culture. 	Series No. GSR Part 2; Requirement 3 4.1	
	the Federation and the Länder review their management systems with regard to whether any internal guidance have to be supplemented for licensing and supervision processes that are significant in the longer term.		

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QIDActionReferenceThe essential requirements of nuclear safety and the corresponding regulatory reviews and assessments are applicable to licences according to § 7 Atomic Energy Act and licences according to §§ 6, 9 and 9b Atomic Energy Act and §7 Radiation Protection Ordinance.Safety Standards Series No. GSR Part 1 (Rev. 1); Requirement 25 and 26The Handbook on Cooperation between the Federation and the Länder in Nuclear Law describes the collaboration between the Federation and the Länder in nuclear procedures. The Handbook on Cooperation between the Federation and the Länder in nuclear procedures. The Handbook on Cooperation between the Federation and the Länder agovernment oversight in the context of federal executive administration according to Article 85 of the Basic Law.Requirement oversight in the context of federal executive administration of the Handbook on Cooperation between the Federation and the Länder in Nuclear Law to include processes in licensing and supervisory authorities of the Federation and the Länder in Nuclear Law to include processes in licensing areas other than those stated aboveSafety Standards Series No. GSR Part 1 (Rev. 1); Requirement 25 and 26	5. Authorization / 6. Review and Assessment / 7. Inspection			
The essential requirements of nuclear safety and the corresponding regulatory reviews and assessments are applicable to licences according to § 7 Atomic Energy Act and licences according to §§ 6, 9 and 9b Atomic Energy Act and §7 Radiation Protection Ordinance.Safety Standards Series No. GSR Part 1 (Rev. 1); Requirement 25 and 26The Handbook on Cooperation between the Federation and the Länder in Nuclear Law describes the collaboration between the Federation and the Länder in nuclear procedures. The Handbook on Cooperation between the Federation and the Länder in Nuclear Law describes the important processes in the enforcement of the Atomic Energy Act by the Länder, including federal government oversight in the context of federal executive administration according to Article 85 of the Basic Law.Safety Standards Series No. GSR Part 1 (Rev. 1); Requirement 27,28.295.1 The licensing and supervisory authorities of the Federation and the Länder in Nuclear Law to include processes in licensing areas other than those stated aboveSafety Standards Series No. GSR Part 1 (Rev. 1); Requirement 27,28.29	QID	Action	Reference	
The Handbook on Cooperation between the Federation and the Länder in Nuclear Law describes the collaboration between the Federation and the Länder in matters related to power reactors with operating licences and the collaboration between the Federation and the Länder in nuclear procedures. The Handbook on Cooperation between the Federation and the Länder in Nuclear Law describes the important processes in the enforcement of the Atomic Energy Act by the Länder, including federal government oversight in the context of federal executive administration according to Article 85 of the Basic Law.Requirement 27,28.295.1 The licensing and supervisory authorities of the Federation and the Länder determine the need for an extension of the Handbook on Cooperation between the Federation and the Länder in Nuclear Law to include processes in licensing areas other than those stated aboveNote and the Länder in Nuclear Law to include processes inNote and the Second to the Second t		The essential requirements of nuclear safety and the corresponding regulatory reviews and assessments are applicable to licences according to § 7 <u>Atomic Energy Act</u> and licences according to §§ 6, 9 and 9b <u>Atomic Energy</u> <u>Act</u> and §7 <u>Radiation Protection Ordinance</u> .	Safety Standards Series No. GSR Part 1 (Rev. 1); Requirement 25 and 26	
5.1 The licensing and supervisory authorities of the Federation and the Länder determine the need for an extension of the <u>Handbook on Cooperation between the Federation and the Länder in Nuclear Law</u> to include processes in licensing areas other than those stated above		The Handbook on Cooperation between the Federation and the Länder in Nuclear Law describes the collaboration between the Federation and the Länder in matters related to power reactors with operating licences and the collaboration between the Federation and the Länder in nuclear procedures. The Handbook on Cooperation between the Federation and the Länder in Nuclear Law describes the important processes in the enforcement of the Atomic Energy Act by the Länder, including federal government oversight in the context of federal executive administration according to Article 85 of the Basic Law.	Requirement 27,28.29	
		5.1 The licensing and supervisory authorities of the Federation and the Länder determine the need for an extension of the <u>Handbook on Cooperation between the Federation and the Länder in Nuclear Law</u> to include processes in licensing areas other than those stated above.		

8. Enforcement

None

9. Regulation and Guides			
QID	Action	Reference	
	The <u>Safety Requirements for Nuclear Power Plants</u> apply to installations that are used for the fission of nuclear fuels for the commercial generation of electricity (NPPs) and, mutatis mutandis ("graded approach") to research reactors. To identify potentially required changes to the national regulations, the requirements are reviewed regularly to ensure that they are up to date. In the case of the <u>Safety Requirements for Nuclear Power Plants</u> , such a review is carried out every five years (Process 22, <u>Handbook on Cooperation between the Federation and the Länder in Nuclear Law</u>).	Safety Standards Series No. GSR Part 1 (Rev. 1); Requirement 32, 33, 34	
	9.1 Against the background of the new <u>Radiation Protection Act</u> and the phase out of the use of nuclear energy, the BMU, together with the licensing and supervisory authorities of the Federation and the Länder, determine the necessary demand for a redevelopment and advancement of the substatutory regulations. This should be/is guided by the needs after 2022 in particular for research reactors, decommissioning and dismantling, and storage and disposal.	RR, Question 14 and 21	

JD	Action	Reference
	Despite the decision to phase out nuclear energy until 2022, radiological emergency preparedness remains an important task for the German federal and Länder authorities. The part of the new <u>Radiation Protection Act</u> relating to radiological emergencies came into force in autumn of 2017. The <u>Radiation Protection Act</u> prescribes a range of innovations and improvements to the emergency preparedness and response system in Germany. These include i.a. the establishment of the Radiological Situation Centre of the Federation (RLZ), which consists of the main stakeholders BMU, BfS and GRS, and which is responsible in transregional emergencies for consistent situation assessments and overviews as well as for the national and international coordination of emergency response. Furthermore, the <u>Radiation Protection Act</u> prescribes the preparation of new detailed emergency response plans of the Federation and the Länder.	Safety Standards Series No. GSR Part 7; Requirement 23,
	10.1 According to § 98 <u>Radiation Protection Act</u> , the BMU prepares the federal general emergency response plan, which is agreed by the Federal Government with consent of the Bundesrat as a binding administrative regulation for all authorities of the Federation and the Länder. As a core element, the federal general emergency plan contains a catalogue of different postulated events and related scenarios, which serves as a basis for the Federation and the planning for possible emergencies in Germany or abroad. Furthermore, the federal general emergency plan contains an optimised protection strategy for each of these emergency scenarios. Until the issuing of the federal general emergency and special emergency plans, the documents specified in Appendix 4 <u>Radiation Protection Act</u> apply as the provisional federal emergency plans.	
	10.2 According to § 99 <u>Radiation Protection Act</u> , the federal ministries responsible for the respective areas compile a range of special federal emergency response plans which supplement and specify the federal general emergency plan. They represent the emergency planning and response (EP&R) for the specific and legal areas affected in an emergency (such as waste disposal, drinking water supply, traffic etc.). The special federal emergency response plans are likewise adopted as a binding administrative regulation by the Federal Government with the consent of the Bundesrat.	
	10.3 According to § 100 <u>Radiation Protection Act</u> , the Länder prepare general and special emergency response plans, which supplement the corresponding federal plans. These specify the emergency precautions for the area and the authorities of each Land. Until the issuing of the emergency response plans of the Länder, the relevant documents existing at Land level apply as provisional emergency response plans for the Länder.	

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10.4 According to § 101 Radiation Protection Act, the disaster control authorities of the Länder prepare or update external emergency response plans for the surroundings of installations with special hazard potential (such as nuclear installations). These site-specific external emergency response plans specify the emergency protection precautions and the emergency response plans of the Federation and the Länder with consideration of the local conditions and on-site emergency preparedness.	
10.5 The BMU prepares the ordinances prescribed in the emergency protection part of the <u>Radiation Protection Act</u> , if these are necessary and have not already been considered in the first article ordinance of the <u>Radiation Protection Act</u> .	

11. Safety Requirements for Occupational Radiation Protection				
QID	Acti	on	Reference	
	Agai regu	nst a background of the new radiation protection law, the organisation of radiation protection and the further lations that relate to radiation protection are reviewed.	Safety Standards Series No. GSR Part	
	11.1	The BMU prepares a general administrative provision (AVV) concerning activities for the prospective and retrospective calculation of exposure of the population, considering all relevant sources, and publishes this in the Federal Gazette.	20, 29, 30	
	11.2	The BMU prepares a general administrative provision concerning radiation passbook with the particular intention of EU-wide use of radiation passbook and publishes this in the Federal Gazette.		

10 Policy Issues

Policy issue on regulatory safety culture and maintenance of competence

Requirements Safety Standards Series No. GSR Part 1; Page 36; Requirement 11 Requirement 11: Competence for safety The government shall make provision for building and maintaining the competence of all parties having responsibilities in relation to the safety of facilities and activities. 2.34. As an essential element of the national policy and strategy for safety, the necessary professional training for maintaining the competence of a sufficient number of suitably qualified and experienced staff shall be made available. 2.35. The building of competence shall be required for all parties with responsibilities for the safety of facilities and activities, including authorized parties, the regulatory body and organizations providing services or expert advice on matters relating to safety. Competence shall be built, in the context of the regulatory framework for safety, by such means as: • Technical training; • Learning through academic institutions and other learning centres; • Research and development work.

Safety Standards Series No. GSR Part 2; Page 17; Requirement 14 (para. 6.9-6.11)

Requirement 14: Measurement, assessment and improvement of leadership for safety and of safety culture

Senior management shall regularly commission assessments of leadership for safety and of safety culture in its own organization.

Starting point and objective

The nuclear phase-out that has been decided in Germany goes hand in hand with new, different challenges. On the one hand, these relate to questions concerning the maintenance and further development of the safety culture practiced in Germany. On the other hand, changing processes away from the active use of nuclear energy and towards decommissioning and dismantling, storage and eventually disposal must be integrated into the future concept developments. These processes are complex, and it will only become clear in practice how they can be steered jointly, i.e. by the Federal Government, its subordinate agencies, the Länder, the licensees, and the technical support organisations. It is already clear, however, that maintaining competence and adjusting the emphasis in the areas of decommissioning and disposal will be a key element in mastering the challenges. This applies not only to national processes, but also extends to international context. German contributions to improving nuclear safety in countries close to its borders and worldwide can be made only with the necessary expertise.

Regulatory safety culture (supervisory culture)

Maintaining and promoting their supervisory culture beyond the operating time of the nuclear power plants is important to the authorities in Germany as the decommissioning and dismantling of the nuclear power plants as well as other nuclear installations continue to be subject to state supervision, whereby the protection of man and the environment remains an overriding priority.

The initiated process towards a common understanding of regulatory safety culture of the nuclear authorities in Germany is therefore to be continued. It is intended to contribute to the promotion of regulatory safety culture across all authorities as well as within each individual authority.

This raises the question of suitable methods for self-reflection and self-assessment of the regulatory safety culture and measures for its promotion and improvement.

Maintenance of competence

The phase-out of the commercial use of nuclear energy will lead to a shift in the tasks and priorities of many authorities and their technical support organisations towards decommissioning and dismantling, storage, and eventually to disposal. Germany strives to contribute also in future to the further development of safety requirements and regulations at the international level and to continue fulfilling its responsibility. However, this can only be achieved with the necessary expertise.

Competencies in decommissioning and dismantling as well as in questions of disposal should therefore be maintained and expanded upon. However, existing know-how in the field of nuclear engineering should also be maintained and, if necessary, developed further.

Questions for the experts about the regulatory safety culture (supervisory culture)

What experiences are there regarding self-reflections and self-assessments of the safety culture across heterogeneous organisations? Who is involved in the joint reflection/discussion?

Which measures to promote and strengthen safety culture are suitable for organisations in transition? How should the changing risk potential be taken into account?

Questions to the experts on maintaining competence

What measures can be taken to provide qualified staff over longer periods of time?

What methods are suitable to motivate existing staff to take on new topics? What methods are used in the experts' countries for the recruitment of junior staff?

Policy issue: Informing the public about operational activities and changes at the sites of nuclear facilities

Requirements

Safety Standards Series No. GSR Part 1 (Rev. 1); Page 56; Requirement 36

Requirement 36: Communication and consultation with interested parties

The regulatory body shall promote the establishment of appropriate means of informing and consulting interested parties and the public about the possible radiation risks associated with facilities and activities, and about the processes and decisions of the regulatory body.

4.66. The regulatory body shall establish, either directly or through authorized parties, provision for effective mechanisms of communication, and it shall hold meetings to inform interested parties and the public and for informing the decision-making process. This communication shall include constructive liaison such as:

(a) Communication with interested parties and the public on regulatory judgements and decisions;

4.67. The regulatory body, in its public informational activities and consultation, shall set up appropriate means of informing interested parties, the public and the news media about the radiation risks associated with facilities and activities, the requirements for protection of people and the environment, and the processes of the regulatory body. In particular, there shall be consultation by means of an open and inclusive process with interested parties residing in the vicinity of authorized facilities and activities, and other interested parties, as appropriate [1]. Interested parties including the public shall have an opportunity to be consulted in the process for making significant regulatory decisions, subject to national legislation and international obligations. The results of these consultations shall be taken into consideration by the regulatory body in a transparent manner.

4.68. The authorized party shall inform the public about the possible radiation risks (arising from operational states and accidents, including events with a very low probability of occurrence) associated with the operation of a facility or the conduct of an activity. This obligation shall be specified in the regulations promulgated by the regulatory body, in the authorization or by other legal means.

4.69. Public information activities shall reflect the radiation risks associated with facilities and activities, in accordance with a graded approach.

Starting point and objective

In addition to the specified form of public participation in nuclear licensing procedures, the nuclear rules and regulations contain requirements for the information of the public by the licensee and the authority concerning the specified normal operation of the nuclear facilities as well as reportable events and accidents. The local population as well as the stakeholders in the vicinity of a nuclear facility are to be given special consideration. Different communication formats (internet, informative events, etc.) are used for this purpose. In addition to these formal procedures, the nuclear authorities in Germany endeavour to regularly inform the general public in the vicinity of nuclear facilities about

safety aspects of operations and of changes in the nuclear power plants. Experience shows that interest is generally rather low as long as no significant events occur.

To inform the public about the decommissioning of a nuclear power plant, communication formats such as information committees, public debates, etc. are used in particular. The parties involved (local representatives and elected representatives, citizens' initiatives and environmental associations, authorities, citizens, etc.) have different interests. In addition to safety-related issues connected in particular with the topics of interim storage and disposal of radioactive waste, any changes in the site locality affecting the economy, the labour market and everyday life in the region could also be addressed. These topics are not yet part of the information provided to the population.

The question therefore arises of what suitable forms of information and communication with the population are and what contents should be discussed.

Questions for the experts

- What experience is there with regular formats of information and communication with the public? Are these organised by the regulatory authority, the licensee, or a different institution?
- Which measures by the supervisory and licensing authority (provision of information on the internet, communication via social media, communication with stakeholders and multipliers, information via the media, etc.) prove to be particularly effective with regard to the confidence of the public in the safety-related supervision by the authorities?
- What experience is there with committees and others who deal not only with safety issues but also with other issues relevant to the site in the long run? What role does the nuclear authority play in this?

11 **Further Documentation**

In the following a list of further documentation is giving including the documents with the detailed answers to the SARIS self-assessment questions and references of the German regulatory system. In the electronic format of the ARM links to these documents have been included. All documents are provided together with the ARM in electronic format.

Self-assessment

Module 1 Responsibilities and Functions of the Government Module 2 Global Safety Regime Module 3 Responsibilities and Functions of the Regulatory Body Module 4 Management System for the Regulatory Body Module 5 Authorization Module 6 Review and Assessment Module 7 Inspection Module 8 Enforcement Module 9 Regulations and Guides Module 10 Basic Primary Responsibilities of the Regulatory Body in Emergency Module 11 Safety of Occupational Radiation Protection **Regulation of Nuclear Power Plants** Regulation of Research Reactors Regulation of Fuel Cycle Facilities Regulation of Decommissioning of Facilities Safety Requirements for Predisposal Management of Radioactive Waste

Safety Requirements for Disposal of Radioactive Waste





Law and convention

- Basic Law for the Federal Republic of Germany (GG) of 23rd May 1949, last Amendment of 13th July 2017, Excerpt art. 20, 30, 51, 64, 65, 73, 85, 87c
- Act on the peaceful utilisation of nuclear energy and the protection against its hazards (Atomic Energy Act) of 23rd December 1959, as amended and promulgated on 15th July 1985, last amendment of 26th July 2016
- Act on the Protection against the Harmful Effects of Ionizing Radiation (Radiation Protection Act StrlSchG), of 27th June 2017, excerpt
- Act on the Search for and Selection of a Site for a Disposal Facility for High-Level Radioactive Waste (Site Selection Act –StandAG) of 5th May 2017, last amendment of 20th July 2017
- Act on the Convention of 26th October 1979 on the Physical Protection of Nuclear Material, of 24th April 1990, last amendment of 26th January 1998
- Act on the Establishment of a Fund for the Financing of Nuclear Waste Management (Waste Management Fund Act EntsorgFondsG) of 27th January 2017, amended by Article 1 of the Ordinance of 16th June 2017
- Act on Transparency Regarding the Costs of Decommissioning and Dismantling of Nuclear Power Plants and the Packaging of Radioactive Waste (Transparency Act), of 27th January 2017

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- Convention on Nuclear Safety, Report by the Government of the Federal Republic of Germany for the Seventh Review Meeting in March/April 2017
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Report of the Federal Republic of Germany for the Sixth Review Meeting in May 2018

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- Ordinance on the Protection against Damage and Injuries Caused by Ionizing Radiation (Radiation Protection Ordinance), 26th July 2016
- Ordinance on the Shipment of Radioactive Waste or Spent Fuel (Nuclear Waste Shipment Ordinance) of 30th April 2009, last amendment of 27th June 2017
- Ordinance Concerning the Financial Security Pursuant to the Atomic Energy Act (Nuclear Financial Security Ordinance), as of 25th January 1977, last Amendment of 27th June 2017
- Cost Ordinance under the Atomic Energy Act (AtKostV), as of 17th December 1981, last amendment of 27th June 2017
- Ordinance on the Nuclear Safety Officer and the Reporting of Incidents and other Events (Nuclear Safety Officer and Reporting Ordinance), of 14th October 1992, last Amendment of 8th June 2010
- Modification of the Nuclear Safety Officer and Reporting Ordinance, 29th November 2018
- Ordinance on the Procedure for Licensing of Installations under § 7 of the Atomic Energy Act (Nuclear Licensing Ordinance), of 18th February 1977, as Amended and Promulgated on 3rd February 1995, last amendment of 20th June 2017
- Ordinance on the verification of trustworthiness as a protection against diversion or release of radioactive material in accordance with the Atomic Energy Act (Nuclear Trustworthiness Verification Ordinance AtZüV), of 1st July 1999, last amendment of 27th. June 2017
- Ordinance Concerning Prepayments for the Erection of Federal Facilities for the Long-Term Engineered Storage and Disposal of Radioactive Waste (Disposal Prepayment Ordinance), of 28th April 1982, last amendment of 27th June 2017

- Code of Administrative Court Procedure (VwGO) of 21st January 1960, last amendment of 8th. October 2017, Excerpt §§ 42, 43
- Ordinance on the Requirements and Methods for the Disposal of Radioactive Waste (Nuclear Waste Disposal Ordinance – AtEV), 29th November 2019
- Ordinance on the stipulation of dose values for early emergency response measures (Emergency Dose Values Ordinance NDWV), 29th November 2019

General administrative provisions

- <u>General Administrative Provisions on the Integrated Measurement and Information System for</u> <u>Monitoring Radioactivity in the Environment (IMIS) in accordance with the Precautionary</u> <u>Radiation, Protection Act (AVV-IMIS) of 13th December 2006</u>
- <u>General Administrative Provision regarding § 47 Radiation Protection Ordinance: Determination of</u> <u>radiation exposure due to the discharge of radioactive substances from installations or facilities,</u> <u>only cove page and table of content</u>
- <u>General Administrative Provision regarding § 40 (2), § 95 (3) of the Radiation Protection Ordinance</u> and § 35 (2) of the der X-ray Ordinance (AVV Radiation Passbook), 20th July 2004, only cover page

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- Data for the Evaluation of Site Properties for Nuclear Power Plants of 11th June 1975, Edition 7/98
- <u>Guide to the decommissioning, the safe enclosure and the dismantling of facilities or parts thereof</u> as defined in § 7 of the Atomic Energy Act as at 23rd June 2016
- Safety Review for Nuclear Power Plants pursuant to § 19a of the Atomic Energy Act Guide Probabilistic Safety Analysis - of 30th August 2005, Edition 08/05
- <u>Guideline concerning Emission and Immission Monitoring of Nuclear Installations of 7th December</u> 2005, Edition 12/05
- Guideline on the Control of Residual Radioactive Material and Radioactive Waste, 19th November 2018
- <u>Guideline Deterministic Physical Protection Analysis for the Performance of Periodic Safety Reviews</u> (PSR) for Nuclear Power Plants in the Federal Republic of Germany – Part II – Guideline Deterministic Physical Protection Analysis
- Guideline Relating to Measures for the Protection of Facilities of the Nuclear Fuel Cycle and Other Nuclear Facilities against Disturbances or Other Interference by Individuals Entitled to Access to the Facility of 28th January 1991, Edition 3/93
- Guideline for the Maintenance of Technical Qualification of Responsible Nuclear Power Plant Personnel, Edition 08/13
- Guideline Relating to the Procedure for the Preparation and Implementation of Maintenance Work and Modifications at Nuclear Power Plants of 1st June 1978, Edition 06/78
- <u>Guideline for the Protection of Nuclear Power Plants against Pressure Waves from Chemical</u> <u>Reactions by Means of the Design of Nuclear Power Plants with Regard to Strength and Induced</u> <u>Vibrations and by Means of the Adherence to Safety Distances of 13th September 1976, Edition</u> <u>1/77</u>
- Guideline Relating to Measures for the Protection of Facilities of the Nuclear Fuel Cycle and Other Nuclear Facilities against Disturbances or Other Interference by Individuals Entitled to Access to the Facility of 28th January 1991
- Guideline for the Technical Qualification of Radiation Protection Officers at Installations for the Fission of Nuclear Fuel, Edition 02/14
- <u>Guideline relating to the Technical Qualification of Responsible Persons in Facilities for the</u> <u>Production of Fuel Elements for Nuclear Power Plants of 30th November 1995, Edition 4/97</u>
- <u>Guideline on Technical Qualification Required in Radiation Protection (Technical Qualification</u> <u>Guideline Pursuant to the Radiation Protection Ordinance) of 18th June 2004, only cover page</u> <u>and table of content</u>
- <u>Guidelines Concerning the Requirements for Safety Specifications for Nuclear Power Plants:</u> <u>Checklist for Format and Content of Safety Specifications for Nuclear Power Plants of 27th April 1976, Edition 6/77</u>
- <u>Guideline Concerning the Proof of the Technical Qualification of Nuclear Power Plant Personnel,</u> <u>Edition 05/12</u>
- Guideline Relating to the Proof of the Technical Qualification of Research Reactor Personnel of 16th February 1994, Edition 3/96
- <u>Guides for the Periodic Safety Review of Nuclear Power Plants (Basics of the Periodic Safety</u> <u>Review, Safety Status Analysis, Probabilistic Safety Analysis) of 18th August 1997, Edition 08/97</u>
- <u>Guideline for Radiation Protection of Personnel during the Execution of Maintenance Work in</u> <u>Nuclear Power Plants with Light Water Reactors, Part 1: The Precautionary Protective Measures</u> to be taken during the Planning of the Plant of 10th July 1978, Edition 14/78
- Guideline concerning the Radiation Protection of the Personnel during Maintenance, Modification, Waste Management and Dismantling Work in Nuclear Facilities and Installations, Part 2:

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- List of Contents and Structure of a Standard Safety Analysis Report for Nuclear Power Plants with <u>Pressurized Water Reactor or Boiling Water Reactor, Edition 08/76</u>
- <u>Guideline on Requirements for Personal Dose Measurement Offices in Accordance with the</u> <u>Radiation Protection and X-Ray Ordinance of 10th December 2001</u>
- Principles for the Applicant's/Licensee's Documentation of Technical Documents Pertaining to the Construction, Operation, and Decommissioning of Nuclear Power Plants of 19th February 1988, Edition 5/89
- Requirements for the Documentation at Nuclear Power Plants of 8th August 1982, Edition 7/85
- Requirements Relating to the Physical Protection Service and Physical Protection Officers at Nuclear Facilities and Installations of 4th July 2008, Edition 08/08
- Guideline for the determination of body doses from external and internal radiation exposure Part 1: "Determination of the body dose in the case of external radiation exposure" (§§ 40, 41, 432 StrlSchV; §35 RöV) of 8th December 2003, BMU circular of 8/12/2003 - RS II 3 - 15530/1, only cover page and table of content
- <u>Guideline for the determination of body doses from external and internal radiation exposure, Part 2:</u> <u>Determination of the Body Dose in the Case of Internal Radiation Exposure (Incorporation</u> <u>monitoring) (§§ 40, 41 and 42 StrlSchV) of 12th January 2007, only cover page and table of</u> <u>content</u>
- Safety Criteria for the Final Disposal of Radioactive Wastes in a Mine of 20th April 1983, Edition 3/84
- Nuclear Power Plant Safety Criteria: Promulgation of 21st October 1977 updated and replaced by the Safety Requirements for Nuclear Power Plants of 3rd March 2015 and the interpretations on this of 29th November 2013 as amended on 3rd March 2015, Edition 10/77
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- Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste, As at 30th September 2010
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- Interpretations of the "Safety Requirements for Nuclear Power Plants", 3rd March 2015
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- Final Report of Commission on Storage of High-Level Radioactive Waste, 20th March 2018

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- Recommendation of the Nuclear Waste Management Commission (ESK), 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
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- Recommendation of the Nuclear Waste Management Commission (ESK), Guidelines for dry cask storage of spent fuel and heat-generating waste, Revised version of 10th June 2013
- Recommendation of the Nuclear Waste Management Commission (ESK), ESK guidelines for the storage of radioactive waste with negligible heat generation, Revised version of 10th June 2013
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- Recommendation of the Nuclear Waste Management Commission (ESK), Guideline on the safe operation of a disposal facility for in particular heat-generating radioactive waste
- Joint Recommendation by the Reactor Safety Commission (RSK) and the Radiation Protection Commission (SSK), Criteria for alerting the disaster control authority by the operators of nuclear facilities
- <u>RSK statement (481st meeting of the Reactor Safety Commission (RSK) on 10th February 2016),</u> <u>Aspects of the determination of the site-specific design basis flood</u>
- <u>RSK statement (462nd meeting of the Reactor Safety Commission (RSK) on 6th November 2013),</u> <u>Assessment of the coverage of extreme weather conditions by the existing design</u>
- <u>RSK Statement (488th Meeting of the Reactor Safety Commission (RSK) on 3rd November 2016),</u> <u>Lightning with parameters above the standard lightning current parameters</u>
- Recommendation of the Commission on Radiological Protection and the Reactor Safety Commission (SSK), General guidelines for emergency planning by nuclear power plant operators
- Recommendation of the German Commission on Radiological Protection (SSK), General Guidelines for Emergency Response in the Vicinity of Nuclear Installations
- Recommendation from the Commission on Radiological Protection (SSK), Guideline for Informing the Public in Nuclear Emergencies
- Recommendation by the German Commission on Radiological Protection (SSK), Basic Radiological Principles for Decisions on Measures for the Protection of the Population against Incidents involving Releases of Radionuclides

ΚΤΑ

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- KTA 1202 (2017-11), Requirements for the Testing Manual
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- KTA 1401 (2017-11), General Requirements for the Quality Assurance
- KTA 1402 (2017-11), Integrated Management System for the Safe Operation of Nuclear Power Plants
- KTA 1403 (2017-11), Ageing-Management in Nuclear Power Plants
- KTA 1404 (2013-11), Documentation during Construction and Operation of Nuclear Power plants
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- KTA 1408.2 (2017-11), Quality Assurance of Weld Filler Metals and Welding Consumables for Pressure- and Activity-Retaining Systems in Nuclear Power Plant, Part 2: Manufacture
- KTA 1408.3 (2017-11), Quality Assurance of Weld Filler Metals and Welding Consumables for Pressure- and Activity-Retaining Systems in Nuclear Power Plants, Part 3: Processing
- KTA 1501 (2017-11), Stationary System for Monitoring the Local Dose Rate within Nuclear Power Plants
- KTA 1502 (2017-11), Monitoring Volumetric Activity of Radioactive Substances in the Inner Atmosphere of Nuclear Power Plants
- <u>KTA 1503.1 (2016-11), Monitoring the Discharge of Radioactive Gases and Airborne Radioactive</u> <u>Particulates, Part 1: Monitoring the Discharge of Radioactive Matter with the Stack Exhaust Air</u> <u>During Specified Normal Operation</u>
- KTA 1503.2 (2017-11), 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 (2017-11), Monitoring the Discharge of Radioactive Gases and Airborne Radioactive Particulates, Part 3: Monitoring the Non-Stack Discharge of Radioactive Matter

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- KTA 1505 (2017-11), Suitability Verification of the Stationary Measurement Equipment for Radiation Monitoring
- KTA 1507 (2017-11), Monitoring the Discharge of Radioactive Substances from Research Reactors
- KTA 1508 (2017-11), Instrumentation for Determining the Dispersion of Radioactive Substances in the Atmosphere
- KTA 2101.1 (2015-11), Fire Protection in Nuclear Power Plants, Part 1: Basic Requirements
- KTA 2101.2 (2015-11), Fire Protection in Nuclear Power Plants, Part 2: Fire Protection of Civil Structures
- KTA 2101.3 (2015-11), Fire Protection in Nuclear Power Plants, Part 3: Fire Protection of Mechanical and Electrical Plant Components
- KTA 2103 (2015-11), Explosion Protection in Nuclear Power Plants with Light Water Reactors (General and Case-Specific Requirements)
- KTA 2201.1 (2011-11), Design of Nuclear Power Plants against Seismic Events, Part 1: Principles
- KTA 2201.2 (2012-11), Design of Nuclear Power Plants Against Seismic Events, Part 2: Subsoil
- KTA 2201.3 (2013-11), Design of Nuclear Power Plants Against Seismic Events, Part 3: Civil Structures
- KTA 2201.4 (2012-11), Design of Nuclear Power Plants against Seismic Events, Part 4: Components
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- KTA 2206 (2009-11), Design of Nuclear Power Plants Against Damaging Effects from Lightning
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- KTA 2501 (2015-11), Structural Waterproofing in Nuclear Power Plants
- KTA 2502 (2011-11), Mechanical Design of Fuel Assembly Storage Pools in Nuclear Power Plants with Light Water Reactors
- KTA 3101.1 (2016-11), Design of Reactor Cores of Pressurized Water and Boiling Water Reactors, Part 1: Principles of the Thermo-Hydraulic Design
- <u>KTA 3101.2 (2012-11), Design of Reactor Cores of Pressurized Water and Boiling Water Reactors;</u> <u>Part 2: Neutron-Physical Requirements for the Design and Operation of the Reactor Core and</u> <u>Adjacent Systems</u>
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- KTA 3102.1 (1978-06), Reactor Core Design for High-Temperature Gas-Cooled Reactors, Part 1: Calculation of the Material Properties of Helium
- KTA 3103 (2015-11), Shutdown Systems for Light Water Reactors
- KTA 3104 (1979-10), Determination of the Shutdown Reactivity
- KTA 3107 (2014-11), Nuclear Criticality Safety Requirements during Refueling
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- KTA 3201.2 (2017-11), Components of the Reactor Coolant Pressure Boundary of Light Water Reactors, Part 2: Design and Analysis
- KTA 3201.4 (2016-11), Components of the Reactor Coolant Pressure Boundary of Light Water Reactors, Part 4: In-service Inspections and Operational Monitoring
- KTA 3205.3 (2011-06), Component Support Structures with Non-Integral Connections, Part 3: Series-Production Standard Supports
- KTA 3206 (2014-11), Break Preclusion Verifications for Pressure-Retaining Components in Nuclear Power Plants
- KTA 3211.1 (2017-11), Pressure- and activity-retaining components of systems outside the primary circuit, Part 1: Materials
- KTA 3211.2 (2013-11), Pressure and Activity Retaining Components of Systems Outside the Primary Circuit, Part 2: Design and Analysis
- KTA 3301 (2015-11), Residual Heat Removal Systems of Light Water Reactors
- KTA 3303 (2015-11), Heat Removal Systems for Fuel Pools in Nuclear Power Plants with Light Water Reactors
- KTA 3401.1 (1988-09), Steel Containment Vessels, Part 1: Materials
- KTA 3401.2 (2016-11), Steel Containment Vessels, Part 2: Design and Analysis
- KTA 3401.3 (1986-11), Steel Reactor Safety Containment, Part 3: Manufacture
- KTA 3401.4 (2017-11), Steel Containment Vessels, Part 4: In-service Inspections
- KTA 3402 (2014-11), Airlocks on the reactor containment of nuclear power plants Personnel airlocks
- KTA 3403 (2015-11), Cable Penetrations through the Reactor Containment Vessel of Nuclear Power Plants
- KTA 3404 (2013-11), Isolation of Operating System Pipes Penetrating the Containment Vessel in the Case of a Release of Radioactive Substances into the Containment Vessel
- KTA 3405 (2015-11), Leakage Test of the Reactor Containment Vessel
- KTA 3407 (2017-11), Pipe penetrations through the Reactor Containment Vessel

- KTA 3409 (2009-11), Airlocks on the reactor containment of nuclear power, plants Equipment airlocks
- KTA 3413 (2016-11), Determination of Loads for the Design of a Full Pressure Containment Vessel against Plant-internal Incidents
- KTA 3501 (2015-11), Reactor Protection System and Monitoring Equipment of the Safety System
- KTA 3502 (2012-11), Accident Measuring Systems
- KTA 3503 (2015-11), Type Testing of Electrical Modules for the Instrumentation and Control System Important to Safety
- KTA 3504 (2015-11), Electrical Drive Mechanisms of the Safety System in Nuclear Power Plants
- KTA 3505 (2015-11), Type Testing of Measuring Sensors and Transducers of the Instrumentation and Control System Important to Safety
- KTA 3507 (2014-11), 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 (2017-11), Ventilation Systems in Nuclear Power Plants
- KTA 3602 (2003-11), Storage and Handling of Fuel Assemblies and Associated Items in Nuclear Power Plants with Light Water Reactors
- KTA 3603 (2017-11), Facilities for Treating Radioactively Contaminated Water in Nuclear Power Plants
- KTA 3604 (2005-11), Storage, Handling, and Plant-internal Transport of Radioactive Substances in Nuclear Power Plants (with the Exception of Fuel Assemblies)
- KTA 3605 (2017-11), Treatment of Radioactively Contaminated Gases in Nuclear Power Plants with Light Water Reactors
- KTA 3702 (2014-11), Emergency Power Generating Facilities with Diesel-Generator Units in Nuclear Power Plants
- KTA 3703 (2012-11), Emergency Power Facilities with Batteries and AC/DC Converters in Nuclear Power Plants
- KTA 3705 (2013-11), Switchgear, Transformers and Distribution Networks for the Electrical Power Supply of the Safety System in Nuclear Power Plants
- KTA 3706 (2000-06), Ensuring the Loss-of-Coolant-Accident Resistance of Electrotechnical Components and of Components in the Instrumentation and Controls of Operating Nuclear Power Plants
- KTA 3901 (2017-11), Communication Means for Nuclear Power Plants
- KTA 3902 (2012-11), Design of Lifting Equipment in Nuclear Power Plants
- KTA 3903 (2012-11), Inspection, Testing and Operation of Lifting Equipment in Nuclear Power Plants

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KTA 3905 (2012-11), Load Attaching Points on Loads in Nuclear Power Plants

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- KTA 3201.3 (2007-11), Components of the Reactor Coolant Pressure Boundary of Light Water Reactors; Part 3: Manufacture
- KTA 3204 (2017-11), Reactor Pressure Vessel Internals
- <u>KTA 3205.1 (2018-10), Component Support Structures with Non-integral Connections; Part 1:</u> <u>Component Support Structures with Non-integral Connections for Components of the Reactor</u> <u>Coolant Pressure Boundary of Light Water Reactors</u>
- <u>KTA 3205.2 (2018-12), Component Support Structures with Non-integral Connections; Part 2:</u> <u>Component Support Structures with Non-Integral Connections for Pressure and Activity-</u> <u>Retaining Components in Systems Outside the Primary Circuit</u>
- <u>KTA 3211.3 (2017-11)</u>, Pressure and Activity Retaining Components of Systems Outside the Primary <u>Circuit; Part 3: Manufacture</u>
- <u>KTA 3211.4 (2017-11)</u>, Pressure and Activity Retaining Components of Systems Outside the Primary <u>Circuit; Part 4: Inservice Inspections and Operational Monitoring</u>
- KTA 3506 (2017-11), System Testing of the Instrumentation and Control Equipment Important to Safety of Nuclear Power Plants
- KTA 3701 (2014-11), General Requirements for the Electrical Power Supply in Nuclear Power Plants
- KTA 3704 (2013-11), Emergency Power Facilities with Static and Rotating AC/DC Converters in Nuclear Power Plants

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- Act on the Implementation of Measures of Occupational Safety and Health to Encourage Improvements in the Safety and Health Protection of Workers at Work, as of 31st August 2015, Excerpt: Sections 15, 21
- Federal Civil Servants Act (BBG), as of 08th June 2017, excerpt: § 61
- Act to promote electronic government (E-Government Act EgovG), as of 25th July 2013, Excerpt: section 9
- Industrial code (GewO), as of 17th October 2017, Excerpt: Section 139b
- German Commercial Code (HGB), as of 18th July 2017, Excerpt § 249
- Model Building Regulation (MBO), as of 13th May 2016, Excerpt § 14
- Criminal Code, as of 30th October 2017, Excerpt: <u>§§ 89a, 126, 129a, 138, 140, 145, 306-330</u>

Environmental Information Act (UIG), as of 20th July 2017

- Environmental Impacts Assessment Act (UVPG), as of 12th February 1990, last Amendment of 8th September 2017, Excerpt §§ 1, 6, 16, 18, Annex 1
- Implementation law for the verification treaty and for the additional treaty and for the additional protocol (VerifZusAusfG), as of 29th January 2000, Excerpt § 2

International treaties

- ADR, European Agreement concerning the International Carriage of Dangerous Goods by Road, Volume I
- No. 14120, Multilateral, Convention relating to civil liability in the field of maritime carriage of nuclear material (with Final Act and official Russian and Spanish translations). Concluded at Brussels on <u>17th December 1971</u>
- Budapest convention on the Contract for the Carriage of Goods by Inland Waterway (CMNI) done at Budapest on 22nd June 2001
- <u>C115</u> Radiation Protection Convention, 1960 (No. 115), Convention concerning the Protection of Workers against Ionising Radiations (Entry into force: 17th June 1962)
- Convention on access to information, public participation in decision-making and access to justice in environmental matters, done at Aarhus, Denmark, on 25th June 1998
- Convention on Civil Liability for Damage Caused during Carriage of Dangerous Goods by Road, Rail and Inland Navigation Vessels (CRTD), Geneva, 10th October 1989
- IAEA INFCIRC/335, 18th November 1986, Convention on Early Notification of a Nuclear Accident
- IAEA INFCIRC/449, 5th July 1994, Convention on Nuclear Safety
- IAEA INFCIRC/567, 22nd July 1998, Convention on Supplementary Compensation for Nuclear Damage
- Convention on the Establishment of a Security Control in the Field of Nuclear Energy
- Convention on the Liability of Operators of Nuclear Ships, 1962
- IAEA INFCIRC/274, November 1979, Text of the Convention on the Physical Protection of Nuclear Material
- <u>1996, Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and</u> <u>other Matter, 1972 (as amended in 2006)</u>
- <u>1988, UN Treaty Series, Convention on Third Party Liability in the Field of Nuclear Energy,</u> <u>concluded at Paris on 29th July 1960</u>

- Convention of 31st January 1963 Supplementary to the Paris Convention of 29th July 1960, as amended by the additional Protocol of 28th January 1964 and by the Protocol of 16th November <u>1982 ("Brussels Supplementary Convention")</u>
- Convention relative aux transports internationaux ferroviaires (COTIF) du 9 mai 1980, dans la teneur du Protocole de modification du 3 juin 1999
- Convention on Environmental Impact Assessment in a Transboundary Context, UN 1991
- European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN)

International Convention for the Suppression of Acts of Nuclear Terrorism, UN 2005

- IAEA INFCIRC/546, 24th December 1997, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
- OECD, Decision on the Adoption of Radiation Protection Standards for Radioluminous Timepieces (The Council having regard to Article 5(a) and (b) of the Convention on the Organisation for Economic Co-operation and Development of 14th December 1960
- IAEA INFCIRC/140, 22nd April 1970, Treaty on the Non-Proliferation of Nuclear Weapons

IAEA INFCIRC/500, 20th March, 1996, Vienna Convention on Civil Liability for Nuclear Damage

EU directives

- <u>COMMISSION REGULATION (EURATOM) No 302/2005 of 8th February 2005 on the application of</u> <u>EURATOM safeguards</u>
- DIRECTIVE 2003/4/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 28th January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC
- <u>COUNCIL DIRECTIVE 2006/117/EURATOM of 20th November 2006 on the supervision and control</u> of shipments of radioactive waste and spent fuel
- COUNCIL DIRECTIVE 2009/71/EURATOM of 25th June 2009 establishing a Community framework for the nuclear safety of nuclear installations
- <u>COUNCIL DIRECTIVE 2011/70/EURATOM of 19th July 2011 establishing a Community framework</u> for the responsible and safe management of spent fuel and radioactive waste
- <u>COUNCIL DIRECTIVE 2013/59/EURATOM of 5th December 2013 laying down basic safety</u> standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/EURATOM, 90/641/EURATOM, 96/29/EURATOM, 97/43/EURATOM and 2003/122/EURATOM
- <u>COUNCIL DIRECTIVE 2014/87/EURATOM of 8th July 2014 amending Directive 2009/71/EURATOM</u> <u>establishing a Community framework for the nuclear safety of nuclear installations</u>

BMU organisation

Strategic Plan for the General Directorate RS

Annual Objectives 2018 BMUB/RS Division

- Directive for the processing and administration of written material (files and documents) in federal ministries (RegR)
- Framework Agreement on Co-operation in the Field of Nuclear Safety and Radiation Protection between the Federal Republic of Germany represented by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH

<u>Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH, Articles of association, 26 August</u> 2014

Framework agreement for personnel development at the BMUB

Rules of Procedure of the BMU (GO-BMU)

Joint Rules of Procedure of the Federal Ministries (GGO) as at 1st September 2011

Handbook on Cooperation between the Federation and the Länder in Nuclear Law (as at June 2018)

QM Manual - Central Document - Directorate-General S

- Process description Alarming from the international reporting systems of the EU and the IAEA – Directorate-General S
- Process description General administrative provisions (AVV) Directorate-General S
- Process description Budgeting Directorate-General S
- Process description Federal supervision Directive Directorate-General S
- Process description Preparation and performance of emergency response exercises (IMIS)
 <u>Directorate-General S</u>
- Process description Legislative procedure according to EURATOM Treaty "EAEC" Directorate-General S
- Process description Federal supervision-Licensing procedure Directorate-General S
- Process description Federal supervision-Supervisory procedure (including technical supervision) – Directorate-General S
- Process description Regular reports to the German Bundestag and the Bundesrat Directorate-General S
- Process description Fulfilment of international conventions Directorate-General S

- Process description Participation in international emergency response exercises Directorate-General S
- Process description Collaboration in the drafting of KTA Safety Standards Directorate-General S
- Process description LAA Main Committee and Technical Committees Directorate-General S
- Process description Drawing-up of the departmental research plan Directorate-General S
- Process description Technical supervision-Licensing Procedures Directorate-General S
- <u>Procedure Advisory request to ESK Directorate-General S</u>
- Procedure Advisory request to RSK SSK Directorate-General S
- <u>Procedure Appointment ESK members Directorate-General S</u>
- Procedure Appointment of members of the KTA Directorate-General S
- <u>Work Procedure Appointment RSK/SSK members Directorate-General S</u>
- Work Procedure Process according to Article 37 EURATOM Treaty Directorate-General S

Training concept for BMU employees

- BMU Compulsory training measures for lower level and middle level public employees Annex 1, Modul A
- BMU Compulsory training measures for upper middle level and upper level public employees
 Annex 1, Modul B
- BMU Compulsory training measures for public service executives Annex 1, Modul C

Information Notice on reportable events in nuclear power plants in the Federal Republic of Germany (IN 2016/02) – "Failure of a 6.3-/0.4-kV emergency power transformer by actuation of the Buchholz protection at the Isar 1 nuclear power plant"

- Information Notice on reportable events in nuclear power plants in the Federal Republic of Germany (IN 2018/05) – "Detachment of a Fuel Bundle From the Fuel Assembly's Upper Plate" – Aspects of the Handling Impact on the Fuel Element Sup-port Structure – in NPP KRB-II-C on 05th November 2015"
- Information Notice on reportable events in nuclear power plants in the Federal Republic of Germany (IN 2018/03) – "Oil leakage from a main coolant pump with local flame formation at the Emsland nuclear power plant on 27th October 2013"

Länder references

Bavarian Disaster Control Act (BayKSG) as of 24th July 1996, Excerpt Art. 1, 3, 3a, 6

- Act on Fire Protection, Assistance and Disaster Control of the Land of Brandenburg (Brandenburg Fire and Disaster Control Act - BbgBKG) as of 18th June 2018, excerpt: § 40, 48
- Ordinance of the Ministry of the Environment, the Ministry of Social Affairs and the Ministry of Rural Areas and Consumer Protection on responsibilities according to § 19 of the Atomic Energy Act and the Radiation Protection Ordinance (Radiation Protection Competence Ordinance -StrlSchZuVO), as of 17th January 2009

Act on hazard prevention in the case of disasters (Disaster Control Act – KatSG) as of 9th May 2016, excerpt: § 5

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- MS-AH-400-P, Supervision, monitoring, licensing, State of revision 12/2010
- MS-AH-400-R, Supervision, monitoring, authorization, Status of revision 11/2017
- <u>MS-AH-402-V</u>, Structure chart of the Supervision Manual (AHB) of Department Nuclear Supervision, Radiation Protection
- MS-AH-501-R, On-site inspections, State of revision 10/2015
- MS-AH-507-P, Annual inspection programme, State of revision 12/2010
- MS-AH-514-R, Safety Management System, State of revision 02/2017
- <u>MS-AH-548-R</u>, Supervision of modifications, Status of revision 11/2014
- <u>MS-AH-548-U, Land-wide standard modification procedure, Status of revision 05/2016</u>
- MS-AH-656-R, Means of coercion, State of revision 01/2011
- MS-AH-657-R, Administrative fine, State of revision 01/2011
- <u>MS-AK-050-K</u>, Concept for the state supervision of the nuclear facilities in Baden-Württemberg (Supervision Concept - AK), excerpt chapter 7 and 8, State of revision 11/2017
- <u>MS-AT-001-R</u>, Principles, structure and content of the management system, State of revision 08/2016</u>
- <u>MS-AT-002-K</u>, <u>Mission statement</u>, <u>State of revision 02/2015</u>
- MS-AT-003-V, Structure of the management system, State of revision: 03/2011
- MS-AT-004-V, Overview of the processes of the management system, State of revision: 10/2010
- MS-AT-005-V, Overall table of content, State of revision: 02/2017

- MS-OH-110-R, Management review and objectives, State of revision 05/2013
- MS-OH-130-R, Staffing and human resources management, State of revision 09/2016
- MS-OH-160-R, Knowledge and advanced training, State of revision 02/2016
- <u>MS-OH-164-K</u>, Training concept for new staff members, State of revision 12/2013
- MS-OH-165-U, Sample introductory training programme, State of revision 08/2010
- MS-OH-180-R, Documentation of the management system, State of revision 01/2018
- MS-OH-190-R, Review and improvement, State of revision 01/2017

Examples of oversight practice

- Administrative order of measures to rectify irregularities in in-service inspections
- <u>Communication of inspection findings</u>
- ISIS-notification, Daily report on the operation of the PWR plant
- Finding by authorized expert
- Notification of the reportable event 05/2004 at GKN II; Administrative offence under § 11 (1)
 <u>AtSMV</u>
- <u>Subsequent license condition</u>
- <u>Notice Inspection Findings Cat B</u>
- On-site supervision of the Neckarwestheim site in 2017
- Inspection report: Inspection concerning the fulfilment of the managers' respon-sibility in GKN I/II on 2nd August 2018
- Supervision protocol GKN I
- Inspections 2017 Overview GKN site

12 Abbreviations

AHB	Aufsichtshandbuch Oversight manual
ALARA	As Low As Reasonably Achievable
ANSN	Asian Nuclear Safety Network
ARM	Advance Reference Material
ARTEMIS	Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation
AtDeckV	Atomrechtliche Deckungsvorsorge-Verordnung Nuclear Financial Security Ordinance
AtG	Atomgesetz Atomic Energy Act
AtSMV	Atomrechtliche Sicherheitsbeauftragten- und Meldeverordnung Nuclear Safety Officer and Reporting Ordinance
AtVfV	Atomrechtliche Verfahrensverordnung Nuclear Licensing Procedure Ordinance
AtZüV	Atomrechtlichen Zuverlässigkeitsüberprüfungs-Verordnung Nuclear Trustworthiness Verification Ordinance
AVV	Allgemeine Verwaltungsvorschrift General administrative provision
BfE	Bundesamt für kerntechnische Entsorgungssicherheit Federal Office for the Safety of Nuclear Waste Management
BfS	<i>Bundesamt für Strahlenschutz</i> Federal Office for Radiation Protection
BGZ	<i>Bundesgesellschaft für Zwischenlagerung</i> Federal company for radioactive waste disposal
BHB	<i>Betriebshandbuch</i> Operating Manual
BMBF	Bundesministerium für Bildung und Forschung Federal Ministry of Education and Research
BMU	Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
BMWi	<i>Bundesministerium für Wirtschaft und Energie</i> Federal Ministry for Economic Affairs and Energy
BWR	Boiling Water Reactor
CNS	Convention on Nuclear Safety
DIN	Deutsches Institut für Normung German Institute for Standardization
EnBW	Energie Baden-Württemberg AG
EnKK	EnBW Kernkraft GmbH (NPP operator)
ENSREG	European Nuclear Safety Regulator Group
EP&R	Emergency Preparedness and Response

ARM	IRRS Mission Germany Page 156
ERAM	<i>Endlager für radioaktive Abfälle Morsleben</i> Morsleben Disposal Facility for Radioactive Waste
ESK	Entsorgungskommission Nuclear Waste Management Commission
EURATOM	<i>Europäische Atomgemeinschaft</i> European Atomic Energy Community
FINAS	Fuel Incident Notification and Analysis System
FNRBA	Forum of Nuclear Regulatory Bodies in Africa
FORO	Ibero-American Forum of Radiological and Nuclear Regulatory Agencies
GG	Grundgesetz Basic Law
gGmbH	<i>Gemeinnützige Gesellschaft mit beschränkter Haftung</i> Non-profit limited liability company
GKN	<i>Kernkraftwerk Neckarwestheim</i> Nuclear Power Plant Neckarwestheim
GMLZ	Gemeinsames Melde- und Lagezentrum von Bund und Ländern Joint Reporting and Situation Centre of the Federation and the Länder
GNR	Gesellschaft für nukleares Reststoffrecycling GmbH
GNSSN	Global Nuclear Safety and Security Network
GO	<i>Geschäftsordnung</i> Rules of procedure
GRS	Gesellschaft für Anlagen- und Reaktorsicherheit gGmbH
HAW	High-level Active Waste
HERCA	Heads of the European Radiological Protection Competent Authorities
HGF	Helmholtz-Gemeinschaft Deutscher Forschungszentren Helmholtz Asssociation of German Research Centres
HMN	Handbuch für mitigative Notfallmaßnahmen Accident mitigation manual
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
INES	International Nuclear and Radiological Event Scale
IEC	International Electrotechnical Commission
IRS	International Reporting System on Operating Experience
IRRS	Integrated Regulatory Review Service
IRSRR	Incident Reporting System for Research Reactors
ISO	International Organization for Standardization
ITB	lodine thyroid blockade
JC	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
KTA	Kerntechnischer Ausschuss Nuclear Safety Standards Commission
KVKT	<i>Kompetenzverbund Kerntechnik</i> Alliance for Competence in Nuclear Technology
KWU	Kraftwerk Union AG (former German NPP manufacturer)

LAA	Länderausschuss für Atomkernenergie Länder Committee for Nuclear Energy
NCA	National Competent Authority
NHB	Notfallhandbuch Emergency manual
NPP	Nuclear power plants
OECD/NEA	Organisation for Economic Co-operation and Development/Nuclear Energy Agency
ОНВ	Organisationshandbuch Organisation manual
OIL	Operational Intervention Level
PDCA	Plan Do Check Act
PSR	Periodic Safety Review
PWR	Pressurized Water Reactor
QSB	<i>Qualitätssicherungsbereiche</i> Quality assurance areas
QSK	Qualitätsverbund Strahlenschutzkursstätten Association of radiation protection training facilities
RBZ	Reststoffbearbeitungszentrums Waste treatment centre
REI	Richtlinie zur Emissions- und Immissionsüberwachung kerntechnischer Anlagen Guideline on Emission and Immission Monitoring of Nuclear Installations
RLZ	Radiologisches Lagezentrum des Bundes Federal Radiological Situation Centre
RSK	Reaktor-Sicherheitskommission Reactor Safety Commission
S	Directorate General S (Nuclear Safety, Radiation Protection) of the BMU
SAL	Standort-Abfalllagers Intermediate storage facility for medium a low level waste
SAMG	Severe Accident Management Guidelines
SBO	Station blackout
SHB	Störfallhandbuch Emergency manual
SiAnf	Sicherheitsanforderungen an Kernkraftwerke Safety Requirements for Nuclear Power Plants
SSC	Systems, Structures and Components
SSK	Strahlenschutzkommission Commission on Radiological Protection
SSV	Strahlenschutzverantwortlicher Radiation protection executive
StandAG	<i>Standortauswahlgesetz</i> Site Selection Act
StGB	Strafgesetzbuch Criminal Code
StrlSchG	Strahlenschutzgesetz Radiation Protection Act

StrlSchV	Strahlenschutzverordnung Radiation Protection Ordinance
SZL	<i>Standortnahen Zwischenlager</i> On-site storage facilities
TBL	<i>Transportbehälterlager</i> Tansport cask storage facility
ToR	Terms of Reference
TSO	Technical support organization
ΤÜV	<i>Technischer Überwachungsverein</i> Technical Inspection Association
UVPG	Gesetz über die Umweltverträglichkeitsprüfung Environmental Impacts Assessment Act
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e. V. Association for Electrical, Electronic and Information Technologies
VwVfG	<i>Verwaltungsverfahrensgesetz des Bundes</i> Federal Administrative Procedure Act
WENRA	Western European Nuclear Regulators Association
WGOE	Working Group on Operating Experience

13 List of German Organisations and Institutions

- AA (Federal Foreign Office / Auswärtiges Amt)
- BAFA (Federal Office for Economic Affairs and Export Control / Bundesamt für Wirtschaft und Ausfuhrkontrolle)
- <u>BfE</u> (Federal Office for the Safety of Nuclear Waste Management / Bundesamt für kerntechnische Entsorgungssicherheit)
- <u>BfS</u> (Federal Office for Radiation Protection / Bundesamt für Strahlenschutz)
- <u>BMBF</u> (Federal Ministry of Education and Research / Bundesministerium für Bildung und Forschung)
- BMF (Federal Ministry of Finance / Bundesministerium der Finanzen)
- <u>BMU</u> (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety / Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit)
- **<u>BVA</u>** (Federal Office of Administration / Bundesverwaltungsamt)
- <u>BMVg</u> (Federal Ministry of Defence / Bundesministerium der Verteidigung)
- <u>BMWi</u> (Federal Ministry for Economic Affairs and Energy / Bundesministerium für Wirtschaft und Energie)
- BRH (Federal Court of Auditors / Bundesrechnungshof)
- EBA (Federal Railway Authority / Eisenbahn-Bundesamt)
- **ESK** (Nuclear Waste Management Commission / Entsorgungskommission)
- Federal Government (Die Bundesregierung)
- FZJ (Research Centre- / Forschungszentrum Jülich)

Bundestag (Federal Parliament)

Bundesrat (Federal Council)

- <u>GRS</u> (Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH)
- <u>GSF</u> (German Research Center for Environmental Health / Deutsches Forschungszentrum für Gesundheit und Umwelt former: Gesellschaft für Strahlenforschung)
- <u>GSI</u> (Gesellschaft für Schwerionenforschung)
- HZDR (Research Centre- / Helmholtz-Zentrum Dresden-Rossendorf)
- <u>HMUKLV</u> (Ministry for the Environment, Climate Protection, Agriculture and Consumer Protection of the State of Hesse / Ministerium für Umwelt, Klimaschutz, Landwirtschaft und Verbraucherschutz, Hessen)

- <u>IM MV</u> (The Ministry of the Interior and Europe of the State of Mecklenburg-Western Pomerania / Ministerium für Inneres und Europa)
- KIT (Research Centre- / Karlsruhe Institute of Technology)
- KTA (The Nuclear Safety Standards Commission / Kerntechnischer Ausschuss)
- LBA (Federal Aviation Office / Luftfahrtbundesamt)
- <u>LUBW</u> (State Agency for the Environment, Baden-Wurttemberg / Landesanstalt für Umwelt, Baden-Württemberg) [only in German]
- MELUND (The Ministry of Energy, Agriculture, the Environment, Nature and Digitalization of the State of Schleswig-Holstein / Ministerium für Energiewende, Landwirtschaft, Umwelt, Natur und Digitalisierung) [only in German]
- <u>MWIDE</u> (The Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia / Ministerium für Wirtschaft, Innovation, Digitalisierung und Energie, Nordrhein-Westfalen) [only in German]
- <u>NMU</u> (The Ministry of the Environment, Energy, Building and Climate Protection of the State of Lower Saxony / Niedersächsisches Ministerium für Umwelt, Energie, Bauen und Klimaschutz) [only in German]
- MPA (Materials Testing Institute / Materialprüfungsanstalt, Stuttgart)
- <u>UM BW</u> (The Ministry of the Environment, Climate Protection and the Energy Sector Baden-Württemberg / Ministerium für Umwelt, Klima und Energiewirtschaft Baden-Württemberg)
- <u>RSK</u> (Reactor Safety Commission / Reaktor-Sicherheitskommission)
- <u>SSK</u> (Commission on Radiological Protection / Strahlenschutz Kommission)
- <u>StMUV</u> (The Bavarian State Ministry of the Environment and Consumer Protection / Bayerisches Staatsministerium für Umwelt und Verbraucherschutz)
- <u>TÜV Nord</u> (Technical Inspection Association)
- <u>TÜV Süd</u> (Technical Inspection Association)
- <u>TÜV Rheinland</u> (Technical Inspection Association)
- <u>TÜV Hessen</u> (Technical Inspection Association)
- VdTÜV e.V. (Association of Technical Inspection Agencies / Verband der TÜV e.V)



14 Organizational Charts of the Involved Authorities



The whole organisational chart is available under:

https://www.bmu.de/fileadmin/Daten_BMU/Organigramme/organigramm_bf.pdf







The whole organisational chart is available under: <u>https://um.baden-wuerttemberg.de/fileadmin/redaktion/m-um/intern/Dateien/Dokumente/1 Ministerium/Aufgaben und Organisation/180901 Organisationsplan.pdf</u>



Organisational chart (excerpt)

Ministry of Energy, Agriculture, the Environment, Nature and Digitalization



The whole organisational chart is available under: <u>https://www.schleswig-</u> <u>holstein.de/DE/Landesregierung/V/Ministerium/OrganisationAnsprechpartner/_documents/Organigramm.pdf?__blob=pu</u> <u>blicationFile&v=52</u>



Bavarian State Ministry of the







Ministry for the Environment, Climate Protection, Agriculture and Consumer Protection



The whole organisational chart is available under:

https://umwelt.hessen.de/sites/default/files/media/hmuelv/organisationsplan 1.8.2018.pdf





The whole organisational chart is available under: <u>https://www.regierung-mv.de/Landesregierung/im/Ministerium/Organigramm/</u>

Ministry for the Environment, Energy, Building and Climate Protection of the State of Lower Saxony













Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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