Republic of Austria

9th NATIONAL REPORT

under the

CONVENTION ON NUCLEAR SAFETY - AUSTRIA

Vienna, August 2022

Content

A Introduction

Austria has never operated a nuclear power plant and according to the Federal Constitutional Act for a Nonnuclear Austria [BGBl. I No. 149/1999: Bundesverfassungsgesetz für ein atomfreies Österreich] there is a legal prohibition to do so. Austria has the highest interest in nuclear safety.

In 1978, the Austrian electorate decided in a referendum not to start the operation of the already constructed nuclear power plant (BWR) in Zwentendorf. In 1999, the Austrian parliament unanimously passed the Federal Constitutional Act for a Nonnuclear Austria. It stipulates, inter alia, that installations that serve for energy generation by nuclear power must not be constructed, nor, if they already exist, come on line. Furthermore, the law prohibits the transport of fissile materials for purposes of nuclear power generation or disposal unless this were to conflict with international obligations.

In view of the high risks emanating from nuclear power plants, Austria emphasises the utmost importance of international efforts to harmonise and steadily increase nuclear safety. Consequently, Austria has undertaken a number of bilateral activities with neighbouring countries with regard to the exchange of information on nuclear safety matters. This does not only include operational information on nuclear installations but also early warning schemes in case of nuclear incidents or accidents as well as mutual assistance for the prevention or mitigation of effects from such radiological events.

As a Member State of the European Union and Euratom, Austria has contributed and will continue to contribute to all activities aiming at continuously improving nuclear safety. During its Presidency of the Council of the European Union in the second half of 2018, Austria has initiated forward-looking conclusions with regard to Article 8e of the Council Directive 2014/87/Euratom (the "Nuclear Safety Directive").

Within the limits of a small country with no nuclear power programme, Austria endeavours to contribute on the international level to continuously improving nuclear safety. Together with the research reactor regulatory authorities of Belgium, Germany and the Netherlands, Austria discusses regulatory experience in research reactor oversight, in the application of graded approach, and assists in exchanging information on challenges and good practices.

The form of the Austrian National Report for the 9th Review Meeting under the CNS (2023) follows the structure given in guideline INFCIRC/572/Rev. 6. To support the review process

Austria has highlighted the major changes in the report in *italic*. The content of the national report has been updated, in particular taking into account all recent changes of the legislative and regulatory framework and the Covid-19 countermeasures.

B Summary

Austria would like to recall, that it reports, since the first review cycle under the Convention on Nuclear Safety, on its research reactor on a voluntary basis.

This report intends to reflect the spirit of the Vienna Declaration on Nuclear Safety (VDNS)[1] to continuously improve nuclear safety concerning its research reactor. Austria is committed to the principles as defined under the "Vienna Declaration for the implementation of the objective of the Convention on Nuclear Safety to prevent accidents and mitigate radiological consequences", as far as applicable for research reactors.

Changes in the legislative framework

The Radiation Protection Act 2020 [BGBl. I No. 50/2020, Strahlenschutzgesetz 2020] replaced the Radiation Protection Act [BGBl. No. 227/1969, Strahlenschutzgesetz] and entered into force on 1 August 2020. Due to the requirements of the Council Directive 2013/59/Euratom[2] on the establishment of basic safety standards for protection against the dangers arising from exposure to ionizing radiation, the Austrian radiation protection law was fundamentally reformed. The Radiation Protection Act 2020 regulates particularly the justification and prohibition of practices, the operation of facilities and radiation monitoring; this includes licensing, protection of workers and population, management of radioactive waste, practices involving naturally occurring radioactive material, radiological emergency management and nuclear safety. The target provisions of the Radiation Protection Act 2020 include high level of nuclear safety, taking into account internationally recognized safety standards. This is a measure based on a recommendation from the 2018 IRRS Mission. Simultaneously with the entry into force of the Radiation Protection Act 2020, a number of ordinances entered into force:

- *General Radiation Protection Ordinance 2020 [BGBl. II No. 339/2020]*
- *Radon Protection Ordinance [BGBl. II No. 470/2020]*

[1] Vienna Declaration on Nuclear Safety on principles for the implementation of the objective of the Convention on Nuclear Safety to prevent accidents and mitigate radiological consequences, Adopted by the Contracting Parties meeting at the Diplomatic Conference of the Convention on Nuclear Safety CNS/DC/2015/2/Rev.1
February 9, 2015 Diplomatic Conference to consider a proposal to amend the Convention on Nuclear Safety
https://www.iaea.org/sites/default/files/cns_viennadeclaration090215.pdf

[2] Council Directive 2013/59/Euratom of 5 December 2013
laying down basic safety 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 003/122/Euratom
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013L0059&from=EN

- *Intervention Ordinance 2020 [BGBl. II No. 343/2020]*
- *Radioactive Waste Shipment Ordinance 2009 (amended) [BGBl. II No. 331/2020]*
- *Medical Radiation Protection Ordinance [BGBl. II No. 353/2020]*

Changes regarding the Regulatory body

Responsibility for enforcing the radiation protection law is defined within §§ 153 - 155 of the Radiation Protection Act 2020. The Federal Minister of Climate Action, Environment, Energy, Mobility, Innovation and Technology is the competent regulatory authority for research reactors, waste management facilities, the transport of radioactive material that is not exempt from the obligation to obtain a licence, particle accelerators at universities and research institutes of the Austrian Academy of Sciences (ÖAW) and practices in university organisational units. Prior to the change, the Federal Minister for Education, Science and Research has been the regulatory body for the research reactor.

Covid-19 response

During the Covid-19 pandemic, the regulatory authority implemented countermeasures to ensure the undisrupted fulfilment of its duties. The countermeasures included in particular home-office, virtual meetings, hygienic measures, separation of personnel at the workplace. The situation was evaluated regularly and countermeasures were adapted as necessary. The BMK managed to remain operational, despite increased Covid-19 cases in autumn 2021 and in spring 2022. The transition to virtual and or hybrid working methods were managed successfully without any negative impact on nuclear safety.

Inspections at the research reactor according to § 61 Radiation Protection Act 2020 were carried out by the BMK despite the Covid-19 pandemic and the accompanying restrictive measures. Both the licensees and the regulatory authorities continued to show flexibility regarding the timing and the modalities of the reviews. The annual inspection was carried out with reduced amount of personnel, in order to reduce the risk of infection. Other measures to reduce the risk of infection included: distance keeping, wearing facemasks, and putting an emphasis on preparatory work and (virtual) meetings before the actual inspections took place. So far, the measures proved effective; inspections could be carried out in a satisfying manner.

International peer review missions

An IRRS Mission 2018 took place in Austria from 25 June – 3 July 2018. Several recommendations and suggestions were raised by the Mission. The IRRS Mission triggered several changes in the Austrian legislation. Furthermore, the Federal Minister of Climate Action, Environment, Energy,

Mobility, Innovation and Technology became the regulatory authority for the research reactor in order to strengthen independence of the regulatory body. The impact of the changes can be seen throughout the whole report. Austria plans to invite an IRRS Follow-up Mission.

From 20 –30 November 2022, an ARTEMIS Mission will take place in Austria.

Challenges and Suggestions from the 7th CNS Review Meeting

Four challenges and one suggestion were noted in the 7th Country Review Report. Austria addressed all of these challenges and suggestions.

Challenge 1: To ensure independence of both licensing and supervisory processes

Challenge 2: To review and assess the updates of the research reactor safety report

Challenge 3: To implement the Nuclear Safety Directive

Challenge 4: Consolidate competencies in the field of Nuclear Safety and Radiation Protection

Challenge 1 and 4 were addressed with the assignment of the competence for oversight of the research reactor from the Federal Minister for Education, Science and Research to the Federal Minister for Climate Action, Environment, Energy, Mobility, Innovation and Technology. By doing so, Austria has enhanced the independency of the regulatory body and consolidated the competences in the field of nuclear safety and radiation protection. Prior to the change, the Federal Minister for Education, Science and Research was the regulatory body for the research reactor, while the Federal Minister of Climate Action, Environment, Energy, Mobility, Innovation and Technology was the regulatory body for Austria's nuclear waste facility. Now BMK has the exclusive oversight for these installations regarding radiation protection, whereas BMBWFs competence regarding the research reactor now relates to research agendas and funding only.

Challenge 2 was addressed via § 61 of the General Radiation Protection Ordinance 2020 which stipulates the licensees duty to update the safety report as appropriate and bring the report to the attention of the competent authority without undue delay in the event of any material changes. The content of the safety report for research reactors is specified in Annex 10 of the General Radiation Protection Ordinance 2020. With the support of external experts, the competent authority reviews updates of the safety report. The safety analysis report (SAR) for the research reactor is prepared in compliance with the relevant IAEA requirements.

Challenge 3 was addressed by implementing the Nuclear Safety Directive into the Austrian legal framework.

Suggestion 1: To report on the status of actions taken on the challenges from the CNS 7th Review Meeting in the National Report for the 8th Review Meeting Country. The suggestion is reflected in this report.

C Article by Article Review

Article 6 Existing Nuclear Installations

Austria does not operate any nuclear installations as defined in Article 2 of the Convention. However, Austria has traditionally reported on its existing TRIGA research reactor facility, which is a nuclear installation as defined in the Nuclear Safety Directive 2014/87/Euratom[3].

The Technical University of Vienna (TU Wien) operates a pool type TRIGA Mark II research reactor. It has a maximum steady state thermal output of 250 kW and pulsing capabilities up to 250 MW. Being in operation since March 1962, the usage of this research reactor is only for basic and applied academic research and teaching purposes. As it is the closest research reactor to the IAEA headquarters, it is also frequently used by IAEA staff for the development and calibration of safeguards instruments. In 2012, irradiated fuel elements from the core and the spent fuel storage were shipped to the Idaho National Lab and replaced by 77 standard TRIGA fuel elements with an enrichment of 19,9%, based on a lending agreement between the TU Wien and the US Department of Energy. With this new core, the TRIGA research reactor went critical on 27 November 2012.

At present, 90 fuel elements are at TU Wien, of which 82 are currently in the reactor core, three in storage casks and five unirradiated fuel elements in the fuel storage. The total activity of these fuel elements after one year of cooling time is $7.27x10^{13}$ Bq and after ten years approx. $1.5x10^{13}$ Bq. The TU Wien has a total spent fuel storage capacity of 168 fuel elements.

The spent fuel elements have to be returned to the USA in 2025 or later, if the parties agree upon an extension of the existing contract between TU Wien, Euratom and US DoE.

The reactor instrumentation, the control system, the primary and secondary cooling circuits, the reactor control room as well as the radiation warning system have undergone a major overhaul from April 2014 until April 2017. The operating licence was suspended for the period of the refurbishment and re-established in autumn of 2016.

[3] Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0087&from=EN

Within the relevant time-period for this report, no significant safety related issues or events have been recorded.

As the re-instrumentation of the reactor facility was extensive, there are no short to mid-term plans for other major system upgrades. While a decommissioning concept for the TRIGA research reactor has been prepared and assessed, there are currently no plans for the decommissioning of the facility.

Radioactive waste, which will result from the decommissioning of the research reactor in the future, will be brought to Nuclear Engineering Seibersdorf for treatment, conditioning and interim storage.

Article 7 Legislative and Regulatory Framework

Article 7 (1) Establishing and maintaining a legislative and regulatory framework

The legislative and regulatory framework comprises the legal areas of radiation protection, nuclear safety, safeguards and physical protection of nuclear material and nuclear facilities. As a federal state Austria has a number of federal (Bund), provincial (Länder) and district authorities (Bezirksverwaltungsbehörden) that are involved in the regulation of these matters. While legislation is exclusively made on the federal level, execution is partially entrusted to the provincial or district authorities. However, major nuclear installations or practices are subject to federal authority and inspection. This applies in particular to the TRIGA research reactor.

The following acts form the primary legislative framework for nuclear safety in Austria:

Federal Constitutional Act for a Nonnuclear Austria

The Federal Constitutional Act for a Nonnuclear Austria [BGBI. No. I Nr. 149/1999, BVG für ein atomfreies Österreich] prohibits the construction and operation of installations for the production of energy by means of nuclear fission as well as – with some exemptions – the transport of fissile materials in Austria. Where an international obligation exists, the international obligation would prevail. The use of installations for research and development activities is compatible with the quoted constitutional law.

Radiation Protection Act 2020

The Radiation Protection Act 2020 [BGBl. I No. 50/2020, Strahlenschutzgesetz 2020] replaced the Radiation Protection Act [BGBl. No. 227/1969, Strahlenschutzgesetz] and entered into force on 1 August 2020. Due to the requirements of the Council Directive 2013/59/Euratom on the establishment of basic safety standards for protection against the dangers arising from exposure to ionizing radiation, the Austrian radiation protection law was fundamentally reformed. The Radiation Protection Act 2020 regulates particularly the justification and prohibition of practices, the operation of facilities and radiation monitoring; this includes licensing, protection of workers and population, management of radioactive waste, practices involving naturally occurring radioactive material, radiological emergency management and nuclear safety. The target provisions of the Radiation Protection Act 2020 include high level of nuclear safety, taking into account internationally recognized safety standards. This is a measure based on a recommendation from the 2018 IRRS Mission. Simultaneously with the entry into force of the Radiation Protection Act 2020, a number of ordinances entered into force:

- *General Radiation Protection Ordinance 2020 [BGBl. II No. 339/2020]*
- *Radon Protection Ordinance [BGBl. II No. 470/2020]*
- *Intervention Ordinance 2020 [BGBl. II No. 343/2020]*
- *Radioactive Waste Shipment Ordinance 2009 (amended) [BGBl. II No. 331/2020]*
- *Medical Radiation Protection Ordinance [BGBl. II No. 353/2020]*

Federal Act on Civil Liability for Damage Caused by Radioactivity

The Federal Act on Civil Liability for Damage caused by Radioactivity (Nuclear Liability Act) [BGBl. I No. 170/1998, Atomhaftungsgesetz 1999] entered into force on 1 January 1999. The Act covers any damage to persons or property resulting from ionizing radiation due to nuclear installations, nuclear substances and radionuclides. Further coverable damages are the costs of the removal of impairments to the environment and the costs of preventing measures undertaken to avert immediate danger originating from nuclear installations, nuclear substances or radionuclides.

Overview of ratified international conventions

Austria is a signatory party of international conventions that establish common obligations and mechanisms to ensure continuous improvement of nuclear safety. Austria has signed, ratified, and actively participates in various international legal instruments. To increase readability of this report they are listed in ***Annex I****.*

Article 7 (2) (i) National safety requirements and regulations

The following ordinances form the secondary legislative framework regarding nuclear safety.

General Radiation Protection Ordinance 2020

The General Radiation Protection Ordinance 2020 [BGBl. II No. 339/2020, Allgemeine Strahlenschutz Verordnung 2020] entered into force on 1 August 2020. The ordinance contains provisions regarding radiation protection (dose limits, requirements for exposed workers, requirements for sealed und unsealed radioactive sources, requirements for research reactors, etc.). The General Radiation Protection Ordinance 2020 establishes a graded approach with regard to the authorization process.

Ordinance for Interventions in Case of Radiological Emergencies and in Case of Lasting Exposure

The Ordinance for Interventions in case of Radiological Emergencies and in case of Lasting Exposure 2020 [*BGBl. II No. 343/2020*, Interventionsverordnung] entered into force on 1 August 2020.

The ordinance contains regulations regarding interventions in case of radiological emergencies and in case of lasting exposure from a past radiological emergency or a past practice. These include inter alia significant releases of radioactive material due to accidents involving facilities or practices, accidents during the transport of radioactive material or terrorist acts using radioactive material.

Ordinance on the Shipment of Radioactive Waste

The Ordinance on the Shipment of Radioactive Waste [BGBl. II Nr. 47/2009, Radioaktive Abfälle-Verbringungsverordnung] entered into force on 19 February 2009. With this ordinance, the Council Directive 2006/117/Euratom [4] on the supervision and control of shipments of radioactive waste and spent fuel was transposed into Austrian national law.

Medical Radiation Protection Ordinance

The Medical Radiation Protection Ordinance [BGBl. II No. 375/2017, Medizinische Strahlenschutzverordnung] entered into force on 6 February 2018 *and was amended in 2020 [BGBl. II No. 353/2020]*.

Article 7 (2) (ii) System of licensing

§§ 15 to 22 Radiation Protection Act 2020 and §§ 7 to 10 General Radiation Protection Ordinance 2020 establish fundamental rules regarding licensing. If a practice requires constructional radiation protection measures, a two-stage licensing procedure shall be performed, firstly a construction licence and secondly licence to perform the practice. In general, a licence may only be granted where:

1. *the intended practice is justified,*
2. *there are no reservations about the reliability of the licence applicant or, in the case of a legal entity, about the reliability of the persons authorised to represent it,*
3. *the provisions of § 44 Radiation Protection Act 2020 are satisfied in the case of practices with dangerous radioactive sources,*

[4] Council Directive 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006L0117&from=EN

4. *the provisions of § 49 Radiation Protection Act 2020 are satisfied in the case of research reactors,*
5. *the provisions of § 53 Radiation Protection Act 2020 are satisfied in the case of practices in waste management facilities,*
6. *sufficient protection is provided for the workers concerned and*
7. *in the case of practices that, in normal operating conditions, may cause such exposure of members of the public as cannot be disregarded, sufficient protection is provided for these individuals.*

Following the graded approach, specific areas such as research reactors, the Radiation Protection Act 2020 contain tailored rules that also need to be fulfilled in order to obtain a licence. § 49 Radiation Protection Act 2020 stipulates requirements for research reactors that include provisions regarding construction, operation and decommissioning.

In order to obtain a construction licence for a research reactor pursuant to § 49 para. 1 Radiation Protection Act 2020, siting must comply with internationally recognised safety standards, the reactor needs to be designed in accordance with the state of the art and internationally recognised safety standards and a preliminary safety report and a preliminary on-site emergence response plan must be available.

Specific requirements for granting a licence to operate a research reactor pursuant to § 49 para.2 Radiation Protection Act 2020 are:

1. *the availability of appropriate technical, human and financial resources for safe operation,*
2. *ensuring that only fuel elements are used whose manufacturer or supplier have committed to taking back the spent fuel or have undertaken a contractual obligation to accept fuel elements that need to be managed,*
3. *the availability of a safety report and an on-site emergency response plan,*
4. *the setting up of a management system with a view to warranting nuclear safety at all times,*
5. *the nomination of nuclear safety officers and*
6. *the availability of a decommissioning concept including appropriate financial provisions for decommissioning.*

In practice, the first step of the licensing process is the submission of the licencing application. The licensing application must include documentation specified in § 10 General Radiation Protection Ordinance 2020 such as an exact description of the intended practice, technical and other information on the radiation source for which radiation protection is to be ensured and training certificates of the designated radiation protection officers. Specific requirements for the granting

of a licence to operate research reactors are in particular the availability of a safety report, the on-site emergency response plan, the decommissioning concept and all further proof of compliance with the specific requirements for granting a licence pursuant to § 49 Radiation Protection Act 2020 have to be submitted.

If a licensing application does not contain all necessary documents, the competent authority shall without delay notify the applicant and request to transmit the missing documents within an adequate period of time. If the applicant fails to submit them, a licence will not be granted.

A licence to operate a research reactor shall be granted if the above-mentioned seven general requirements, the six specific requirements for research reactors as well as the conditions and requirements of the construction licence are fulfilled. Additionally, a radiation protection officer needs to be notified to the competent authority.

Radiation protection officers must have successfully completed scientific or technical studies at a regular university or university of applied sciences, radiation protection training stipulated by the General Radiation Protection Ordinance 2020. Further, they shall present proof to the competent authority of having been employed for a period of no less than two years in a position where they were able to gain sufficient practical experience for the intended practice and proof of having extensive knowledge in radiation protection of the research reactor at which they are supposed to work. The General Radiation Protection Ordinance 2020 contains detailed provisions on the training of radiation protection officers for research reactors that cover training of at least 60 hours particularly in the fields of nuclear physics, ionising radiation and legal provisions. Training schools, which provide education and training for radiation protection officers according to the requirements of the ordinance, require an approval by the competent authority. Training schools issue certificates for those radiation protection officers, who have successfully completed their training and education programme. The role and education of nuclear safety officers are described in more detail in Article 14.

Regarding informing the public pursuant to § 149 Radiation Protection Act 2020 the Federal Minister for Climate Action, Environment, Mobility, Innovation and Technology shall in an appropriate manner, provide the public with information about the regulatory tasks in radiation protection, specifically about the justification of practices as well as the licensing and review procedures. Additionally, the competent authority shall inform the public about the nuclear safety of research reactors and about the management of radioactive waste in Austria.

Article 7 (2) (iii) System of regulatory inspection and assessment

§ 61 Radiation Protection Act 2020 requires that the performance of a licence to perform a practice pursuant to § 17 Radiation Protection Act 2020 shall be reviewed by the licencing authority. In case of research reactors, the inspection must be conducted at least once a year. The Federal Minister of Climate Action, Environment, Energy, Mobility, Innovation and Technology as the competent authority can perform inspections more frequently at any given time. It is the discretionary decision of the regulatory authority whether those are necessary. For instance, in case of events that may significantly affect the safety or in case of significant deficiencies in the research reactor operation, additional announced or unannounced inspections may be deemed necessary. This assessment may change depending on discovering significant deficiencies or planned changes that potentially affect safety significantly during regular supervisory procedures. Pursuant to § 61 para. 4 Radiation Protection Act 2020, inspections shall include compliance with the provisions of this present Federal Act applicable for the relevant practice, the administrative orders issued relative thereto and the directly applicable relevant EU and Euratom legal acts.

Following the recommendations of the IRRS Mission 2018, Austria transferred the former competence of the supervisory authority over the research reactor from the Federal Minister for Education, Science and Research to the Federal Minister of Climate Action, Environment, Energy, Mobility, Innovation and Technology, thus further strengthening the concentration of regulatory competences at a central regulatory body. The Federal Minister of Climate Action, Environment, Energy, Mobility, Innovation and Technology is the competent authority for the TRIGA research reactor and it continues the formal process for inspection that has initially been established by the BMBWF, which includes inspection guidelines as described in its regulatory Supervision Handbook. An inspection programme is established prior to the inspection. The methods used range from questioning, perusal and examination of the operator's documents/information/test plans on-site inspections.

Prior to the inspection, the licensee is obliged to submit a set of documentation listed in the Supervision Handbook (particularly including annual reports on operation, on radiation protection, and on environmental monitoring, safety analysis report, report on training, test results and information on any safety related change in the operation of the research reactor).

The authority and its expert(s) review and assess the submitted documents. During the inspection, the reports of the licence holder are assessed and any measures to be taken are recorded. The competent authority writes a report of the inspection according to the General Administration Procedure Act, that concludes the results of the inspection. The report is communicated to the licence holder at the end of the inspection and has to be signed by the competent authority and the licence holder. The licence holder has to communicate and demonstrate the improvements resulted from the inspection to the competent authority within a certain timeframe, which is

defined in the report. The outcome of an inspection is discussed between the inspector (technical expert) and the legal experts of the regulatory body as basis for improving of processes and the planning of future inspections.

Article 7 (2) (iv) Enforcement of applicable regulations and terms of licences

Where the competent authority determines a breach of a radiation protection provision, the licensee shall be requested to establish compliance with the radiation protection framework within a reasonable period. Where the request is not complied with within the established or extended time limit, the competent authority shall file a complaint with the competent administrative penal authority. In case of a significant breach, the competent authority shall file a complaint without previous request.

In the event of imminent danger, where necessary, the competent authority shall prohibit or restrict the relevant practice. It can only be continued once the authority has determined that the cause of the danger has been eliminated. The competent authority shall set a reasonable time limit for the elimination of the cause. It shall revoke a licence where such practice is no longer justified or the licensee or the persons authorised to represent it, no longer prove reliable.

From a procedural point of view, any complaints filed against such measures taken by the competent authority in case of imminent danger shall have no suspensive effect, meaning that only in case a court ruling that deems those measures ineffective or incorrect they will be deemed obsolete. Additionally, to achieve minimal response times the competent authority has the right to issue an administrative decision without any prior investigation procedure pursuant to § 57 General Administrative Procedure Act 1991.

Where necessary, the competent authority shall implement measures itself directly on site, even prior to issuance of a decision. The members of the public police services shall provide the competent authority with assistance to protect performance of an official act, if so requested. A written administrative decision on such measures must be issued within two weeks, or else the measures taken shall be lifted.

Furthermore, anyone who commits an administrative offence pursuant to § 152 Radiation Protection Act 2020, can be punished, depending on the severity of the act by an administrative fine up to EUR 75.000 provided the act does not constitute an offence within the jurisdiction of the courts or is not subject to more severe penalties according to other administrative provisions.

During the reporting period, no events of imminent danger have occurred at Austria's TRIGA Mark II research reactor. The authority is in close communication with the licensee in order to be informed about potential challenges at an early stage.

Article 8 Regulatory Body

Article 8 (1) Establishment of the regulatory body

Responsibility for enforcing the radiation protection law is defined within §§ 153 - 155 of the Radiation Protection Act 2020. The Federal Minister of Climate Action, Environment, Energy, Mobility, Innovation and Technology is the competent regulatory authority for research reactors, waste management facilities, the transport of radioactive material that is not exempt from the obligation to obtain a licence, particle accelerators at universities and research institutes of the Austrian Academy of Sciences (ÖAW) and practices in university organisational units. Federal Ministers are supported by their respective Federal Ministry functioning as an auxiliary body in the fulfilment of their functions.

The objectives of supervision are described within the Supervision Handbook. The supervision of the reactor is organized within a directorate of the BMK, the director of which signs on behalf of the minister. The respective directorate at BMK consists of four legal staff members, which are in constant exchange with one consultant and four external experts for the evaluation of technical questions related to radiation protection. The department receives a budget reserved for regulatory activity, which is deemed sufficient for the tasks at hand.

The staff must undergo regular training to maintain competence. The director also has to undergo an interview with the director general.

Article 8 (2) Status of the regulatory body

As the regulatory oversight over the research reactor rests with the Minister for Climate Action, Environment, Energy, Mobility, Innovation and Technology, the supervisory activity rest at the highest echelons of the government. The Minister may be held accountable by parliament, five members of which may pose inquiries on any subject under the Minister's purview at any time. Furthermore, the Austrian Court of Auditors may review any and all activities within a ministry, evaluate the performance efficiency and give recommendations on how to improve processes.

As other Ministers also hold authority in certain fields of radiation protection, there are permanent communication channels established. The Federal Minister of Climate Action, Environment, Energy, Mobility, Innovation and Technology , the Federal Minister of the Interior and the Federal Minister of Social Affairs, Health, Care and Consumer Protection share authority for off-site emergency preparedness and response for radiation protection on the federal level and therefore are invited to inspection meetings and informed of its results regardless of attendance.

In 2018, during the IRRS peer review it was recommended to "review the regulatory framework at the federal level to avoid any potential conflict of interest and to ensure the appropriate independence in the discharge of safety related functions". Similarly, the 7th Country Review Report identified that Austria shall ensure independence of both licencing and supervisory processes and to consolidate competences in the field of Nuclear Safety and Radiation Protection. With the assignment of the competence for oversight of the research reactor from the Federal Minister for Education, Science and Research to the Federal Minister for Climate Action, Environment, Energy, Mobility, Innovation and Technology Austria has enhanced the independency of the regulatory body and consolidated the competences in the field of Nuclear Safety and Radiation Protection. Prior to the change, the Federal Minister for Education, Science and Research was the regulatory body for the research reactor, while the Federal Minister of Climate Action, Environment, Energy, Mobility, Innovation and Technology was the regulatory body for Austria´s nuclear waste facility. Now BMK has exclusive oversight for these installations regarding radiation protection, whereas BMBWFs competence regarding the research reactor now relates to research agendas and funding only.

During the Covid-19 pandemic the regulatory authority, implemented countermeasures to ensure the undisrupted fulfilment of its duties. The countermeasures included home office, virtual meetings, hygienic measures and separation of personnel at the workplace. The situation was evaluated and countermeasures adapted as necessary. The BMK managed to remain operational, despite increased Covid-19 cases in autumn 2021 and spring 2022. The transition to virtual/hybrid working methods were managed successfully. No negative impact on safety was identified from the point of view of the regulatory body.

Inspections at facilities according to § 61 Radiation Protection Act 2020 were carried out by the BMK despite the Covid-19 pandemic and the accompanying restrictive measures. Both the licensees and the regulatory authorities showed and continue to show flexibility regarding the timing and the modalities of the reviews, for example by shifting the dates from April to June to circumvent the high number of infections in spring. The annual inspection were carried out with reduced amount of personnel, in order to reduce the risk of infection. Measures to reduce the risk of infections that were and continue to be in place include: smaller teams, distance keeping, wearing face masks, and putting an emphasis on preparatory work and (virtual) meetings before the actual inspections took place. So far, the measures proved effective; inspections could be carried out in a satisfying manner.

Article 9 Responsibility of the Licence Holder

§ 48 para. 3 Radiation Protection Act 2020 stipulates that the licensee shall be responsible for the nuclear safety of a nuclear installation. That responsibility cannot be delegated and includes responsibility for the activities of contractors that might affect nuclear safety. According to § 67 Radiation Protection Act 2020 the licence holder is also responsible for measures to protect workers. §§ 84 to 87 of the General Radiation Protection Ordinance 2020 defines radiation protection measures such as providing working instructions or radiation protection instructions.

The compliance with the legal framework in regard to nuclear safety and radiation protection and the compliance with the requirements deriving from the licence are ensured by regular inspections and reviews performed by the regulatory authority.

According to § 64 General Radiation Protection Ordinance 2020 the licence holder has to inform the staff working at the research reactor as well as the public in a suitable form about the normal operating conditions and immediately in case of events that are relevant from a radiation protection or nuclear safety point of view. Further reporting obligations may arise from pursuant to the Ordinance on Information about the Risk of Incidents [BGBl. II No. 391/1994].

Communication to the public is facilitated by the licence holder's public relations office, using various channels like the university and institute webpage, social media and press releases. The licence holder keeps close contact with the adjoining owners of properties next to the premises of the research reactor and informs them about current developments and activities. People can also take up on the offer of guided tours at the research reactor building. Notification plans are in place for emergencies, which are included in the safety analysis, incident analysis and the institute´s emergency plan.

Nuclear Third Party Liability

The liability for nuclear installations and nuclear substances is governed by the Act on Liability for Damage Caused by Radioactivity of 1999 (Bundesgesetz über die zivilrechtliche Haftung für Schäden durch Radioaktivität (Atomhaftungsgesetz 1999 – AtomHG 1999, BGBl. I No. 170/1998)). The Act covers any damage to persons or property by ionizing radiation from nuclear installations, nuclear substances and radionuclides. Further coverable damages are the costs of the removal of impairments to the environment and the costs of preventing measures undertaken to avert immediate danger originating from nuclear installations, nuclear substances or radionuclides. In this context, impairment to the environment means any interference with the environment, which lastingly alters the latter in such a way that it differs

noticeably from natural processes either in quantity, in quality or in the temporal respect. Only the impairment, which is of some significance, is to be compensated.

The liability both of the operator of a nuclear installation and the carrier of nuclear substances does in principle not presuppose any negligence on their part. Accordingly, the Nuclear Liability Act lays down as a rule the strict liability of the said persons. The operator of a nuclear installation is liable for all harm caused by operating the installation. Not only damages resulting from an accident during operation are covered, but also any damages in the ordinary course of operation (i.e. without any sudden incident). The carrier of nuclear substances is liable for damages caused by an accident during carriage. In addition he has to remedy any other harm caused during carriage (thus likewise independently of a possible incident).

The Act on Liability for Damage Caused by Radioactivity of 1999 designates in principle the unlimited liability of the person liable.

The Act also provides liability rules for the handling of radionuclides. Also in these cases, the amount of compensation is in principle unlimited. The holder of the radionuclide, however, is liable only if he is to be blamed for negligence, since in these cases damage normally cannot reach dimensions comparable to those caused by nuclear installations or the substantially more dangerous nuclear material. Due to the yet given specific danger of radionuclides the burden of proof is shifted from the injured party to the holder of the radionuclide.

Furthermore, the Act abandons the principle of „channelling" of nuclear liability currently governing the international conventions on the subject matter. That means that compensation cannot only be claimed from the operator of an installation, but the injured party can also take legal action against third parties, e.g. the supplier and the constructor. This is meant to make sure that the person injured can recover all damages even if it is more than the operator can pay.

Suppliers are only required to have the pertinent insurance if their activity is a nuclear activity as defined in the act on nuclear liability. In all other cases, the general liability regulations will rule. § 16 (1) of the Nuclear Liability Act stipulates in particular, that provisions under the Austrian Civil Code and other laws governing damages of a broader scope or liability of persons other than those provided for under this Federal Act shall remain unaffected hereby. Persons having suffered damage may bring such claims directly in the courts.

To provide security for the claims of possible injured parties, the Act on Liability for Damage Caused by Radioactivity of 1999 obliges the following persons to effect liability insurances: the operator of a nuclear installation situated in Austria (insurance appr. 400 million EUR plus 40

million EUR interests and costs), the carrier of nuclear substances and the holder of a radionuclide with an activity of more than 370 GBq. Minimum amounts insured shall guarantee that all foreseeable hazards can be covered.

Taking into consideration that Austria is a party neither to the Paris Convention nor to the Vienna Convention and the Convention on the Supplementary Compensation, § 23 of the Act contains special rules for international cases. Whereas pursuant to § 48 of the Austrian Act on Private International Law non-contractual damage claims are governed by the law of the state, in which the act causing the damage was committed, § 23 (1) of the Act on Liability for Damage Caused by Radioactivity of 1999 provides that the person injured by ionizing radiation can demand that Austrian law be applied to claims for damages which occurred in Austria. If vice versa, the incident causing the harm has taken place in Austria and thus Austrian law is applicable, damages which occurred abroad are only covered according to Austrian law as far as compensation is also provided for by the personal statute - usually the lex patriae - of the injured party.

Concerning the Paris and the Vienna Convention as well as the Convention on Supplementary Compensation on Liability for Nuclear Damage, Austria has mainly two concerns: First the maximum liability amounts seem to be insufficient; in contrast the Austrian Act on Liability for Damage Caused by Radioactivity of 1999 provides for unlimited liability combined with obligatory liability insurance covering relatively high amounts of damage. Secondly, the channelling of liability according to which only operators and not also suppliers can be held liable seems inadequate. Above that, the prescription rules and the rules regarding the place of jurisdiction are to the detriment of potential victims.

Article 10 Priority to Safety

The summary under this article provides an overview of how safety is prioritized in context of the TRIGA research reactor as the only installation under the scope of this report. Therefore, other installations and authorities will not be discussed.

Safety policies

Essential objectives of Austria's safety policy are stipulated in the Radiation Protection Act 2020:

1. *the protection of individuals, including their progeny, as well as the protection of the environment with a view to ensuring the long-term protection of human health against the dangers arising from ionising radiation,*
2. *the assurance of a high level of nuclear safety, and*
3. *the responsible and safe management of spent fuel and radioactive waste.*

All of this while giving due consideration to internationally recognised safety standards and Guidance. Obligations on ensuring and continuously improving nuclear safety are fully considered in this regard, comprehensive measure are implemented in a timely manner and the effectiveness of taken provisions is regularly assessed with corrective actions and feedback mechanisms in place.

§ 48 para. 1 and 2 of the Radiation Protection Act 2020 stipulates the objectives and principles for nuclear safety of nuclear installations, explicitly for siting, design, construction, commissioning, operation and decommissioning of nuclear installations. The goal of these objectives is: to prevent accidents and in case of an accident to mitigate its effects; to avoid radioactive substances from being released so early that there is not enough time to implement the necessary off-site protective measures; and finally to avoid radioactive substances from being released to such an extent that the necessary protective measures could not be limited in area or time.

In order to achieve these objectives, the provisions for nuclear installations must be in line with the defence-in-depth concept, which ensures that: the impact of extreme external natural and unintended man-made hazards is minimised, abnormal operation and failures are prevented, abnormal operation is controlled, and failures are detected, accidents within the design basis are controlled, severe conditions are controlled as far as reasonably practicable, including prevention of accident progression and mitigation of the consequences of severe accidents and an organisational structure for on-site emergency preparedness and response is established with a clear allocation of responsibilities and coordination between the licensee, and competent authorities and organisations – taking into account all phases of a radiological emergency.

In addition to this, the licence holder and the competent authority must take measures to promote and enhance an effective nuclear safety culture.

Safety Culture

Pursuant to § 48 para. 2 of the Radiation Protection Act 2020 the licence holder has to take measures to promote and enhance an effective nuclear safety culture.

Pursuant to § 59 no. 11 of the General Radiation Protection Ordinance 2020 the operating rules of research reactor must contain measures to promote and improve an effective safety culture.

Pursuant to § 60 para. 3 – 5 of the General Radiation Protection Ordinance 2020, the licence holder has to promote – at all staff and management levels – the ability to question the delivery of relevant safety principles and practices, and to report safety issues in a timely manner. Additionally, the licence holder has to implement arrangements for registration, evaluation and documentation of internal and external safety-related operating experience. Furthermore, the licensee shall develop improvement and retooling measures, particularly based on the repeat test results and the periodic safety reviews, their own operational experience and the exchange of experience with operators of similar research reactors. Additionally, the licence holder has to verify the functionality of safety-related facilities in repeat tests carried out at appropriate intervals and document these in a test manual.

Due to the regulatory inspection, the topic of safety culture is handled as follows:

Human factor and human-technology interface:

As a result, the "human factor" focuses on expertise *in a* sense of responsibility of the persons, which is why special attention must be paid to the completion of the applicable mandatory training of employees in the area of radiation protection.

Safety in connection with operational experience

In the context of the analysis of events, the TU Wien checks the extent to which human conduct or the human/technology interface was relevant for the event and whether optimisations are required. This takes place in the context of the at least annual meetings of the reactor safety commission. In the context of the annual regulatory interview pursuant to § 61 of the Radiation Protection Act 2020 the nuclear safety officer reports about this as the occasion arises.

Safety due to the organisation

In the context of the *mandatory repeating* tests, experts also assess safety culture with the help of targeted discussions or specific questions in the context of the annual regulatory interview pursuant to § 61 of the Radiation Protection Act 2020 with the management of the TRIGA research reactor based on the review questions as determined within the *Supervision Handbook*.

Management System

§ 49 no. 2 – 4 of the Radiation Protection Act 2020 contains the obligation to set up and apply a management system with a view to warranting nuclear safety at all times.

Pursuant to § 60 para. 1 and 2 General Radiation Protection Ordinance 2020, the management system has to take into account all aspects of nuclear safety, radiation protection and quality assurance. Furthermore, the management system has to be updated as appropriate.

The implementation of the basic provisions is also defined in the Supervision Handbook: The management system must cover all activities and facilities with a bearing on due priority to nuclear safety. In addition, it must take into account other requirements of the operator of the research reactor, including operating safety and the safety performance of experiment set-ups.

The operating procedures are part of the management system and reviewed through the *repeating* test plan: This plan specifies all the processes, installations and facilities that ensure the reactor´s nuclear safety and includes inspection criteria. The proper implementation of the inspections and their results need to be reviewed by the competent persons (management, radiation protection, nuclear safety). Any required maintenance or repairs will be commissioned, monitored and documented by the nuclear safety officer.

A regulatory review of the management system includes

- assessing compliance with the specified requirements regarding the scope and content of the management system and the operators report, as well as proving the plausibility and compliance of the information
- the identification of trends through the analysis of parameters
- assessing whether the management system is being applied to improve safety and promote the safety culture

- determining ambiguities and further concerns within the scope of the annual consultation pursuant to § 61 of the Radiation Protection Act 2020.

Safety assessments

The safety of the reactor facility is reviewed annually during dedicated meetings and accompanying inspections according to § 61 of the Radiation Protection Act 2020.

Pursuant to § *62 para. 1 of the* General Radiation Protection Ordinance 2020**,** the licence holder has to conduct a periodic safety review (PSR) every 10 years. The contents of this review are determined in *Annex 12* of the Ordinance and results of this review are to be submitted to the regulatory authority*. The first-time submission took place in December 2014; therefore, the results of the next periodic safety report shall be available until December 2024. Pursuant to § 62 para. 4 of the General Radiation Protection Ordinance 2020 (AllgStrSchV 2020) the competent authority shall rate these results and issue an administrative decision stating whether the requirements for the continued operation of the research reactor have been met and which deficiencies are identified and open issues are to be investigated in detail. Findings are documented and corrective actions and processing of open issues are fixed.*

In transposing the Euratom Nuclear Safety Directive, § 51 para. 1 of the Radiation Protection Act 2020 was established, which stipulates – at least once every ten years – to perform a self-assessment of the legislation and regulatory practices in respect of research reactors.

With a view to continuously improving nuclear safety, the competent authority has to invite international experts to evaluate key segments of the legislative and regulatory framework (peer reviews) and to inform the European Commission as well as the Member States about the results of these peer reviews without undue delay. In order to comply with that requirement, Austria requested an IRRS Mission in June 2018. The received recommendations and suggestions were reviewed in order to decide next how the adopted Action Plan would be reflecting these results.

Article 11 Financial and Human Resources

Article 11 (1) Financial resources

The TRIGA research reactor is embedded in the Atominstitut of the TU Wien. Thus, the university provides funds for staff, equipment, research and safety of the facility. The regular budget plus additional third party income assures the profound financing to operate the reactor in a safe and efficient way; overall priority is given to the safety of the TRIGA research reactor. All relevant safety measures have to be covered by the regular budget.

The TU Wien budget is provided through performance agreements with the BMBWF as well as third party allocations (the latter being much less significant). These public contracts are re-negotiated every three years and provide the university with a global budget, which is not subdivided any further and is distributed by the university according to budgetary needs. The BMBWF has no say on the discretionary spending of the universities as they have been granted far-reaching autonomy through the Federal Constitution.

The TU Wien as well as the Federal Real Estate Agency (Bundesimmobiliengesellschaft – the property owner of the reactor site) have made provisions in their respective balance sheets to provide for the eventual decommissioning of the research reactor, as this will require a significant investment.

Article 11 (2) Human resources

While the TU Wien is free to allocate personal resources at her discretion, certain obligations may be derived from the legal framework: *According to § 58 General Radiation Protection Ordinance 2020, the licence holder is obliged to specify the company`s organisation:*

1. reactor management (all supervisors of reactor operators who have the authority to issue directives)

2. reactor operators (persons authorised to operate and monitor the reactor in the defined scope);

3. radiation protection officers;

4. nuclear safety officer and his or her deputy.

Therefore, all critical functions for the safety of the facilities are stipulated by legal requirements.

The regulatory monitoring of the specialist knowledge of the persons responsible and of the staff otherwise engaged is key, because the staff's knowledge and expertise constitute the basis for human performance and thus for the safe conduct of reactor operations.

§§ 81 para. 1 and 82 para. 1 General Radiation Protection Ordinance 2020 establish the requirements related to the training and expertise of the radiation protection experts appointed.

§ 63 para. 1 and para. 2 General Radiation Protection Ordinance 2020 establishes the requirements related to the training and expertise of the nuclear safety officer to be appointed for the operation of the research reactor and of the reactor management.

As regards the persons otherwise engaged, the operator shall be required to provide to the regulatory authority evidence of possession of knowledge required for the safe operation of the TRIGA research reactor, of the possible dangers and the protective actions to be taken. Providing such knowledge is necessary for the proper performance of the respective activity at the relevant workplace and for the protection of the individual.

TU Wien also provides academic training for nuclear physicists, which guarantees the national supply of experts in nuclear science. However, considering the scale of nuclear activities in Austria, this program is of moderate size.

Article 12 Human Factors

The human factor is taken into account on all levels of institutional and regulatory oversight as follows:

- Licensing: review of the materials insofar the human factor is appropriately accounted for.
- Regulatory oversight: the human factor being addressed in safety and review instruments (i.e. safety report, safety analysis report, topical peer review, etc.).
- Event analysis: identification of all the factors contributing to the event, including analysis of human error.

The Supervision Handbook takes the human factor into account, which is included in several regulatory activities and check-ups, for example within the repeat inspection sheets.

Feedback from findings on the human factor are discussed during oversight meetings or during procedures according to § 61 of the Radiation Protection Act 2020.

Article 13 Quality Assurance

One of the requirements for the granting of a licence to operate a research reactor is the setting up of a management system with a view to warranting nuclear safety at all times in accordance with § 49 para. 2 Radiation Protection Act 2020. § 60 General Radiation Protection Ordinance 2020 stipulates more detailed provisions with regard to the management system as well as measures to promote and improve the safety culture.

Pursuant to § 60 General Radiation Protection Ordinance 2020 the management system shall take into account aspects of nuclear safety, radiation protection and quality assurance. The licensee has to keep the management system updated. This was also regulated more clearly in the reformed Radiation Protection Act 2020 as a result of a recommendation from the IRRS 2018. The licensee is obligated to promote the ability to question delivery of relevant safety principles and practices at all staff and management levels and to report safety issues in a timely manner. Furthermore, the licensee has to implement arrangements for registration, evaluation and documentation of internal and external safety-related operating experience.

Annex 18 of the General Radiation Protection Ordinance stipulates that quality assurance is a part of the training of radiation protection officers.

Article 14 Assessment and Verification of Safety

Article 14 (1) Assessment of safety

Initial review and assessment is conducted by the regulatory body as part of the authorization process and it is required that qualified experts must be consulted in the review and assessment process.

§ 49 Radiation Protection Act 2020 requires for the granting of a construction licence for research reactors that it is designed in accordance with the state of the art and internationally recognised safety standards. The publications of the IAEA, in particular, shall be used as reference for the state of the art and as internationally recognised safety standards in respect of research reactors. Furthermore, a preliminary safety report must be available.

In order to operate a research reactor, additional requirements ensuring nuclear safety must be met. A safety report and an on-site emergency response plan need to be available. A management system with a view to warranting nuclear safety at all times needs to be in place. Nuclear safety officers have to be nominated and a decommissioning concept must be provided. The 7th Country Review Report identified that updates of the safety report should be reviewed and assessed. § 61 of the General Radiation Protection Ordinance 2020 stipulates the licensees duty to update the safety report as appropriate and bring the report to the attention of the competent authority without undue delay in the event of any material changes. The content of the safety report for research reactors is specified in Annex 10 of the General Radiation Protection Ordinance 2020. With the help of external experts, the competent authority reviews updates of the safety report as part of the inspection programme. The SAR for the research reactor includes, in compliance with the relevant IAEA requirements:

- a detailed description of the reactor site, of the reactor, and of all facilities and activities with safety significance;
- the general safety principles and criteria to be applied to the design;
- the analysis of potential hazards associated with operation of the reactor;
- the safety analyses of the potential accident sequences;
- safety features to avoid or minimize likelihood of accidents or mitigate consequences in accordance with the defence in depth concept;
- information for establishing the operational limits and conditions (OLCs) for the reactor;
- conduct of operations; and
- details on the emergency plan of the research reactor.

The SAR has been updated several times in the past. In particular, due to relevant modifications to the reactor systems, like reactor instrumentation and control system, ventilation system and area monitoring system. A periodic update of the report is mandated by the legal framework.

Aside from a high technical standard of the research reactor and reliable and qualified staff, events that have occurred must be systematically documented and analysed in order to learn from them and to continue improving safety.

The process of event analysis and experience feedback ensures that all events relevant for the TRIGA research reactor in Vienna with regard to the development of contributing factors from humans, technology and organisation are analysed and that something is learned from them and, if necessary, that measures are initiated for the TRIGA research reactor in Vienna. Instruments for event analysis and experience feedback include the repeat test plan, which also defines the daily rounds and the routine inspections related to radiation protection, and the regular meetings at the TRIGA research reactor in Vienna.

The performance of event analyses and of the measures derived from them is subject to regulatory review through analysis of the annual operator report.

Nuclear safety officers play a vital role in nuclear safety. Pursuant to § 50 Radiation Protection Act 2020 the tasks of the nuclear safety officer are:

1. *to provide advice to the licensee on matters concerning nuclear safety and to support the licence holder in the fulfilment of review, documentation and notification obligations,*
2. *to participate in the implementation of the necessary measures in the context of nuclear safety and to supervise their compliance and*
3. *to notify the licensee without undue delay about nuclear safety shortcomings identified and to make recommendations for their remediation.*

The licensee shall provide the nuclear safety officer with the necessary time and access to all the information and resources needed to ensure fulfilment of their tasks and shall ensure that the necessary number of radiation protection officers is present during performance of a practice. The General Radiation Protection Ordinance 2020 requires radiation protection officers to successfully complete education and training to ensure a high standard on nuclear safety.

The licensee provides an event analysis for both internal events (notifiable events in accordance with INES and those below the notification threshold) and external events that could also be relevant for the TRIGA research reactor.

Internal events of the operator (notifiable events in accordance with INES and relevant events below the INES notification threshold) are reported directly to the regulatory authority. Furthermore, measures taken have to be reported without delay, including a description on in the relevant measures' full compliance with the regulatory framework. If the authority deems that the

taken measures are not sufficient to keep the legal requirements, it can stipulate further requirements in order to ensure safety. There have been no events or near misses during the reporting period.

External events are communicated to the TRIGA research reactor in Vienna primarily via the Research Reactor Operators Group (RROG), the Arbeitsgemeinschaft Forschungsreaktoren (AFR) and informal exchanges with IAEA and other reactor operators.

Article 14 (2) Verification of safety

The TU Wien has to prepare several documents for information and transparency, for traceability, documentation and as a working basis for the employees, the authority and as a basis for emergencies. As an example, The TU Wien, as required by the legal framework has defined operating regulations, an operating manual, a repeat inspection plan, as well as a written documentation about the reactor operation. This documentation has to be maintained as long as the reactor is operating. Further documents that have been established are training documents, teachings on the installation, documents about the regular calibration of the instruments, documents about the dosimetry or lists concerning any of the radioactive sources at the installation. Occupationally exposed persons in categories A and B at the TU Wien have to wear dosimeters and are monitored; persons of the category A have to be monitored by conducting medical examinations, which have to be documented. The licensee has to provide appropriate protective clothing, to lay down the radiation areas and mark the escape routes. The licence holder has to lay down the competences of the employees, their access to the different areas of radiation exposure. A new radiation warning system has been installed; the environment has to be monitored by itself and by outside experts by taking samples and measuring them in a regular interval. An on-site emergency diesel generator has been installed and an emergency plan regulates the steps in an emergency case. Current events have to be reported immediately.

All these measures intend to ensure the highest level of safety. The Federal Minister of Climate Action, Environment, Energy, Mobility, Innovation and Technology as the competent authority checks the reports and documentation as described above in the context of the annual inspections and review procedures or on an as-needed basis and verifies the accordance to the safety requirements and OLCs set through the licence and the legal requirements. Any proposed modification that might significantly affect the safety is subject to a review and assessment prior to approval by the regulatory body.

Review and assessment plans and priorities are established by the regulatory body on an annual basis and communicated to the licensees.

Article 15 Radiation Protection

The Radiation Protection Act 2020 and the General Radiation Protection Ordinance 2020 form the legal basis for operational radiation protection for all kinds of applications of ionizing radiation (and therefore also for research reactors) in Austria. The legislation aims at protecting human life and health and the environment against the danger of ionising radiation. It is based on the requirements of the European Basic Safety Standards, IAEA Basic Safety Standards, IAEA standards and on recommendations of the International Commission on Radiological Protection (ICRP). The internationally agreed upon principles of justification of a practice, optimisation of radiation exposure and dose limitation are implemented in the legislation. Further radiation protection requirements are defined in non-binding national standards (Austrian Standards International). Requirements of certain standards can be made obligatory by inclusion in the obligations of licences. Specific obligations for the licence holders are stated in the construction and operation licences granted to each operator of a nuclear facility. All activities must be performed in accordance with radiation protection regulations and the obligations in the licences.

The Austrian radiation protection legislation requires optimisation in line with the ALARA principle as a fundamental principle for limiting the radiation exposure of the workers and the public (§§ 4-6 Radiation Protection Act 2020). It is the responsibility of the licence holder to optimize the radiation doses for its licenced practice and to implement a system of control. Typical measures taken by the operator to minimize the exposure of the workers are regular dose rate measurements at work places and low warning levels at the automatic radiation monitoring system. In addition, swipe tests at critical points are performed regularly.

Regulatory inspections cover the checking of the doses of the exposed workers. The authority has experience regarding the typical occurring dose for a certain kind of practice. In case of deviations of typical doses, the authority scrutinises the radiation protection measures of the licence holder. The authority can ask the licence holder to improve its radiation protection measures for optimising its practice. As a consequence, the authority can prescribe optimization measures.

According to the Radiation Protection Ordinance 2020, the dose limit for individuals of the population is set to 1 mSv per year and the dose limit for occupational exposure to 20 mSv per year. These dose limits are in line with international standards. According to § 71 Radiation Protection Act 2020 and §§ 98 and 99 General Radiation Protection Ordinance 2020 the exposure of occupationally exposed persons shall be monitored systematically on the basis of individual measurements. The external exposure resulting from the handling of sources shall be assessed using personal dosimeters. In case an occupationally exposed person handles unsealed radioactive substances in the course of his or her activity, routine intake monitoring shall be implemented if

the committed effective dose resulting from intake on account of such handling may exceed the limit for members of the public. The analysis of this individual dose monitoring and of incorporation monitoring may only be conducted by authorised services.

Exposed workers are categorised based on expected effective doses. The maximum dose for exposed workers of the category B is 6 mSv per year and of the category A is 20 mSv per year. Exposed workers of the category A have to undergo a preventive medical examination before they start their work. Afterwards they have to repeat the preventive medical examination on an annual basis.

The dose limits and working conditions for underage persons and pregnant women are laid down in the §§ 10 and 11 Radiation Protection Act 2020 and § 4 General Radiation Protection Ordinance 2020. As a general rule, the Radiation Protection Act 2020 states that pregnant women and underage persons may not be assigned to any work which would result in being occupationally exposed workers. Nursing women may not be assigned to any work that contains handling with radioactive materials subject to licensing when there is an imminent danger of incorporation and subsequently an exposure of the infant.

For limitation of the public exposure, Austria has a dose constraint of 0.3 mSv/year for the controlled discharge of gaseous or liquid radioactive material. In the licence application for construction and operation of a facility, the technical measures, i.e. barriers and air filters, which are taken to reduce exposure from radioactive discharges, must comply with the ALARA principle. These measures are explicitly stated as obligations when granting the licence. The release of radionuclides into the atmosphere and body of water is monitored by the licence holder and supervised by the licensing authority. The inspection of installations by the authorities concerning emission and immission is set up of two parts: inspection of the quality of the internal control by the operator and independent surveillance by examination of samples taken by the authority. Investigative measurements by the authorities of gaseous and liquid emissions and the internal surveillance by the operators show that maximum permissible levels were never exceeded. In addition, environmental monitoring in the surroundings did not detect any inadmissibly gamma dose rates or emissions during operation of the research reactor.

The competent authority controls the implementation of the principle of optimisation and the implementation of the radiation protection programme by the licence holder by conducting inspections according to § 61 of the Radiation Protection Act 2020.

Article 16 Emergency Preparedness

Article 16 (1) Emergency plans and programmes

The Radiation Protection Act 2020 establishes the main responsibilities of the competent authorities in case of radiological emergencies. The General Radiation Protection Ordinance 2020 and the Ordinance on Interventions in Emergency Exposure Situations and in Existing Exposure Situations 2020 (Ordinance on Interventions 2020) specifies the framework in more detail, as do subsequent documents like the Austrian National Radiation Emergency Plan and the Austrian Catalogue of Protective Actions. The Ordinance on Interventions 2020 specifies off-site emergency preparedness and response (EPR) such as protection of emergency workers, reference levels for the public, content of emergency response plans, protection strategies; whereas the General Radiation Protection Ordinance 2020 stipulates detailed requirements for EPR of the licensee.

The Austrian legislation transposes the Euratom Basic Safety Standards (Council Directive 2013/59/Euratom) and introduces the requirements of IAEA GSR Part 7 Safety Standard. This applies to the Austrian off-site emergency management system as well as to the EPR requirements for all EP category III facilities and EP category IV practices to be fulfilled by the licence holders. The Austrian Radiation Protection Act 2020 requires that the emergency management system shall be subject to reviews, including self-assessments (e.g. by IAEA EPRIMS) and international peer reviews, at appropriate intervals.

The off-site EPR arrangements are determined in detail at federal level by the Austrian National Radiation Emergency Plan and at regional level by the emergency response plans of the Austrian Federal Provinces. (On-site) emergency response plans have to be prepared by the licence holder and are part of the licensing process. *These emergency response plans have to be reviewed regularly and updated taking into account experience of real events and lessons identified in exercises.*

The specific responsibilities related to off-site emergency preparedness and response follow from their responsibilities set by the legislation related to nuclear and radiation safety, in particular by the Radiation Protection Act 2020:

The BMK has a 24/7 on call duty service for notification of radiological events. The BMK (with participation of the Federal Ministry of Social Affairs, Health, Care and Consumer Protection) is responsible for the evaluation of consequences, classification of the emergency in accordance with IAEA GSR Part 7, the decision on protective actions off-site and communication (to other federal competent authorities and to the public) of emergency exposure situations as a result of an accident in a nuclear installation, the crash of a satellite containing radioactive material,

radiological terror or an accident related to practices for which emergency preparedness must be ensured for the public. For all other emergency exposure situations, responsibility rests with the provincial governors. For reasons of expediency, the BMK can take over responsibility for any emergency exposure situation. The responsibility of BMK also includes governmental monitoring of large-scale radioactive contamination of the environment as well as acting as the competent authority for international information exchange (ECURIE, Convention on Early Notification and bilateral agreements).

The Federal Minister of Social Affairs, Health, Care and Consumer Protection is responsible for radioactivity monitoring in food and drinking water, for the procurement, pre-distribution, storage and a distribution system of potassium-iodine-tablets for Iodine Thyroid Blocking (ITB) and participates in accordance with the responsibilities as mentioned above. The Federal Minister of the Interior is responsible for the coordination of the National Crisis and Disaster Management, for the international disaster relief, staffing and maintaining the Federal Alarm Centre, which is serving as national information platform and 24/7 contact point for information exchange (in the field of radiation protection: ECURIE, Convention on Early Notification and bilateral agreements).

Austria's nine provinces are responsible for all emergency exposure situations where the responsibility does not lie on federal level as stated above. These include e.g. the loss, theft or discovery of dangerous radioactive sources, an event with (possible) serious deterministic health effects or a transport accident involving radioactive sources. The provinces are also responsible for the implementation of protective actions for emergency exposure situation on federal level as well as developing and maintaining the response plans on provincial level (mainly based on the National Radiation Emergency Plans). In addition, notification of the responsible authority at federal level is required in case of radiological emergencies at provincial or local level.

The Austrian National Radiation Emergency Plan consists of several parts. It has been developed based on hazard assessments for different nuclear or radiological emergencies.

According to the hazard assessment and emergency preparedness categorization, the TRIGA research reactor is a category III facility. Off-site protective actions to have to be taken into account for EP category III facilities that are part of the Austrian National Radiation Emergency Plan: "Accidents in Austrian nuclear and radiological facilities". These protective actions are based on the safety reports and hazard assessments.

Another part of the Austrian National Radiation Emergency Plan addresses accidents in nuclear power plants (NPP) outside of Austria (category V). A systematic hazard assessment for potential NPP accidents in the vicinity of Austria was performed. Assuming different

accident scenarios, including severe accidents with releases reaching the magnitude of the Fukushima accident, the radiological impact to Austrian territory was analysed for different weather conditions. Based on the results optimized protection strategies have been developed. In addition, the recommendations of the HERCA-WENRA approach are taken into account. No "emergency planning zones" but "emergency planning distances" (see definitions in IAEA GSR-Part 7) of NPPs lie on Austrian territory.

The Austrian Catalogue of Protective Actions is part of the Austrian National Radiation Emergency Plan. The Austrian Catalogue of protective actions has been developed for different types of nuclear and radiological emergencies with involvement of various stakeholders. It lists protective actions for emergency exposure situations and for existing exposure situations after an emergency (late phase) that should be taken into account with benefits and practicability as well as specific restrictions. Those protective actions are optimized and aligned and form the basis of the optimized protection strategies at the preparedness stage. Criteria for the termination of an emergency and the transition to an existing exposure situation were defined on basis of the IAEA General Safety Guide GSG-11 (2018). Generic and operational criteria based on international criteria for taking protective actions are also defined Austrian National Radiation Emergency Plan. The reference levels for the public and emergency workers are determined in the Ordinance on Interventions 2020.

In the urgent phase of a nuclear or radiological emergency, the coordination between different responsible authorities in Austria is realized by well-established information pathways and procedures and an internet based electronic situation reporting platform with restricted access for all responsible authorities. National competent authorities (NCAs) of neighbouring countries have access to the Austrian system as BMK has access to similar systems in the respective neighbouring countries.

Several types of emergency exercises on international, bilateral, national and local level help to improve the emergency preparedness system and keep the emergency personnel trained. Requirements for conducting exercises are part of the Ordinance on Interventions 2020. A more detailed exercise plan is part of the Austrian National Radiation Emergency Plan, listing the regular exercises with Austrian participation. This includes ConvEx (IAEA), ECURIE (EU), INEX (NEA/OECD), bilateral or regional exercises, national exercises, local exercises conducted by the provinces or first responder organizations and specific exercises performing tasks related to emergency monitoring, sampling or analyses.

The legal framework assigns the responsibility for the on-site emergency preparedness and response to the licensee. The required content of the on-site emergency response plan for the research reactor is established in Annexes of the General Radiation Protection Ordinance 2020.

The regulatory body evaluates the EPR arrangements of the applicant during the licensing process, whereas the prospective authorized party has to submit a radiation protection program including an emergency response plan with the application for licence. Additionally, it is required that the licensee notifies the regulatory body immediately about any emergency and has in place a system for response to an on-site emergency.

For the research reactor, the on-site emergency response plan requires a review on a regular basis and updates taking into account experience of real events and lessons identified in exercises. Whenever a significant change of the emergency response plan is necessary, BMK has to be notified.

The regulatory authority reviews and assesses the on-site EPR arrangements of the licence holder (TU Wien) to verify compliance with the regulatory requirements within the regulatory inspection process.

The licence holder is obliged to report any incidents of safety significance to the regulatory body. In addition, the licensee of the TRIGA research reactor is a member of the incident reporting system for research reactors of the IAEA (IRSRR) and has established a model reporting and evaluation system, which has been transferred to other TRIGA research reactors through IRSRR.

On-site-emergency exercises are performed at the research reactor following their emergency plan pursuant to the Radiation Protection Act 2020 and the General Radiation Protection Ordinance 2020.

A specific requirement is that the authorized party has to develop an emergency exercise plan for the following year, which has to be notified to the regulatory body by the end of the year. The exercise plan comprises among others dates, scope and participants of the planned emergency exercises. The outcome of the exercises as well as improvement measures are addressed in the regulatory inspections.

The last exercise at the TRIGA research reactor took place on September 21st 2021, simulating a radiation alarm followed by a decontamination exercise. Due to pandemic access restrictions, it was not possible to perform a larger scale exercise.

Article 16 (2) Information of the public and neighbouring States

Different provisions exist for informing the Austrian population in case of a radiological or nuclear emergency. An Austrian-wide sirens system for warning and alerting the population in areas

affected by disasters including nuclear and radiological emergencies exists. In addition, in case of an emergency, the competent authorities will provide urgent information to the public together with the protective actions via radio and TV. Text templates for press releases, for radio and TV announcements as well as for social media have been prepared for different types and scenarios of radiological and nuclear emergencies. If necessary, representatives of the Austrian Broadcast Corporation (ORF) and the Austrian Press Agency (APA) will be included in the coordination board of the National Crisis and Disaster Management. A call-centre can be activated on short notice. Public leaflets on radiation protection, emergency management and protective actions are available (www.strahlenschutz.gv.at). Additional information prior and in case of a radiological emergency is provided on the homepage of the BMK.

The exchange of information in case of a radiological or nuclear emergency with the competent authorities in the neighbouring countries is guaranteed by three information systems: Austria fulfils the obligations of the Convention on Early Notification of Nuclear Accidents (IAEA), is part of the ECURIE information exchange system organized by the European Commission and has bilateral agreements with all neighbouring countries operating nuclear power plants. Austria has been striving for years to extend the bilateral and regional co-operation, which resulted, among others, in automatic exchange of information between emergency centres relevant for assessing the impact of a radiological or nuclear accident such as dose rate measurements and source term information and joint emergency exercises.

In accordance with the Euratom Basic Safety Standards Directive transposed into the Radiation Protection Act 2020, it is required that in case of a transboundary emergency BMK shall establish contact with the competent authorities of countries involved for sharing the assessment of the situation, coordinating protective measures and informing the public.

Data gathered by the Radiation Early Warning System are exchanged on-line with the corresponding systems in most of Austria's neighbouring countries (Slovenia, Slovakia, Czech Republic, Hungary, Germany and Switzerland) on the basis of bilateral agreements. In parallel, information is exchanged on European level via the EURDEP system (IRMIS for IAEA Member States). *Based on the EURDEP system measurement data from the Italian Radiation Early Warning System are also available for BMK.*

The Austrian Radiation Early Warning System (Strahlenfrühwarnsystem) continuously monitors ambient gamma dose rates with more than 300 measuring stations throughout the country. In addition, 10 aerosol-monitoring stations have been installed near the Austrian borders. The measurement data of these automatic online systems are transmitted to the National Centre at BMK and to nine provincial centres located in the provincial capitals. *The*

public can access data of approximately 100 measuring stations online (https://sfws.lfrz.at/) or via the Austrian Broadcast (ORF) Teletext service.

According to Austrian radiation protection legislation and the National Radiation Emergency Plan special intervention teams (emergency workers) have to be trained and equipped to perform mobile measurements. Dose-rate measurements (foot, car, helicopters) can be done on short notice by specialized police forces. More detailed measuring capabilities (gamma probe, nuclide multipurpose gamma/beta survey monitor, hand-held radionuclide identifier, in-situ HPGe, etc.) are with trained teams, which are part of the technical support organization who is also responsible for laboratory-based measurements.

In addition, a laboratory-based monitoring network performs a radionuclide-specific routine monitoring of air, precipitation, surface water bodies, feed- and foodstuffs. In addition, an emergency sampling concept is available as part of the Austrian National Radiation Emergency Plan.

The BMK is also obliged to operate appropriate decision support systems (i.e. RODOS) based on meteorological forecast data. The information provided by the accident country (source term, other release parameters) is the basis for a prognosis of possible consequences. The environmental monitoring measurement results and the results of the decision support systems provide the basis for assessing the radiological situation and deciding on protective actions on federal level.

Article 16 (3) Emergency preparedness for Contracting Parties without nuclear installations

As summarized under Article 16 (1) and (2) the Austrian Emergency Management System and the National Radiation Emergency Plan take into account all types of radiological emergencies, which could affect Austria.

This includes in particular accidents in Nuclear Power Plants outside of Austria (EP category V) as well as radiological terror, satellite re-entry with radiation sources on board and events with dangerous sources including transport accidents (EP category IV).

Article 17 Siting

Article 17 (1) Evaluation of site related factors

§ 48 Radiation Protection Act 2020 stipulates the objectives and principles regarding nuclear safety of nuclear installations for siting, design, construction, commissioning, operation and decommissioning. The main objectives is to prevent accidents and in case of an accident to (a) mitigate its effect, (b) to avoid radioactive substances from being released so early that there is not enough time to implement necessary protective measures and (c) to avoid radioactive substances from being released to such an extent that the necessary protective measures could not be limited in area or time. Therefore, nuclear installations in particular must ensure that the impact of extreme external natural and unintended man-made hazards is minimized.

Pursuant to § 53 Radiation Protection Act 2020 in order to obtain a construction licence for a research reactor applicants are required to comply with internationally recognized safety standards regarding siting.

As there are currently no plans to establish new nuclear installations there have been no activities concerning siting during the reporting period.

Article 17 (2) Impact of the installation on individuals, society and environment

Annex 10 of the General Radiation Protection Ordinance 2020 determines the content of the safety report for research reactors. It must include an estimation of the radiological effects of events on humans and the environment in order to achieve the above mentioned objectives pursuant to § 48 Radiation Protection Act 2020.

The operating licence of the TRIGA research reactor includes a requirement on the regular reporting of environmental monitoring and of "dosimetry for measuring external and internal radiation exposure of people" to the regulatory body and is part of the yearly inspection process according to § 61 Radiation Protection Act 2020. So far, no irregular activities or exceedances of dose limits have been reported.

Article 17 (3) Re-evaluation of site related factors

No re-evaluation has taken place during this reporting period.

Article 17 (4) Consultation with other Contracting Parties likely to be affected by the installation

Since the major overhaul from April 2014 until April 2017, (reactor instrumentation, control system, primary and secondary cooling circuits, reactor control room as well as the radiation warning system) Austria reports regularly on its research reactor in the course of the Bilateral Nuclear Experts Meetings according to its bilateral agreements (see Annex). Austria has pertinent bilateral agreements in place with all Contracting Parties likely to be affected by its research reactor. The EU directive on transboundary Environmental Impact Assessments and the ESPOO Convention is fully transposed into Austrian law. Austria will participate in the second topical peer review on fire protection of nuclear installations pursuant to the Nuclear Safety Directive 2014/87/Euratom regarding its TRIGA research reactor on a voluntary basis (not reaching the threshold of 1 MW_{th} power).

Article 18 Design and Construction

Article 18 (1) Implementation of defence in depth

§ 48 Radiation Protection Act stipulates the objectives and principles for regarding nuclear safety of nuclear installations for siting, design, construction, commissioning, operation and decommissioning. The main objectives are to prevent accidents and in case of an accident to (a) mitigate its effect, (b) to avoid radioactive substances from being released so early that there is not enough time to implement necessary protective measures and (c) to avoid radioactive substances from being released to such an extent that the necessary protective measures could not be limited in area or time.

Pursuant to § 53 Radiation Protection Act 2020 in order to obtain a construction licence for research reactors applicants are required to comply with internationally recognized safety standards in regards to siting.

As there are currently no plans to establish new nuclear installations there have been no activities concerning siting during the reporting period.

Article 18 (2) Incorporation of proven technologies

See Art. 18(1).

Article 18 (3) Design for reliable, stable and manageable operation

See Art. 18(1)

Article 19 Operation

Article 19 (1) Initial authorization

Pursuant to the Austrian legal framework, a licence is only granted after an application. Throughout the lifetime of a research reactor, several licence requirements have to be met at three different stages. Firstly, in order to obtain a construction licence requirements regarding siting, design and a preliminary safety report have to be fulfilled. Secondly, specific requirements such as the nomination of nuclear safety officers or a decommissioning concept have to be met in order to obtain a licence to operate research reactors. Lastly, in order to obtain a decommissioning licence requirements regarding the availability of a detailed planning for decommissioning with the state of the art and internationally recognised safety standards have to be fulfilled pursuant to § 49 para. 4 Radiation Protection Act 2020.

As previously mentioned § 48 Radiation Protection Act 2020 stipulates the objectives and principles regarding nuclear safety of nuclear installations for siting, design, construction, commissioning, operation and decommissioning. Pursuant to § 53 Radiation Protection Act 2020 in order to obtain a construction licence for research reactors, applicants are required to comply with internationally recognized safety standards in regards to siting.

The applicant of a construction licence is required to include all documentation necessary to demonstrate that all legal obligations are being met. In the run-up, other relevant permits (i.e., building permit according to the building code) need to be secured. The responsibilities have to be laid down in a transparent way and the licence holder has to draft and apply several written documents laying down the frame of the safety criteria for the working procedures and how to report on relevant topics. The construction authorisation may include testing requirements. Installations may only be operated on the basis of an operation authorisation, which shall be granted if all conditions stipulated in the respective regulations are fulfilled, and after eventual inspection and testing of the installation (if so required).

In order to obtain a construction licence, the applicant must present a concept for decommissioning. The content of the decommissioning concept is prescribed in the General Radiation Protection Ordinance 2020. Furthermore, for obtaining a construction licence for an installation, adequate provisions have to be made also for the disposal of radioactive waste.

At present, there are no plans for the construction of a new research reactor, therefore siting and design licence applications are not expected in the near future.

In order to obtain the operation licence, the application shall enclose, among others, evidence of fulfilment of the conditions prescribed in the construction authorisation, including the testing requirements (i.e. a description of the activities that were conducted in order to fulfil the conditions included in the construction licence. A description, on how the requested tests have been conducted, a written confirmation that all conditions included in the construction licence are fulfilled, as well as all other technical documents are required for obtaining the operation licence).

Issued licences are reconsidered during the lifetime of a facility / duration of the activity if required.

In general, construction or operation licences shall expire upon termination, interruption of the licenced practice for a period of more than three years, expiration of a temporary licence or if certain conditions regarding time limits are met. However, licenced practices in research reactors, whose licence only expires through a legally effective licence to decommission the research reactor, are exempt from this rule.

According to the Radiation Protection Act 2020 further types of authorizations required for research reactors are licences for construction and testing, licences for operation and approval for decommissioning. Commissioning requirements set for new facilities or components of new facilities are reviewed during the Article 17 procedures.

In accordance with the operation licence a detailed SAR has to be submitted which has been updated several times during the past. Extensive updates have been conducted due to modifications in the reactor systems (i.e. reactor instrumentation and control system, ventilation system, area monitoring system).

International experience is constantly exchanged and updated at meetings. The result of this information exchange is reflected in the overall technical and organisational status of the TRIGA research reactor.

Based on the design requirements the inspection plan has to be completed every year and is inspected by the regulatory authority with the help of external experts. After the inspection, a report is written containing the opinions of the experts and the conclusions of the regulatory authority. If the report provides for improvements, the operator shall implement them and subsequently report back to the authority on the fulfilment. It is possible to suspend the operation licence until the identified deficiencies are rectified if the regulatory body has serious concerns regarding safety relevant issues. As of the writing of this report, no such events have ever occurred since the TRIGA research reactor went critical in 1963.

Article 19 (2) Operational limits and conditions

The SAR includes all operational limits and conditions (OLC) derived from the safety analysis and covers operational experience. Typical OLC's are i.e. excess nominal power, excess fuel or water temperature, short reactor period, any failure of PC components in the I&C system.

In addition, any deviation from the nominal value is announced by an optical and acoustical alarm and thus allowing the operator to start any counteraction before an OLC is reached.

The operating rules contain in particular the operating structure, internal regulations governing the operation of the installation, operation of the reactor control, radiation protection, maintenance, fire protection and access control, organisational and safety requirements for the operation of the installation, the procedure for the routine use of the research reactor and the associated facilities, for example, for scientific experiments, operating instructions for all systems critical to safety, but also the safety relevant limits, measures in the case of safety related incidents, criteria for notifiable events and event detection and process description in the case of incidents and the measures to be taken.

Article 19 (3) Procedures for operation, maintenance, inspection and testing

Detailed written procedures for operation, testing, maintenance and re-inspection exist and are regularly updated. These documents are available in electronic format as internal reports. Written procedures exist in the reactor operation manual for responding to operational occurrences and to accidents. Necessary engineering and technical support in safety related fields are available at TU Wien. Besides the in-house workshops, business relations have been established with qualified institutions, companies and research institutes to respond to any technical problem, which cannot be solved by the in-house facilities.

As part of Austria's critical infrastructure, the TRIGA research reactor is also included in a secure communication network. During the COVID-19 Pandemic, this network was extensively used to communicate necessary interventions as well as access restrictions. During hard lock-down phases, the research reactor was shut off and a daily inspection was done by single persons of the reactor crew.

The annual inspection process by the regulatory authority is further detailed in Supervision Handbook. Specifically, the research reactor must be inspected by the regulatory authority at least once per year according to the legal requirements. This annual inspection is announced. For setting up the annual inspection programme, procedural parameters are kept, including at least one on-the-spot inspection in addition to the one prescribed by the Radiation Protection Act 2020.

According to the Radiation Protection Act 2020, the authority may carry inspections at any time. They can be announced or unannounced.

In addition to the annual inspections, which cover all aspects that need to be controlled (e.g. operational radiation protection, emergency preparedness and response, training and qualification of personnel, etc.) there might be topical inspections, as well as reactive inspections.

Depending on the object of inspection, the methods to be used range from questioning, perusal and examination of the operator's documents/information/test plans all the way to on-the-spot inspections.

By law, inspections at research reactors must be conducted at least once a year. Thus, for the TRIGA research reactor there should be at least one inspection per year, but in case of planned changes or events that may significantly affect the safety or in case of significant deficiencies in the research reactor operation, the regulatory authority might deem more than one inspection per year necessary.

Two inspectors perform inspections at the TU Wien, one for the research reactor and one for radiation sources, all holding degrees in technical studies and having experience and training in reactor management. Prior to the inspection, the licensee is obliged to submit a set of documentation listed in the Supervision Handbook (including e.g. annual reports on operation, on radiation protection, and on environmental monitoring, Safety Analysis Report, report on training, test results and information on any safety related change in the operation of the research reactor). The authority and its expert(s) review and assess the submitted documents.

In accordance with the General Act on Administrative Procedures and the Radiation Protection Act 2020, the BMK may use the services of non-official assessors who conduct checks and inspections to verify the compliance of the authorization holder's activities and to avert any dangers on behalf of the BMK using the appropriate tools. The inspections are performed with participation of the representatives of other involved regulatory authorities (e.g. in fire protection, emergency preparedness or building) and of experts assisting the authority, according to a predetermined agenda set by the Supervision Handbook. The inspection consists of discussions (oral hearing) with the licensee and observation of documents and activities/operation.

During the inspection, the reports of the licence holder are discussed and any measures to be taken are recorded. In the extreme case when the inspection reveals that one of the conditions for granting the licence is not complied with and there is a risk to the health or life of humans,

the operation shall be prohibited. The outcome of an inspection is discussed between the inspector (technical expert) and the legal experts of the regulatory body as basis for enhancement of processes and the planning of topical inspections.

The operating organization has to elaborate checklists for any handling of sources in the development of which it is supported by experts. These schedules have to include all relevant data to document any manipulation with radioactive sources in the regular operation as well as in cases of incidents. Special criteria for information and documentation have to be submitted and are subject to reviews by the regulatory body. Safety relevant deviations have to be reported immediately to the regulatory authority to enable further measures if necessary.

Article 19 (4) Procedures for responding to operational occurrences and accidents

The procedures to be followed in case of operational occurrences and accidents are laid down in the on-site emergency response plan including:

- Description of the installation and its equipment with regard to incidents, including an inventory of equipment and its place of storage
- Specifications for the detection and classification of a design basis accident,
- The definition of responsibilities, in particular those of the company's organisation, in the event of accidents,
- Representation of the procedures in the event of incidents, in particular the alarm sequences,
- Summary of reporting obligations to the authorities, including the determination of relevant contact addresses and reporting channels,
- Precautions to ensure the reliability of all communication channels,
- Agreements with external emergency services and authorities regarding assistance in the event of incidents, in particular with regard to the provision of additional human resources,
- Facilities for initial and subsequent radiological impact assessments, including radiological environmental monitoring, and
- Protective actions to minimise the exposure of persons to radiation, in particular the establishment of assembly points for workers inside and outside the reactor building, and measures to delimit and label the radiation hazard area and decontamination measures; and
- Measures to ensure the medical care of injured persons, in particular their hospitalisation,

- Technical measures to prevent the extension of the consequences of design basis accidents, in particular measures to minimise the release and spread of radioactive substances,
- Specifications for the limitation of the dose for the facility's internal personnel,
- Regulations regarding public information,
- Regulations for the resumption of normal operation after the end of an accident,
- Measures to preserve evidence,
- Regulations governing staff training and practice,
- Arrangements for reviewing and updating the contingency plan.

Article 19 (5) Engineering and technical support

To ensure necessary engineering and technical support in all safety related fields the licence holder has to set up and implement a quality assurance system that addresses the above issues. The Austrian law also requires a nuclear safety officer. His tasks include inter alia the development of improvement and retooling measures based on the inspection results, the officer´s operation experience and the exchange of experience with nuclear safety officers of comparable installations. Concerning the technical equipment the licence holder has maintenance contracts with the manufacturers of the facility.

Article 19 (6) Reporting of incidents significant to safety

According to the General Radiation Protection Ordinance 2020, the licensee shall notify the competent authority without undue delay of

1. *any release of radioactive substances into the environment in an amount that exceeds the scope of a licenced discharge;*
2. *any release of radioactive substances within the facility;*
3. *malfunctions, damage or outages of safety-relevant systems or facility parts;*
4. *damage to or leaks from safety-relevant piping or containers;*
5. *criticality incidents;*
6. *the falling of heavy loads with safety-relevant effects on operation of the reactor;*
7. *safety-relevant events during handling and storage of fuel elements;*
8. *safety-relevant impact from outside, including earthquakes or flooding;*
9. *safety-relevant events in the facility, including fire and on-site inundation of the facility;*
10. *contamination of individuals or intake requiring medical care.*

These notifications shall include information on the causes, the effects and their remediation as well as information on precautions take to avoid a repetition of the event. Feedback from

experience in operating the reactor, taking into account the operational experience for other comparable reactors, is also required to be considered by the periodic safety review.

If there are safety endangering circumstances they have to be reported immediately to the licence holder and to the competent authority and the (part of the) facility has to be shut down until the problem could be solved. All these procedures and undertaken measures have to be documented as well.

Depending on the technical problems, the regulatory authority may take advice by external experts and impose conditions and requirements for the resumption of the operation.

Article 19 (7) Operational experience feedback

Operational experience is collected and shared among the TRIGA research reactor operators worldwide as well as through the IAEA with the international research reactor community. The TRIGA Center Atominstitut of TU Wien is member of the

- TRIGA community (meets regularly)
- Arbeitsgemeinschaft Forschungsreaktoren (AFR - meets twice a year)
- Research Reactor Operators Group (RROG - meets once a year) Research Reactor Fuel Management Group (RRFM - meets once a year), International Group on Research Reactor (IGORR - meets every 18 month)
- European Atomic Energy Society (EAES - meets once a year)
- International Nuclear Security Education Network (INSEN – meets annually)

The international experience is constantly exchanged and updated at these meetings. The result of this information exchange is reflected in the overall technical and organisational status of the TRIGA research reactor.

Article 19 (8) Management of spent fuel and radioactive waste on the site

TU Wien returned highly enriched fuel elements back to the USA in 2012. Based on a contract between the TU Wien, the US-DoE and Euratom, the US-DoE lent the university low enriched fuel elements. The fuel elements are kept within the reactor. Additionally, there is a secure storage facility on site; however, it is not used at the moment. Medium and low level radioactive waste is sent to "Nuclear Engineering Seibersdorf" the central waste storage facility of the country about twice a year.

Annex I

The following Multilateral Agreements in the field of nuclear safety and radiation protection have been ratified by the Austrian Parliament:

UN/IAEA

Convention on Early Notification of a Nuclear Accident; BGBl. No. 186/1988, entered into force on 20 March 1988.

Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency; BGBl. No. 87/1990, entered into force on 22 December 1989.

Convention on Nuclear Safety; BGBl. III No. 39/1998, entered into force on 24 November 1997.

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management; BGBl. III No. 169/2001, entered into force on 11 September 2001.

UN/ECE

Convention on Environmental Impact Assessment in a Transboundary Context; BGBl. III No. 201/1997, entered into force on 10 September 1997.

Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context; BGBl. III No. 50/2010, entered into force on 11 July 2010.

Convention on the Protection and Use of Transboundary Watercourses and International Lakes; BGBl. No. 578/1996, entered into force on 23 October 1996.

Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention); BGBl. III No. 88/2005, entered into force in 2005.

Abbreviations

AFR	Arbeitsgemeinschaft Forschungsreaktoren
ALARA	As low as reasonable achievable
AllgStrSchV 2020	General Radiation Protection Ordinance 2020
ARTEMIS	Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation
BGBl.	Federal Law Gazette
BMBWF	Federal Ministry for Education, Science and Research
BMK	Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology
Bq	Becquerel
BWR	Boiling Water Reactor
CNS	Convention on Nuclear Safety
EAES	European Atomic Energy Society
ECURIE	European Community Urgent Radiological Information Exchange
EPR	Emergency preparedness and response
EPRIMS	EPR Information Management System
EU	European Union
EUDEP	EUropean Radiological Data Exchange Platform
Euratom	European Atomic Energy Community
HERCA	Heads of the European Radiological Protection Competent Authorities
IAEA	International Atomic Energy Agency
IAEA GSR	IAEA General Safety Requirements
ICRP	International Commission on Radiological Protection
IGORR	International Group on Research Reactor
IRMIS	International Radiation Monitoring Information System
INES	International Nuclear and Radiological Event Scale
INEX	International Nuclear Emergency Exercises
INSEN	International Nuclear Security Education Network
IRRS	Integrated Regulatory review Service

IRSRR	Incident Reporting System for Research Reactors
KW	Kilowatt
MW	Megawatt
mSv	Millisievert
NCA	National Competent Authority
NPP	Nuclear Power Plant
ÖAW	Austrian Academy of Science
OLC	operational limits and conditions
RRFM	Research Reactor Fuel Management Group
RROG	Research Reactor Operators Group
SAR	Safety Analyses Report
StrSchG 2020	Radiation Protection Act 2020
TU Wien	Vienna University of Technology
TRIGA	Training, Research, Isotopes, General Atomics
VDNS	Vienna Declaration on Nuclear Safety
WENRA	Western European Nuclear Regulators Association

Imprint

Ninth National Report of Austria under the Convention on Nuclear Safety in accordance with Article 5

Publisher: Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology

Stubenring 1, 1012 Vienna, Austria

Division: General Coordination of Nuclear Affairs

(National Contact Point under the obligations of the Convention)

Republic of Austria
Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology
https://www.bmk.gv.at/