SIXTH

NATIONAL REPORT
OF AUSTRIA

October 2017

on the implementation of the obligations of the

Joint Convention

on the Safety of Spent fuel and on the safety of Radioactive Waste Management
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Executive Summary

There is neither a nuclear power plant (NPP) nor any other fuel cycle facility in operation in Austria. One NPP was constructed in Zwentendorf in the 1970s, but, as a consequence of the negative vote in a referendum, never put into operation. One TRIGA research reactor in Vienna is currently in operation. Spent nuclear fuel is stored on site in dry or wet storage facilities if necessary. Ultimately all spent fuel from the research reactor has been and will be returned to the USA. Austria operates one central radioactive waste management and interim storage facility – Nuclear Engineering Seibersdorf GmbH (NES) - for predisposal management including treatment, conditioning and interim storage of all low- and intermediate level radioactive waste (LILW) originating from Austria. High-level radioactive waste (HLW) does not arise. LILW originates primarily from medicine, research, industry and decommissioning. There is no disposal facility for radioactive waste in operation.

NEW: The transposition of Council Directive 2011/70/EURATOM on establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste in Austrian legislation has been completed. The associated national program is actually under public participation procedure.

NEW: Austria formulated its policy for the management of spent fuel and radioactive waste generated in the Radiation Protection Act.

NEW: The modernisation of the central radioactive waste management and interim storage facility is ongoing. Some related projects have already been completed or are near completion.
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A. Introduction

The sixth Austrian National Report contains updated information on the Austrian policy and the usual practices concerning the management of spent fuel of the TRIGA research reactor in Vienna and the management of radioactive waste. Furthermore, it contains information on the Austrian legal regime concerning the management of radioactive waste, the national radioactive waste management policy and applicable national laws, regulations and practices. The general structure of this report follows Infcirc/604/Rev.3.

This report includes also answers to questions received and raised at the country group session of the previous Review Meeting and especially considers the progress of the future radioactive waste management concept at the only existing facility Nuclear Engineering Seibersdorf (abbreviated NES) for the optimisation of radioactive waste treatment (more detailed description see Annex L1).

The Federal Minister of Agriculture, Forestry, Environment and Water Management (abbreviated BMLFUW) represents the leading authority concerning the implementation of this Joint Convention.
B. Policies and Practices – Article 32 Para 1

In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measure taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its

(i) spent fuel management policy;
(ii) spent fuel management practices;
(iii) radioactive waste management policy;
(iv) radioactive waste management practices;
(v) criteria to define and categorize radioactive waste

B1. Spent fuel management policy – Article 32 Para 1 (i)

In the 1970s, a nuclear power plant was constructed in Zwentendorf, but as a consequence of the negative vote in a referendum it was never put into operation. All nuclear fuel elements were removed in the late 1980s. Thus, Austria has never operated a nuclear power plant and has no intention to do so in the future. Austria’s use of nuclear energy for peaceful purposes has significantly been influenced by the passing of the law prohibiting the use of nuclear fission for energy purposes in 1978 and by passing the Federal Constitutional Law for a Nonnuclear Austria in 1999. Currently, Austria operates one research reactor at the Institute of Atomic and Subatomic Physics, which is administered by the Vienna University of Technology.

In October/November 2012 - irradiated fuel elements from the research reactor were shipped to the Idaho National Lab and replaced by 77 19.8% enriched standard TRIGA fuel elements. Said fuel elements constitute a loan from the US Department of Energy (DoE) as stipulated in a treaty between the Vienna University of Technology (TU WIEN), EURATOM and the DoE (contract No.DE-NA0001641). These fuel elements are to be returned to the USA in 2025 or beyond, if the clause to increase the term of the treaty is activated after 2035 at the latest. Therefore, spent fuel management in Austria is limited to the interim storage of the spent fuel elements of the TRIGA Reactor which is currently empty.
B2. Spent fuel management practices – Article 32 Para 1 (ii)

Spent fuel from the TRIGA research reactor can be stored on site until the final return shipment to the United States. The dry interim storage with a capacity of 168 fuel elements is situated in the reactor building. At present, no spent fuel elements are stored there.

Storage of spent fuel is performed according to the relevant radiation protection and safeguards legislation. An appropriate license is needed for the storage and annual inspections are performed by the licensing authority. Future shipment is performed according to the relevant transport and safeguards legislation.

B3. Radioactive waste management policy – Article 32 Para 1 (iii)

The Austrian Federal Constitutional Law for a Nonnuclear Austria prohibits any kind of handling of nuclear weapons and related facilities (§ 1) as well as the construction and use of facilities for production of energy by nuclear fission (§ 2) on the Austrian territory. In line with Austria’s attitude towards nuclear power no facilities for spent nuclear fuel are in operation in Austria. Also no facilities for high-level radioactive waste are in operation in Austria.

Radioactive waste originates from applications of radioactive substances in medicine, industry, education and research. Waste originates also wherever radiation facilities at their end of life are decommissioned. Responsible radioactive waste management aims to protect human health and the environment and to avoid placing an unnecessary burden on future generations.

For the management of radioactive waste generated in Austria, § 36b (1) to (4) of the Radiation Protection Act requires the following internationally recognized principles to be applied:

The Republic of Austria shall bear the ultimate responsibility for the safe management of radioactive waste arising in its territory. This basic principle reinforces national responsibility with regard to the Austrian radioactive waste management policy. This principle also applies when radioactive waste is transported to another country for treatment.

Since a relatively small amount of radioactive waste is to be disposed of in Austria, cooperation at European or international level is advantageous from an economic point of view. Therefore, the possibilities of cooperation with other Member States of the European Union or States that have ratified the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management will be considered.

Whilst the construction and operation of research reactors in Austria are permitted, the operator of a research reactor must ensure that no spent fuel is left to be disposed in Austria. This is to be achieved by means of a take back (return) agreement with the manufacturer or supplier of the fuel elements.

Radioactive waste minimization (i.e. the prevention or avoidance of waste creation) is a basic principle when dealing with radioactive substances in general and the management of radioactive waste in particular. This is based on ecological, ethical and safety-relevant considerations, given that the potential impact on the environment and the safety risk during treatment and storage increase with the amount of waste. The burden on future generations should be kept as low as possible. Further, radioactive waste minimization together with volume reduction have important economic advantages, since both treatment and disposal are costly and smaller waste volumes will result in lower costs.

Interdependencies between the individual steps taken during the management of radioactive waste must be considered. The background of this principle is the close interlinking of the individual steps in the management of radioactive waste starting from its generation through to disposal, whereby decisions taken at any step can decisively influence a subsequent step. Each individual management step should be analysed and designed so that it,
and subsequent steps, are optimized. For example, conditioned drums should be dried before being placed in an interim. With this measure, the possibility of corrosion of the inside of the waste drums is largely prevented.

An important principle is that radioactive waste shall be managed safely: radioactive waste must be isolated from humans and the environment also in the long-term (in this respect, aspects of passive safety must also be taken into account). Examples are the use of corrosion-resistant drums for the interim storage of conditioned radioactive waste or design of a repository in such a way that it can be left to itself after the final closure, without risks.

The safety measures for a facility or an activity related to the radioactive waste management should be determined in a graded approach according to the risks. For example, the requirements for disposal facility are much more extensive than for an interim storage facility.

A fact-based and documented decision-making process is applied to all radioactive waste management steps. The decision-making process shall be based on a summary of the arguments and facts demonstrating that the required standard for the safety of a facility for or activity related to the management of radioactive waste has been achieved.

According to § 36c Radiation Protection Act NES is entrusted by the Republic of Austria with the predisposal management of the radioactive waste arising in Austria. This contract covers the collection, sorting, conditioning and long-term interim storage of radioactive waste at Seibersdorf. The ongoing comprehensive modernization of the NES treatment and storage facilities provides the best technical conditions for safe treatment, conditioning and interim storage as defined in Directive 2011/70/EURATOM.

The costs of predisposal management as well as disposal of all radioactive waste are covered by the “polluter pays principle”. The aim of this principle is cost recovery through the polluters, also with regard to future disposal, so as not to burden future generations with the costs. In the case of transfer to NES, the companies/institutions where radioactive waste is generated have to pay a fee for treatment and interim storage and, on the other hand, a pre-payment fee which the Federal Government may use as revenue exclusively for the purpose of financing a subsequent disposal of this waste. The Republic of Austria, on the other hand, is responsible for the costs of setting up disposal facilities and interim storage facilities and for making major adjustments to current technical standards.

Until a decision on disposal is taken, for the existing radioactive waste in Austria the concept of interim storage at NES in Seibersdorf is applied in the view of small quantity and low risk potential (more than 95% low level radioactive waste). Waste treatment and interim storage at the Seibersdorf location is currently contractually secured until 2045.

According to the Waste Management Directive (Council Directive 2011/70/EURATOM for the responsible and safe management of spent fuel and radioactive waste) Austria has to establish a national program to ensure the timely implementation of all steps of spent fuel and radioactive waste management from generation to disposal. Austria has drafted such a program, which will be subject of a Strategic Environmental Assessment according to § 36b of the Radiation Protection Act (planned for autumn 2017). It is warranted with this measure that the public has the necessary opportunities to participate in the pertinent proceeding.

The radioactive waste inventory, which is currently stored at NES, will have to be disposed of. A decision on the location and type of the required disposal facility has not yet been taken in Austria. In addition to the clarification of the legal and organizational issues, it is above all necessary to ensure that the entire process is completely transparent. All important decisions must take place with the appropriate involvement of the public and all interested institutions. The aim is to determine the type and location of one or more repositories for Austrian waste. Austria will seek cooperation with other European countries to resolve the issue of final disposal. Collaboration is particularly appropriate for those countries in which the situation is similar to that in Austria, i.e., smaller countries without domestic nuclear power programme. An exchange of experience, cooperation in international working groups and joint action in
some areas - for example coordinated research projects - would bring benefits for all parties. According to the present state-of-the-art, various types of repositories are considered, which are suitable for different types of waste. Since Austria does not have to dispose of highly radioactive waste or spent nuclear fuel, the technical disposal requirements for Austrian radioactive waste are significantly lower than in countries with nuclear power plants. The safe disposal of short-lived radioactive waste, which makes up most of the waste volume, is possible in disposal facilities that, according to best world practice, can be constructed comparatively easily. Such disposal facilities already exist in several countries of the world. Austria is striving for the timely establishment of a repository for its short-lived radioactive waste in its own country. In order to find a suitable solution for the small quantities of long-lived waste, the possibility of cooperation with other countries seems to be an option. In the international community, regional or international cooperation is regarded as a suitable option for final disposal and there are corresponding initiatives for a common approach. The advantages and disadvantages of Austria’s participation in a joint repository will have to be weighed in a discussion process.

B4. Radioactive waste management practices – Article 32 Para 1 (iv)

Nuclear Engineering Seibersdorf GmbH (NES) is the only centralised waste management facility in Austria, where all conditioned low level and intermediate level radioactive waste (LILW) arising in Austria is currently interim stored. High level radioactive waste does not arise in Austria.

Austria follows the principle of minimisation of radioactive waste. For this reason radioactive waste with radionuclides with short half-lives is allowed to be stored by the producers until its activity has decayed below applicable clearance levels. Subsequently, this material as inactive waste can be either released to the environment or disposed in an appropriate way. Another possibility is the controlled release or discharge of very small amounts of gaseous or liquid radioactive material in line with the requirements of an appropriate license (§ 74 of the General Radiation Protection Ordinance). All other radioactive material which cannot be used anymore must be transferred to NES for treatment and conditioning.

The aim of treatment and conditioning is to transform the radioactive waste into a chemical stable form and to isolate it safely from the environment. The volume reduction of the waste is also necessary to lower the cost of interim and future long term storage. Procedures are established to effectively minimise and monitor the releases of radioactivity in accordance with applicable environmental regulations, i.e. HEPA filtration of gas effluents from the incinerator. A comprehensive program of environmental radiation monitoring is in place to ensure that any unexpected releases of radioactivity are detected and that the necessary actions can be taken in a timely manner.
A number of conditioning systems are operated by NES (see Annex L1).

Depending on the type of waste, several treatment techniques are applied:

- **Combustible waste** is incinerated. In the past, the resulting incinerator ash has homogeneously been cemented. Since 2007 ash is stored in 100-litre-drums which are placed into custom made stainless steel cartridges. These cartridges are purged with nitrogen, shut by welding and placed into 200-litre-drums. Volume reduction: > 40:1.

- **Non-combustible compactable waste** is supercompacted; the pellets are loaded into 200-litre-drums made of steel for interim storage, volume reduction: ~ 4:1.

- **Liquids** are either injected into the incinerator or dried in a vacuum cone dryer (usually after mixing with sludge from the waste water treatment plant). The resulting powder is supercompacted; volume reduction: > 30:1.

- **Filters** are supercompacted; pellets are loaded into 200-litre-drums for interim storage.

- **Conditioned 200-litre-drums** are dried in the 32-drum-dryer to minimize the risk of corrosion effects and chemical reactions inside.

- **Sealed sources** are segregated according to their half-life (\(^{60}\)Co, \(^{137}\)Cs, \(^{241}\)Am). They are enclosed in stainless steel cartridges and/or lead shielding and retrievably stored in 200-litre-drums.

- **Radium sources** are encapsulated by welding them into stainless steel capsules; they are retrievably stored in lead shielding. Other sources are collected in small steel containers and stored in shielded drums.

- **High-activity sealed sources** can be handled in the hot cell facility and are stored in the storage tubes of the underground storage below the hot cell.

- **Before the conditioned drums** are transferred to the interim storage they are characterized regarding radionuclide content with the waste assay system.
All radioactive waste management facilities and activities in NES are duly licensed and regularly supervised by the BMLFUW in accordance with the relevant Austrian radiation protection legislation (see section E).

B5. Categorisation of Radioactive Waste – Article 32 Para 1 (v)

Radioactive waste is defined as radioactive material for which no further use is foreseen. Radioactive material means any substance that contains or is contaminated with one or more radionuclides with an activity or concentration that cannot be neglected, as far as radiation protection is concerned, and unless they are exempt from regulatory control. Exemption and clearance levels are laid down in the General Radiation Protection Ordinance. The nuclide specific values for clearance are derived from the internationally accepted concept of 10 µSv/year additional dose. Clearance measurements have to be certified directly or indirectly by the competent authority.

Effective from 1st January 2004, NES adopted the Recommendation of 15th September 1999 on a classification system for solid radioactive waste 1999/699/EC, EURATOM. This radioactive waste classification system is based on the IAEA classification scheme (Safety Series No 111-G-1.1) GSG 1 and has been accepted by the regulatory body:

- Transition radioactive waste: Type of radioactive waste (mainly from medical origin) which will decay within the period of temporary storage and may then be suitable for management outside of the regulatory control system subject to compliance with clearance levels. Waste in the transition phase i.e. short-lived decay waste from medical applications containing $^{125}$I is left to decay at the producers' sites, i.e., hospitals, or is brought to NES for decay storage.

- Low and intermediate level waste (LILW): In LILW, the concentration of radionuclides is such that generation of thermal power during its disposal is sufficiently low. These acceptable thermal power values are site-specific following safety assessments.
  - Short-lived waste (LILW-SL): This category includes radioactive waste with nuclides half-life less than or equal to those of $^{137}$Cs and $^{90}$Sr (around 30 years) with a restricted alpha long-lived radionuclide concentration (limitation of long-lived alpha emitting radio-nuclides to 4000 Bq/g in individual waste packages and to an overall average of 400 Bq/g in the total waste volume). For classification purposes at NES internal waste-acceptance criteria for interim storage uses the limit of 400 Bq/g of long-lived alpha emitting radionuclides per waste package (instead of 4000 Bq/g per package).
  - Long-lived waste (LILW-LL): Waste with alpha long-lived radionuclides whose concentration exceeds the limits for short-lived waste.

- High level waste (HLW): Waste with levels of activity concentration high enough to generate significant quantities of heat by the radioactive decay process or waste with large amounts of long lived radionuclides that need to be considered in the design of a disposal facility (is not arising in Austria).
C. Scope of Application – Article 3

Reprocessing – Article 3 Para 1

*This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.*

There is no reprocessing facility in Austria.

Waste containing only NORM – Article 3 Para 2

*This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or is declared as radioactive waste for the purpose of this Convention by a Contracting Party.*

The Austrian Radiation Protection Legislation defines waste that contains only naturally occurring radioactivity as radioactive waste if the exposure to the general public would exceed 1 mSv/a. If such material is declared as radioactive waste (if no further use is foreseen), it is subject to the same requirements as other radioactive waste and is considered to be radioactive waste for the purpose of the Convention.

Radioactive waste from defence programs – Article 3 Para 3

*This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.*

The Austrian Radiation Protection Legislation applies without exception on the safety of radioactive waste management from civilian and military applications. All radioactive waste from military applications is sent to NES for treatment, conditioning and interim storage. Radioactive Waste from military applications in Austria actually comprises spent sources used for training purposes and weapon sights.
D. Inventories and Lists – Article 32 Para 2

This report shall also include:

(i) a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features;

(ii) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

(iii) a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

(iv) an inventory of radioactive waste that is subject to this Convention that:
   (a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;
   (b) has been disposed of; or
   (c) has resulted from past practices.

This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

(v) a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

D1. Spent fuel management facilities

There are no spent fuel management facilities in Austria since Austria does not operate nuclear power plants. As stated in chapters B1 and B2, spent fuel elements from the only operating research reactor will be returned to the USA according to a contract between the United States Department of Energy, the Vienna University of Technology and EURATOM. There is an interim storage at the site of the reactor in the Institute of Atomic and Subatomic Physics, which is administered by the Vienna University of Technology (see below), available, which is currently empty ever since the core conversion in October 2012.

D2. Inventory of spent fuel

No spent fuel elements are actually in interim storage at the research reactor of the Institute of Atomic and Subatomic Physics of the Vienna University of Technology.
D3. Radioactive waste management facilities

The only radioactive waste management facility existing in Austria is Nuclear Engineering Seibersdorf GmbH (NES). This limited liability company with a controlling majority stake owned by the Austrian Government is located at the Seibersdorf site south of Vienna.

NES is responsible for the treatment, conditioning and interim storage of all radioactive waste generated in Austria. The following treatment, conditioning and waste handling facilities are in operation:

- LILW incinerator (40 kg/h)
- High force compactor
- Waste water treatment facility (precipitation, filtration)
- Sludge dryer
- Cementation equipment
- Drum drying facility
- Waste assay system
- Hot-cell facility
- Buffer storage facilities for raw radioactive waste
- Interim storage facilities for conditioned radioactive waste.

Currently a comprehensive modernisation project of the NES facilities is ongoing, major parts are already completed. For details of the NES facility and this project see Annex 0. There are no radioactive waste disposal facilities in operation in Austria (see Section 0).

D4. Inventory of radioactive waste

As Austria has neither nuclear power plants nor uranium mines or any other nuclear fuel cycle facilities, no HLW is produced in Austria. The main sources of LILW in Austria are the use of radioactive material in medicine, industry and research (approximately 15 tons/year) as well as the ongoing decommissioning and dismantling activities of nuclear research facilities (30-110 tons/year).

The annual quantity of incoming/raw waste is largely depending on the ongoing decommissioning projects. Usually a large part of this waste can be decontaminated and cleared, why only a small part ends in the interim storage as conditioned radioactive waste. Therefore the resulting amount of conditioned waste is in maximum approx. 250 drums per year.

Activity inventory and waste volume present at NES interim storage facility (end of 2016):

- total activity of short-lived waste (LILW-SL): ~ 9.94E+15 Bq, approx. 2240 m³
- total activity of long-lived waste (LILW-LL): ~ 4.57E+12 Bq, approx. 60 m³

The major amount of solid waste is material from decommissioning or dismantling activities and combustible waste from the use of radioactive material in medicine. Liquid waste mainly originates from the operation of waste treatment facilities (e.g. NES incinerator’s wet scrubber) and radionuclide laboratories on the Seibersdorf site. A small fraction of liquid waste originates from medical facilities and universities.
Sealed sources such as $^{60}$Co, $^{137}$Cs, $^{241}$Am and others are widely used for industrial purposes. Sources containing $^{60}$Co and $^{137}$Cs are used for medical applications as radiation sources for high dose treatment (Few in number but showing high activities). Special categories are radium sources used from around 1900 to about 1960 for medical treatment. They were produced in different qualities and some showed a tendency for leakage. Due to the high radio-toxicity of radium, their usage was discontinued and they were replaced by safer sources as soon as available. More than 14 g of radium were conditioned and are stored in the interim storage facility.

Naturally Occurring Radioactive Material (NORM) originating from different industrial processes has been treated and conditioned at NES until 2006. Since 2008, the treatment of residues originating from handling of NORM is regulated by a radiation protection ordinance in compliance with international recommendations and regulations.

End of year 2016, there have been 11 223 mainly 200-litre-drums containing conditioned radioactive waste in the interim storage facility, as well as five “Mosaik™” containers and five “Konrad Type II” containers with decommissioning waste from the ASTRA reactor.

D5. Nuclear facilities in the process of being decommissioned

Since the year 2012 the decommissioning of an old storage facility for radioactive waste (sources) on the NES site in Seibersdorf is going on, end of 2016 the project is almost completed. In the year 2016 a second decommissioning project of a former storage building for radioactive waste started. In addition, work has proceeded for the decommissioning of the old hot-cell laboratory, which should be finished within the next 10 years.
E. Legislative and Regulatory System

E1. Implementing Measures – Article 18

*Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.*

As described below in Sections 0 and 0, Austria has taken legislative, regulatory and administrative measures and other necessary steps for implementing its obligations under the Joint Convention.

E2. Legislative and Regulatory Framework – Article 19

Overview – Article 19 Para 1

*Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.*

The safety of spent fuel management (regarding research reactors) and the safety of radioactive waste management are mainly governed by the federal legislation on radiation protection, consisting of the following laws and ordinances:

- Radiation Protection Act,
- General Radiation Protection Ordinance,
- Ordinance on the Shipment of Radioactive Waste,
- Ordinance for Naturally Occurring Radioactive Material.


- general principles of the national policy in waste management,
- provisions for the national program and
- public participation in the decision making process

The General Radiation Protection Ordinance "BGBl. II No. 191/2006: Allgemeine Strahlenschutzverordnung" has been amended in the year 2015 in order to transpose the obligations of the Council Directive 2011/70/Euratom on establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste into Austrian legislation. This latest amendment addresses the following key issues:

- provisions for the construction of waste management facilities,
- provisions for the organisation and safety of waste management facilities,
- provisions for record keeping and obligations for notifications to the competent authority,
- requirements for radiation protection officers,
- provisions for the information of the public regarding waste management

The requirements of the legislation are stated in detail in the relevant building and operating licenses. Constructional and technical norms and standards designed to afford protection against radiation from spent fuel or radioactive waste are specified on an individual basis in the different licenses.
Radiation Safety - Article 19 Para 2 (i)

This legislative and regulatory framework shall provide for the establishment of applicable national safety requirements and regulations for radiation safety.

National requirements for radiation safety are established in the Radiation Protection Act, the General Radiation Protection Ordinance and the Medical Radiation Protection Ordinance with the aim to protect lives and health of individuals and their descendants, as well as the environment from the hazards of ionising radiation. It implements the principles of justification of a practice, optimisation of radiation exposure and dose limitation. Detailed radiation protection measures for the handling of radioactive waste are additionally laid down in the individual operating licenses.

Important requirements regarding radioactive waste management are as follows:

- The generation of radioactive waste must be minimised. The feasibility of radioactive waste minimisation has to be evaluated prior to the handling with radioactive substances.
- Radioactive waste, which is not discharged or released in line with the legal requirements, must be delivered to an appropriate recycling or re-use facility or to an appropriate facility for conditioning, interim storage and later disposal.
- The possibility of cooperation with other EU Member States or other Contracting Parties to the Joint Convention has to be taken into account regarding radioactive waste management (pre-disposal treatment and disposal in order to follow the principles of risk balance, optimisation of radiation protection and cost minimisation).
- Radioactive waste containing radionuclides with a half-life less than 100 days has to be collected and labelled separately from waste exceeding 100 days.
- Waste containing α-nuclides must be sorted, labelled and stored separately.
- The issuance of a construction and/or operating license requires (among other prerequisites) the presentation of a site-specific safety analysis report and a decommissioning plan incl. a concept for closure and radioactive waste management (see below).

Beyond these specific regulations, the General Administrative Procedures Act of 1991 and related instruments subsequently apply to the licensing procedures.

These requirements are in line with the standards on radiation protection agreed on the international level. More detailed criteria concerning radiation protection are defined in the individual licenses.
Licensing System – Article 19 Para 2 (ii)

*This legislative and regulatory framework shall provide for a system of licensing of spent fuel and radioactive waste management activities.*

As a result of the Austrian federal structure, there are federal and regional authorities involved in the different radiation protection licensing procedures. The distribution of responsibilities is specified in § 41 of the Radiation Protection Act. Concerning the management of radioactive waste, the BMLFUW is the competent authority to lay down provisions for the safe management of radioactive waste. The same federal authority is also responsible for granting licenses for the construction and operation of facilities for the treatment, conditioning, interim storage and disposal of radioactive waste as well as changes to them. As there is no spent fuel or high-level radioactive waste to be handled, there is no implementing body to deal with that task (see 0).

The process of licensing which is also applied to the management of radioactive waste is laid down in the Radiation Protection Act where the relevant provisions state that a license is required for

- the construction and test, operation or change of purpose, nature and size of any installation for the handling of radioactive material and for the use of radiation emitting devices
- any activity involving radioactive materials exceeding the exemption levels, i.e. work activities with radioactive materials: the extraction, production, storage, carriage, delivery, supply, import, export processing, handling or disposal of radioactive materials or any other activity resulting in the emission of radiation and
- the possession and operation of radiation-emitting devices

An installation for the handling of radioactive material consists of the radioactive sources and the relevant components and assemblies, devices and accommodation which are necessary for their conventional use.

Among the prerequisites for granting a license for facility like this, the protection of human health and the environment as well as the operator's aptitude for meeting all the requirements must be demonstrated.
In Austria, the licensing procedure for installations consists of two stages whereby radiation protection measures are already required at the stage of their construction (= major installations such as radioactive waste management facilities):

1. **Construction license** according to § 5 Radiation Protection Act: For the licensing procedure the application documents must contain
   - detailed plans and description of the planned installation
   - a decommissioning concept for the closure of the facility including recycling or disposal of radioactive waste
   - a preliminary safety analysis with regard to the site and potential exposure during normal operation and potential emergencies, including a detailed description of measures for protecting the radioactive material against trespassers

After the licensing authority has been provided with all necessary documents, a license is allowed to be granted if the construction is in compliance with all specific obligations of the radiation protection legislation and if the planned radiation protection measures are deemed adequate. With due respect to the protection of accrued rights of the licensee, additional radiation protection measures may be required at any stage of the construction if new insights were gathered in the course of the construction or new scientific evidence has proven them necessary.

2. **Operating license** according to Art. 6 Radiation Protection Act: For the licensing procedure the applicant must present the following documents:
   - comprehensive documentation on the construction, modification and operation,
   - a comprehensive safety analysis for normal operation and for emergency cases,
   - a detailed design accident evaluation and a concept for on-site emergency preparedness,

An operating license is granted if the installation has been constructed in compliance with the specified conditions and obligations, a radiation protection officer has been appointed and the regular operation of the installation entails no hazard from ionising radiation. Regarding the licensing procedure, additional radiation protection measures can be required at any stage of the construction, if new insights were gathered in or new scientific evidence have proven them necessary in course of construction. Accrued rights of the licensee, however, must be duly respected.
Prohibition of operation without a license – Article 19 Para 2 (iii)

This legislative and regulatory framework shall provide for a system of licensing of spent fuel and radioactive waste management activities.

The Radiation Protection Act requires a license for the operation of a radioactive waste management facility and explicitly prohibits the construction or operation without appropriate license (concerning the process of licensing refer to Section E.2 – Licensing System). There are no exceptions to this requirement.

Control, regulatory inspection, documentation and reporting - Art 19 Para 2 (iv)

This legislative and regulatory framework shall provide for a system of appropriate institutional control, regulatory inspection and documentation and reporting.

In general the competent licensing and regulatory authority for the operation of installations for the management of radioactive waste is the BMLFUW. All facilities which have been licensed according to the Radiation Protection Act are monitored and inspected at regular intervals by the competent licensing authorities. In the course of these inspections, the compliance of the license holder with the applicable regulations and the terms of the licences are checked on an annual basis. In case of the TRIGA Mark II Research Reactor the Federal Ministry of Science, Research and Economy reviews the waste management as part of these annual inspections. If necessary, the license holder can be requested to implement additional radiation protection measures.

The radiation protection legislation requires comprehensive documentation on the construction, modification and operation of facilities for the handling of radioactive material. Detailed specifications on documentation and reporting are set forth in the individual licenses.

Enforcement – Article 19 Para 2 (v)

This legislative and regulatory framework shall provide for the enforcement of applicable regulations and of the terms of the licences.

The competent regulatory authorities are also in charge of enforcing the legislation and the regulations applicable to facilities for the use of radioactive material as well as the obligations of the licenses. They are empowered to take the necessary enforcement measures.

According to the Radiation Protection Act, anyone building or operating an installation for the handling of radioactive material without an adequate license commits a crime and is fined with an administrative penalty of up to 25 000 EURO. Anyone not fulfilling the requirement or obligation of a license is charged with an administrative penalty of up to 15 000 EURO. The range of punishment is laid down in § 39 of the Radiation Protection Act. The enforcement procedure is primarily laid down in the Administrative Penal Act. The provisions found in the General Administration Procedures Act and in the Administrative Enforcement Act are subsidiarily applicable to administrative penal procedures.
Allocation of Responsibilities – Article 19 Para 2 (vi)

This legislative and regulatory framework shall provide for a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.

The Republic of Austria is responsible for the disposal of the radioactive waste currently interim stored and newly produced in Austria. For this purpose, the BMLFUW has been authorised to conclude contracts on the management and disposal of radioactive waste with appropriate facilities obliging them to treat all radioactive waste arising in Austria.

In addition, the contracts must contain measures for treatment and reconditioning of the conditioned radioactive waste stored at NES. The contracts may also contain provisions to achieve cooperation with other EU Member States having ratified the Joint Convention. The Federal Minister as contracting authority is further entitled to control the contracts comprehensively.

Hence, the Republic of Austria (represented by BMLFUW), the municipality of Seibersdorf and NES concluded a Joint Agreement on the Management of Radioactive Waste. Thus, the Republic of Austria is obliged to remove all conditioned radioactive waste interim stored at the site of NES to a final or long-term repository until December 31st, 2045 at the latest. NES is obliged to accept, treat, condition and interim store all radioactive wastes arising in Austria. On the other hand the Republic of Austria guarantees NES the necessary financial funds for fulfilling their tasks, including reconditioning (if necessary) and transfer of the radioactive waste to a final repository. The Joint Agreement has been revised in 2013 and guarantees the operation of the radioactive waste treatment, conditioning and interim storage facilities in Seibersdorf until 2045.

The financial resources at NES are approved by the Federal Minister of Finance. These funds are administered by the BMLFUW but supervised by the Minister of Finance. Thus, an adequate financial independence is given and guarantees a regulatory independence in the area of radioactive waste management.

Regulating Radioactive Materials as Radioactive Waste – Article 19 (3)

When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.

According to the definition of the Radiation Protection Act and the General Radiation Protection Ordinance, radioactive waste is defined as follows:

Radioactive waste means any substance

- which contains or is contaminated with one or more radionuclides which cannot be disregarded as far as radiation protection is concerned,
- which is not exempted from regulatory control and
- for which no further use is foreseen.

Exemption and clearance levels are laid down in the General Radiation Protection Ordinance as nuclide specific values derived from the internationally accepted 10 µSv/year dose concept. Clearance measurements have to be authorized by the competent authority.
E3. Regulatory Body – Article 20

Establishment and Designation – Article 20 Para 1

*Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 19, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.*

The **BMLFUW** is the competent licensing and supervisory authority for the management of radioactive waste and the only waste management facility in Austria, NES. Thus, in the field of the safety of radioactive waste management, the regulatory body entrusted with the implementation of the legislative and regulatory framework (see E2) is also the BMLFUW.

Concerning radiation protection, the competencies are divided between different authorities in Austria due to her federal and regional structure: The **Federal Minister of Science, Research and Economy** is the competent authority for the licensing of the construction and operation as well as for the inspection of university-based accelerators on the one hand and for the licensing of the construction and operation as well as for the inspection of research reactors on the other hand (the TRIGA Mark II Reactor of the Vienna University of Technology is currently the only research reactor in operation. There are no plans to build new research reactors in the future). The **Federal Ministry for Transport, Innovation and Technology** is responsible for transport matters. The **Federal Ministry of Health and Women** is responsible for radiation matters in the medical field and with regard to foodstuff. The **Federal Minister of Justice** is responsible for all legal matters relating to the Nuclear Liability Act. The **Governors of the Federal Provinces** are the common radiation protection authorities and responsible for licensing and supervision according to the Radiation Protection Act. They also issue licenses according to the Environmental Impact Assessment Act.

To ensure cooperation between federal and regional authorities in Austria, periodical conferences are held, bilateral exchange of opinions is conducted and administrative edicts are issued.

Independence – Article 20 Para 2

*Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organisations are involved in both spent fuel or radioactive waste management and in their regulation.*

Both the responsibility for the safety of management of radioactive waste and the regulatory task in this field reside within the Austrian Federal State represented by the BMLFUW, which is the licensing and regulatory authority for the construction and operation of radioactive waste management facilities. The financial resources of the only waste management facility in Austria (NES) are agreed by the Federal Minister of Finance and form a separate part of the budget of the BMLFUW. These funds are administered by BMLFUW but supervised by the Minister of Finance. With regard to these special provisions taking into account the polluter-pays-principle for the regular operation of NES, an adequate financial independence is given.

The Vienna University of Technology, which is a fully autonomous entity of higher education and research under Article 81c of the Austrian Federal Constitutional Law. It has its own global budget since January 1st, 2004 and is the licensee for the TRIGA Mark II Research Reactor situated at the Atomic und Subatomic Physics Institute. The global budget of the university is negotiated with the Federal Ministry of Science, Research and Economy every third year and supplied by the Ministry of Finance. Therefore the Federal Ministry of Science, Research and Economy has no undue influence on any decisions the Vienna University of Technology may make as the license holder and can fulfil its duty as regulatory authority unbiased and according to the law.
F. Other General Safety Provisions

F1. Responsibility of the license holder – Article 21

License Holder – Article 21 Para 1

Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

In Austria, radioactive waste management comprises treatment, conditioning, storage and later disposal. All these activities need licensing and are carried out by NES. As an appropriate nuclear facility, NES is operated according to the corresponding licenses and supervised by the BMLFUW.

The Radiation Protection Act clearly states in § 3 (2) that the license holder is responsible for compliance with the legal provisions of the Radiation Protection Act, the corresponding Ordinances, with regulatory and administrative requirements on that legal basis as well as with all radiation protection provisions of directly applicable EU-Law. The license holder is, hence, ultimately responsible for the safety of the facility and its operation. The specific obligations of the license holder resulting from that fundamental responsibility are listed in the Radiation Protection Act and further elaborated in the General Radiation Protection Ordinance (§ 15) supported by relevant standards and guidelines of the waste management facility.

In the field of the safety of radioactive waste management the BMLFUW forms the main part of this regulatory body. The Minister has the necessary authority and competence to fulfil his enforcement functions. His Ministry carries out annual inspections to assure that the license holder of the waste management facility meets its responsibilities and obligations and keeps the state of the art.

With respect to the research reactor of the Institute of Atomic and Subatomic Physics of the Vienna University of Technology, a decommissioning concept was submitted by the licence holder to the competent authority. This includes the shipment of the spent fuel to its country of origin (US) under the supply contract DE-NA0001641 between the Vienna University of Technology, the US Department of Energy and EURATOM-ESA. Interim storage for spent fuel is available on site at the research reactor but currently empty. Any radioactive waste produced during decommissioning will be sent to NES. Financial provision for the future decommissioning has to be provided by the Vienna University of Technology and the Federal Real Estate Limited Company (“Bundesimmobiliengesellschaft, BIG”) as owner of the property and the building the reactor is situated at.
Unlicensed Facilities, Activities and Materials – Article 21 Para 2

*If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.*

In the Radiation Protection Act, orphan radioactive sources are defined as "radioactive sources which are subject to authorisation or at least registration and which are not under regulatory control either

- because they never have been under regulatory control or
- because they have been abandoned, lost, misplaced, stolen or
- because they have been transferred to a new holder, without proper notification of the competent authority, or without informing the recipient"

However, this definition does not apply to radioactive material in recycling material subject to a sales contract between individuals or corporate bodies capitalising on the trade of recycling material.

§ 26 of the Radiation Protection Act lays down the relevant provisions for the finding of orphan sources. The competent radiation protection authorities (in general the District Authorities) have to confiscate orphan sources and arrange for their recycling or disposal as radioactive waste at the expense of their pre-possessor. In case this pre-possessor cannot be found under Austrian jurisdiction, the confiscating national or provincial authorities have to bear the costs for disposal themselves. Otherwise, the occurring costs can be claimed back by recourse.
F2. Human and financial resources – Article 22

Qualified Staff – Article 22 (i)

*Each Contracting Party shall take the appropriate steps to ensure that qualified staff is available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility.*

The Austrian Radiation Protection Act requires qualified staff to manage and operate any facility and to fulfil all legal, regulatory and licence requirements. Verification of the necessary human resources is part of the licensing process of a waste management facility as well as the annual inspections. For each license under the Radiation Protection Act the designation of a radiation safety officer is required. The radiation safety officers are defined as qualified persons who have been designated by the licence holder to take over duties and responsibilities regarding radiation protection matters. Their formation and expertise must be approved by the competent regulatory authority. Their mental and physical ability, their reliability and aptitude for the requirements of their appointed field of activity are conditions for their designation and are regularly supervised. Further requirements, responsibilities and duties of the radiation safety officer are laid down in detail in the Radiation Protection Ordinance, the operating licence and in the technical specifications of the facility. If necessary, the applicant must provide for a radiation safety officer and a sufficient number of other safety related staff and prove for their qualifications.

The operator’s guidelines define specific requirements on the organisation, the operating staff and on the radiation protection staff and are approved by the regulatory authority. The implementation of these legal requirements is ensured practically by review of the projects submitted to licence and by regular supervision of the facility operations according to § 17 of the Radiation Protection Act.
Adequate Financial Resources – Article 22 (ii)

Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning.

It is Austria’s policy to collect, treat and condition all radioactive waste for safe interim storage in order to minimise the burden for future generations. Although a solution for final disposal is not yet solved, adequate financial means are being established to support any future final disposal strategy.

According to the Joint Agreement between the Republic of Austria (represented by BMLFUW), the Community of Seibersdorf and NES, the necessary financial resources for the infrastructure and equipment of the Austrian waste management facility are guaranteed by the Austrian State. The ultimate responsibility of the Austrian Federal State for the final disposal of all radioactive waste currently and in future interim stored at NES ensures the availability of sufficient financial resources for the decommissioning of nuclear facilities and the final disposal of radioactive waste.

As stated in chapter E3 the Research Reactor is operated by the Vienna University of Technology, who as a fully autonomous institution receives its own global budget for a three year period. In the current performance agreement between the Federal Ministry of Science, Research and Economy and the Vienna University of Technology for the years 2016 through 2018 the Vienna University of Technology is obligated under article B2.3.1 to ensure the implementation of all requirements laid down in the Radiation Protection Act in regard to infrastructural and safety measures, which includes the intermediate storage of spent fuel elements.

According to the Radiation Protection Act, the producers of radioactive waste are responsible for its safe management including disposal. They must take care that the radioactive waste is brought into a form suitable for transport, storage and disposal (conditioning), to store it pending disposal, and eventually to dispose it at their own costs. For this reason, the treatment of radioactive waste is financed according to the polluter-pays-principle by the relevant licence holder, the holder of the waste (especially arising from recycling of scrap) and the authorities detecting and confiscating radioactive material or receiving orphan sources. When the radioactive waste is delivered to NES for treatment and interim storage, a charge (“Vorsorgeentgelt”) taking into account a risk premium (“Risikozuschlag”) has to be paid. This charge comprises the estimated costs for interim storage, pre-disposal treatment and transport to the final repository as well as for disposal and long term management of the final repository. The final disposal fee is calculated using cost estimates based upon the comparison of costs on existing foreign repositories. The tariffs are annually revised and adopted by the BMLFUW. However, should the collected funds in spite of the state-of-the art estimations prove at a later period of time to be insufficient to pay for the real costs of final disposal, the Austrian Federation covers the difference. The contributions of the producers go into a special separated fund which is not part of the state budget and is administered by Austrian national authorities. This fund is exclusively dedicated for financing the future final disposal in an appropriate repository.
Financial Provision for Institutional Controls – Article 22 (iii)

Each Contracting Party shall take the appropriate steps to ensure that financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

Since there are no disposal facilities in operation in Austria, there are no special requirements laid down in the radiation protection legislation. However, according to the existing legislation, a repository could only be closed, if the permanent protection of human life and health and of their descendants and of the environment is ensured.

F3. Quality assurance – Article 23

Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmes concerning the safety of spent fuel and radioactive waste management are established and implemented.

NES has implemented an integrated management system (consisting of three regulations namely BS OHSAS 18001:2007, ISO 9001:2008 and ISO 14001:2015) which requires regular external and internal audits. In addition, a special quality assurance program for the radioactive waste management has been established.
F4. Operational radiation protection – Article 24

The Radiation Protection Act and the General Radiation Protection Ordinance form the legal basis for operational radiation protection in Austria in the non-medical field. This legislation aims at protecting human life and health and the environment against ionising radiation. It is based on the recommendations of the International Commission on Radiological Protection (ICRP) and implements the internationally agreed principles of justification of a practice, optimisation of radiation exposure and dose limitation. After the amendment of the Radiation Protection Act and the publication of the new Radiation Protection Ordinances, the provisions of the Basic Safety Standards Directive 96/29/EURATOM are fully implemented in Austrian national law. Further radiation protection requirements are defined in non-binding national standards and specific obligations are stated in the construction and operation licences granted to each operator of nuclear facilities. All activities must be performed in accordance with radiation protection regulations.

Radiation Exposure – Article 24 Para 1(i)

Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account.

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 of the Radiation Protection Act and § 3 of the General Radiation Protection Ordinance). It is the responsibility of the license holder to define and implement optimisation and to implement a system for control. Depending on the level of estimated collective dose, a dose relevant job has to be controlled by a radiation safety officer. During the annual inspections according to § 17 of the Radiation Protection Act the supervisory authority also controls how optimisation is implemented.

Radiation Doses – Article 24 Para 1 (ii)

Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.

According to the Radiation Protection Ordinance, 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. The Ordinance defines limits and constraints for dose and activity to ensure that the dose limits are not exceeded. The dose limits and working conditions for underage and pregnant women are laid down in § 12 of the General Radiation Protection Ordinance. As a general rule, the Radiation Protection Act states that pregnant women may not be assigned to any work which would result in being exposed workers (Art. 30). 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.

The NES employees receive training in handling radioactive materials and are equipped with personal protective devices and dosimeters. Exposed workers of “category A” take part in a medical monitoring program. Segregation of incoming radioactive waste is performed in a self-contained box, where handling is accomplished via glove-box-gloves. Handling of spent sealed sources is carried out in a lead cell. High activated sealed sources are handled in a hot cell facility. A safety analysis required by the national authorities is periodically reviewed by the regulatory authority.
The average effective dose – including external background radiation - for all personnel involved in radioactive waste management is reported in the table below.

<table>
<thead>
<tr>
<th>Year</th>
<th>av. Dose [mSv/y]</th>
<th>ex. Background [mSv/y]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>1.20</td>
<td>0.76</td>
</tr>
<tr>
<td>2015</td>
<td>0.92</td>
<td>0.87</td>
</tr>
<tr>
<td>2016</td>
<td>0.82</td>
<td>0.80</td>
</tr>
</tbody>
</table>

*Average effective dose and external background*

**Preventive measures taken – Article 24 Para 1 (iii)**

*Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.*

The release limits for NES facility are determined by the BMLFUW as the competent regulatory authority. Annual inspections ensure the compliance of the operator of the facility with the legal and administrative requirements. If the regulatory authority is of the view that safe operation is not ensured the authority can take steps to immediately stop the operation of the facility.

Releases under normal conditions and potential releases during abnormal conditions from the facility are very low (transboundary emergencies cannot occur).

**Radiation Exposure and Radiation Doses Due to Discharges – Article 24 Para 2**

*Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited*

(i) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account.

(ii) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.

In the licence application for the construction and operation of a facility for the handling with radioactive material or radiation emitting devices (radioactive waste management facilities included), the technical measures, i.e., barriers and air filters, 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 from the waste management facility to atmosphere and water bodies is monitored by the license holder and surveyed by the licensing authority. The inspection of the nuclear installations by the authorities concerning emission 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.
The highest effective doses for the members of the public within a radius of 1 km due to discharges to the atmosphere and the water body from radioactive waste management facilities at NES are summarized in the table below.

<table>
<thead>
<tr>
<th>Year</th>
<th>Atmosphere [µSv]</th>
<th>Water body [µSv]</th>
<th>Sum [µSv]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>6.4E-3</td>
<td>7.4E-2</td>
<td>8.04E-2</td>
</tr>
<tr>
<td>2015</td>
<td>5.76E-3</td>
<td>9.4E-2</td>
<td>9.98E-2</td>
</tr>
<tr>
<td>2016</td>
<td>1.16E-2</td>
<td>1.23E0</td>
<td>1.24E0</td>
</tr>
</tbody>
</table>

*Effective dose due to discharges to the atmosphere and the water body*

The dose calculation was performed using the “Allgemeine Verwaltungsvorschrift” to § 47 of the German radiation protection act for liquid discharges and the “AUSTAL 2000” Software package for gaseous discharges, using the monitored activity concentrations as shown in the tables below.

<table>
<thead>
<tr>
<th>Year</th>
<th>Alpha [Bq/l]</th>
<th>Beta [Bq/l]</th>
<th>$^3$H [Bq/l]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>7.3E-1</td>
<td>4.1E-1</td>
<td>9.25E2</td>
</tr>
<tr>
<td>2015</td>
<td>3.72E-1</td>
<td>2.03E0</td>
<td>6.58E2</td>
</tr>
<tr>
<td>2016</td>
<td>6.3E-1</td>
<td>2.6E0</td>
<td>1.2E3</td>
</tr>
</tbody>
</table>

*Activity concentration in water discharged to the water body*

<table>
<thead>
<tr>
<th>Year</th>
<th>Alpha [Bq/m³]</th>
<th>Beta [Bq/m³]</th>
<th>$^3$H [Bq/m³]</th>
<th>$^{14}$C [Bq/m³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>8.2E-4</td>
<td>5.7E-4</td>
<td>4.83E1</td>
<td>7.26E2</td>
</tr>
<tr>
<td>2015</td>
<td>3.6E-4</td>
<td>1.0E-3</td>
<td>6.2E0</td>
<td>2.2E0</td>
</tr>
<tr>
<td>2016</td>
<td>1.3E-3</td>
<td>2.43E-3</td>
<td>9.9E0</td>
<td>4.5E0</td>
</tr>
</tbody>
</table>

*Activity concentration in air discharged to the atmosphere*

At the Institute of Atomic and Subatomic Physics, Vienna University of Technology, the average yearly dose of atmospheric release (mainly $^{41}$Ar of the research reactor) and the average yearly dose of wastewater stayed below 0.02 mSv since the founding of the Institute.

In general investigative measurements by the authorities of gaseous and liquid emissions and the internal surveillance by the operators show that maximum permissible levels never were exceeded. Additionally environmental monitoring in the surroundings did not detect any inadmissibly high gamma dose rates or immissions.
F5. Emergency preparedness – Article 25

Facility Emergency Plans – Article 25 Para 1

Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.

On-site Emergency Plans

The BMLFUW is the competent licensing authority for radioactive waste management facilities. On-site Emergency planning is part of the licensing procedure according to the Radiation Protection Act and the General Radiation Protection Ordinance.

Prior to the start of the construction the design of installations for handling of radioactive materials and radiation emitting devices with a higher potential threat, such as a radioactive waste management facility needs to be licensed according to § 5 of the Radiation Protection Act. This construction license facilitates the subsequent licensing procedure for operation and requires among other documentation a concept for emergency preparedness for the specific site.

In a second step the facility needs the operating license in accordance with § 6 of the Radiation Protection Act. A final safety and accident analysis and a final on-site emergency plan is a precondition for the operating license. The safety and accident analysis as well as the on-site emergency plan has to be approved by the licensing authority.

In addition the Austrian Radiation Protection Act requires annual technical inspections of radioactive waste management facilities by the licensing authority. In the course of these annual inspections, the licensing requirements including the emergency plans are also reviewed. During these periodic safety reviews the licensing authority can order the updating of emergency plans, if necessary.

More detailed requirements regarding the content and structure of the on-site emergency plan and conducting of emergency exercises for the centralised waste management facility NES are part of the General Radiation Protection Ordinance which was amended in 2015. Based on these new regulations the on-site emergency plan had a major update in 2015 and since 2015 it has been reviewed and updated every year by NES.

Basically the regulations in the field of on-site emergency preparedness and response for the centralised waste management facility will remain unchanged by the current transposition of Basic Safety Standards (Directive 2013/59/EURATOM) into Austrian legislation.
Emergency exercises for testing the on-site emergency plan:

In advance NES has to develop yearly exercise plans, which cover different events. The exercises plans have to be sent in advance to the licensing authority which will participate in specific exercises. The exercise plan for 2017 for example includes 10 different exercises and training events such as fire alarms, flooding and medical treatment of contaminated personal.

In addition the plant fire brigade of the Seibersdorf site performs about 20 fire drills each year. At least 15 of these drills held directly in the buildings and facilities, including the incinerator plant, the water treatment plant and the hot-cell laboratory of NES.

Additional requirements concerning evaluating exercises and the participation of the regulatory body in exercises is also be part of the amended General Radiation Protection Ordinance.

In regard to the TRIGA Mark II Reactor the on-site emergency plan is included in the safety report. This includes emergency plans in regard to the fuel elements and radioactive waste. As of September 2017 the safety plan is currently being revised by the Vienna University of Technology and will be reviewed by the regulatory body.

Off-site Emergency Plans

Off-site emergency plans were established based on the Ordinance on Interventions in Case of Radiological Emergencies which was amended in 2017 for transposition of Basic Safety Standards (Directive 2013/59/EURATOM) into Austrian legislation in the field of EPR. These plans are in accordance with the recommendations of the IAEA document GSR Part 7 and EPR-METHOD 2003, taking into account different events which could cause radiological emergencies in Austria. Among others accidents in the central radioactive waste management and interim storage facility – NES are taken into account in the off-site emergency planning. The Ordinance on interventions and the off-site emergency plan also provide requirements on the periodic testing of the emergency planning by conducting emergency exercises.

National and International Notification

In accordance with § 6 of the Radiation Protection Act a radiological emergency in an Austrian facility has immediately to be notified to the licensing authority by the licensee. Information on the causes of the accident and the possible consequences has to be provided for by the licensee. Additional notification and information requirements for radiological emergencies on Austrian territory are part of the Ordinance on Interventions in Case of a Radiological Emergency.

In addition detailed criteria for notification and information in case of incidents, accidents and emergencies are part of the amended General Radiation Protection Ordinance.

In case of an event which has to be notified according to the Early Notification Convention and according to Council Decision 87/600/EURATOM (ECURIE), BMLFUW is the competent authority for the notification to the respective international organisations. Provisions for national and international notification are a central part of the off-site emergency plan.
**Territory Emergency Plans – Article 25 Para 2**

*Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.*

**Off-Site Emergency Planning Organisations and Responsibilities**

BMLFUW takes action in case of any radiological emergency coming from abroad. For the different responsibilities in the field of off-site emergency preparedness for accidents in neighbouring countries as well as in Austria see the table below:

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Responsibilities</th>
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| BMLFUW                                            | • evaluation of the consequences of radiological and nuclear emergencies and decisions on counter measures in cooperation with Federal Ministry of Health and Women  
• environmental monitoring                           |
|                                                   | • Competent Authority for international information exchange (ECURIE, IAEA Convention on Early Notification and bilateral agreements) |
| Federal Ministry of Health and Women              | • food monitoring                                                                
• pre-planned provisions for KI-blocking            |
| National Crisis and Disaster Protection Management coordinated by the Federal Ministry of the Interior (BMI) | • federal co-ordinating institution for crisis management  |
| Federal Alarming Centre (FAC) in the Federal Ministry of Interior (BMI) | • National information exchange centre  
• Contact Point for international information exchange (ECURIE, IAEA Convention on Early Notification and bilateral agreements) |
| Nine Austrian Provinces                           | • implementation of counter measures                                            |

*Emergency planning responsibilities*
Territory Emergency Planning

As stated previously, due to the Ordinance on Interventions in Case of Radiological Emergencies the existing off-site emergency plans at state level are regularly updated in accordance with the requirements of the IAEA document EPR-METHOD 2003. These plans also cover the possible consequences for Austria of emergencies in nuclear installations in neighbouring countries.

Testing off-site emergency plans for the Austrian territory

An exercise plan for different types of emergency exercises is part of the updated off-site emergency plan at the state level. In addition to the participation in exercises at international (IAEA, EC, NEA/OECD) and bilateral level (neighbouring countries) and specific exercises for training, the exercise plan requires to conduct national emergency exercises for testing the emergency plans every 2-3 years. Based on lessons identified in these exercises BMLFUW is responsible for updating the off-site emergency plans at state level.

The latest national exercise was conducted in June 2017 in combination with CONVEX-3 (international level).

Radiation Warning Systems and Monitoring

The Radiation Protection Act obliges the BMLFUW to operate and maintain an automatic Radiation Early Warning System ("Strahlenfrühwarnsystem") which consists of an automatic dose rate monitoring systems and an automated air monitoring system.

The data gathered by the Radiation Early Warning System are exchanged on-line with the corresponding systems in the neighbouring countries of Slovenia, Switzerland, Germany, the Czech Republic, Slovakia and Hungary on the basis of bilateral agreements. The EURDEP data on European level from the EURDEP platform of the EC are also available within the Austrian Radiation Early Warning System. In addition, a laboratory-based monitoring network is operated together with the Austrian Ministry of Health and Women in order to comply with the requirements of rapid recognition and precise determination of radioactive contaminants; it mainly performs the radionuclide-specific monitoring of air, precipitation, surface water bodies, soil, feed- and foodstuffs. Additional measuring data can be obtained by car-borne and air-borne dose rate measurement units by emergency teams of the Federal Ministry of the Interior.
F6. Decommissioning – Article 26

Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility.

Since 2012 the decommissioning of an old storage facility for radioactive waste (sources) on the NES-site in Seibersdorf is going on, end of 2016 the project is almost completed. In the year 2016 a second decommissioning project of a former storage building for radioactive waste started. In addition, work proceeded for the decommissioning of the old hot-cell laboratory, which should be finished within the next 10 years.

The Radiation Protection Act requires the operator of a facility to present a decommissioning plan in the application documents for the construction license. However, neither construction nor operating license is usually limited to a legal operational lifetime. Instead of that, the regulatory authority examines the operation of a facility being in line with the relevant legislation and the conditions and requirements of the relevant licenses. Any nuclear facility must be closed if the requirements of the legislation and of the licensing and regulatory acts are not or no longer met taking into account the state-of-the-art of science and technology.

According to the Joint Agreement between the Republic of Austria, NES and the Community of Seibersdorf, the waste management and interim storage facility is scheduled to be operated until 2045. From that time on, the Austrian Government is responsible for transferring all interim stored waste into an appropriate disposal or long term storage facility. The radioactive waste management installations and equipment of NES have been subject to regular upgrading and back fitting (process has to continue until the end of 2045). For this reason a licence extension is not necessary.

In regard to the TRIGA Mark II Research Reactor there are no short-term or mid-term plans for decommissioning, because of the guaranteed further reactor operation after the Core Conversion in 2012. Nevertheless the Institute of Atomic and Subatomic Physics has produced a decommissioning concept. Since all 90 fuel elements will be returned to the USA this concept mainly focusses on the disposal of irradiated reactor components and how to decontaminate the site.
Staff and Financial Resources – Article 26 (i)

_Such steps shall ensure that qualified staff and adequate financial resources are available._

Adequate financial resources for the decommissioning of existing R&D facilities are guaranteed by a second agreement between the Republic of Austria (represented by the Federal Minister of Transport, Innovation and Technology) and the NES. Ultimately, the Austrian Government has taken over responsibility for the costs of decommissioning of nuclear facilities which have been and are operated and owned finally by the Austrian State (research reactors and waste management facility). For this reason no special decommissioning fund has been established.

NES has its own Business Unit “Decommissioning and Decontamination” and therefore qualified staff with a lot of experience in decommissioning. Also employees from the waste management group are educated and have experience in decontamination and decommissioning practices and techniques. Younger personnel is systematically trained and educated to preserve and pass on know-how. NES is provided with adequate financial resources for the recruitment of qualified external staff, if necessary.

In case of the TRIGA MARK II Research Reactor the Vienna University of Technology and the Federal Real Estate Limited Company ("Bundesimmobiliengesellschaft, BIG") as owner of the property and the reactor-building has to finance the future decommission.

Radiation Protection – Article 26 (ii)

_Such steps shall ensure that the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied._

The Radiation Protection Act and the General Radiation Protection Ordinance apply to the decommissioning of nuclear facilities as well. This legislation covers all aspects of Article 26 (ii) (see Section 0). As the shut-down, dismantling and decommissioning are major modifications to the operation of a facility for the handling with radioactive material, these activities need a license according to § 8 of the Radiation Protection Act. This decommissioning licence lays down complementary obligations as appropriate.

Emergency Preparedness – Article 26 (iii)

_Such steps shall ensure that the provisions of Article 25 with respect to emergency preparedness are applied._

The legal requirements concerning emergency preparedness apply independently of whether a facility is in operation or under decommissioning. These requirements cover all aspects of Article 26 (iii) (see Section 0).

Record Keeping – Article 26 (iv)

_Such steps shall ensure that records of information important to decommissioning are kept._

Records of essential information for decommissioning are kept during the operation. This information allows a more efficient sampling of important materials and components and is very helpful for the determination of the necessary radiation safety measures.
G. Safety of Spent Fuel Management – Article 4-10

Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management individuals, society and the environment are adequately protected against radiological hazards.

The Vienna University of Technology signed the supply contract DE-NA0001641 between the Vienna University of Technology, the US Department of Energy and EURATOM-ESA, guaranteeing that all 90 fuel elements currently at the TRIGA Reactor will be accepted for return by the US Department of Energy. This contract was signed in the context of the core conversion in 2012. The fuel at the TRIGA Reactor is under EURATOM and IAEA inspection.

The storage facility at the Institute of Atomic and Subatomic Physics allows either wet or dry storage depending on the fuel element activity. The total capacity for dry storage is 168 and for wet storage 90 TRIGA standard fuel elements in the reactor tank. After the core conversion in 2012, no spent fuel elements are actually stored at the TRIGA Reactor Vienna.

Typically for TRIGA reactors worldwide, spent fuel elements are stored right inside the reactor hall and are therefore under the safety and security management of the reactor building. There are several types of storage facilities available at TRIGA Reactors:

- special designed storage racks inside the reactor tank about 3 meters below the pool water surface
- racks in a pool adjacent to the reactor shielding block filled with water
- fuel storage pits embedded in the reactor hall floor which can be used either for fresh or for spent fuel storage

At the TRIGA reactor Vienna the first and the third mentioned type of storage can be used:

- The storage racks directly in the reactor tank which are suspended along the tank wall about 3 m underwater, which can accommodate up to 90 fuel elements (fresh or spent).
- Six storage-pits in the floor of the reactor hall 3 m deep and about 30 cm in diameter where each one can accommodate up to 28 fuel elements (168 fuel elements in total). These storage pits can either be filled with water for shielding purposes; in case of fresh fuel elements or low active spent fuel elements these pits are filled with ambient air and vertically shielded by a 25 cm thick lead plug.

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H. Safety of Radioactive Waste Management

H1. General Safety Requirements – Article 11

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.

The protection of individuals, society and the environment against radiological and other hazards is subject to the Austrian legislation on radiation protection (described in Section 0), and to the legislation on environmental protection (mainly the Environmental Impact Assessment Act and associated ordinances).

Protection of the environment from hazards other than radioactivity is verified by BMLFUW on the basis of the Environmental Impact Assessment Act 2000, which requires an EIA for major facilities, and on the basis of the Environmental Management Act, which implements the EU eco-management and audit scheme (EMAS).

During the operation, the protection of the workers is assured by requirements and compliance checks of the Austrian Labour Inspectorate ("Arbeitsinspektorat") and the Occupational Health Services ("Arbeitsmedizinischen Dienste").

Civil protection is a competence of the Federal Minister of the Interior, implemented by the Provincial Authorities. Compliance with the legislation on protection of the general public and the environment from non-radiological hazards is verified by the nine Provincial Authorities ("Bundesländer").

Criticality and Removal of Heat – Article 11 (i)

In so doing, each Contracting Party shall take the appropriate steps to ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed.

Criticality and removal of residual heat are not an issue for the LILW waste in the NES interim storage.

Generation of Radioactive Waste – Article 11 (ii)

In so doing, each Contracting Party shall take the appropriate steps to ensure that the generation of radioactive waste is kept to the minimum practicable.

Minimisation of radioactive waste is required according to the Radiation Protection Act. The feasibility of radioactive waste minimisation has to be evaluated prior to each handling with radioactive substances. The compliance is verified by the regulatory body during the licensing procedure, assurance of operation permits, and periodic inspections. There has never been any need for a regulatory enforcement action regarding minimisation of radioactive waste.
Interdependencies – Article 11 (iii)

In so doing, each Contracting Party shall take the appropriate steps to take into account interdependencies among the different steps in radioactive waste management.

Optimisation is required by the Austrian Radiation Protection Legislation at all stages of radioactive waste management, thus interdependencies among the different steps are taken into account in practice. NES periodically performs an optimisation study comparing the available options for the treatment, conditioning, storage and disposal of radioactive waste. The licensing procedures as well as the periodic inspections by the regulatory authority take into account interdependencies among the different steps in radioactive waste management.

Protection of Individuals, Society and the Environment – Article 11 (iv)

In so doing, each Contracting Party shall take the appropriate steps to provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards.

The Austrian Radiation Protection Legislation aims at the protection of individuals, society and the environment from the effects of ionising radiation (see Section 0) and will fully implementing the new EU Basic Safety Standards Directive 2013/59/EURATOM based upon the ICRP system of justification, optimisation and dose limitation.

The applicable dose limits are compatible with the International Basic Safety Standards. In particular, a dose limit for members of the public of 1 mSv effective dose per year and a dose limit for workers of 20 mSv per year are implemented.

The protection of the environment against hazards other than radioactivity is the subject of different legal instruments.

During the operational phase compliance with the legislation is verified and enforced by regulatory supervision, mainly by annual inspections. The regulatory supervision includes monitoring of the radioactivity in the environment of the facility. Compliance with the environmental protection legislation is verified by the responsible regional authorities.
Biological, Chemical and other Hazards – Article 11 (v)

*In so doing, each Contracting Party shall take the appropriate steps to take into account the biological, chemical and other hazards that may be associated with radioactive waste management.*

Biological, chemical and other hazards are subject to the environmental protection legislation, which also aims at human health protection, especially with requirements concerning air and water quality. An Environmental Impact Assessment is required prior to the construction license and for the operation permit of large-scale projects. This assessment is reviewed by the appropriate environmental protection authorities before the licence is issued. Hazards other than radiation encountered by workers during handling radioactive material are covered by the general legislation on safety at working places, enforced by the supervision by the Austrian Labour Inspectorate ("Arbeitsinspektorat").

Impacts on Future Generations – Article 11 (vi)

*In so doing, each Contracting Party shall take the appropriate steps to strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation.*

The burdens emanating from present-day nuclear activities shall not be greater than those permitted for the current generation.

Burdens on Future Generations – Article 11 (vii)

*In so doing, each Contracting Party shall take the appropriate steps to aim to avoid imposing undue burdens on future generations.*

It is Austria’s policy to collect, treat, and condition all radioactive waste for safe interim storage in order to minimise the burden for future generations. Adequate financial means are being established to support any future final disposal strategy.
H2. Existing facilities and past practices – Article 12

Since the beginning of the 1960s, the management of all radioactive waste generated in Austria has been carried out centrally at the Seibersdorf site. This activity has always been based on long-term contracts with the Republic of Austria, so the waste treatment facilities and safety devices always had to comply with the legal requirements and the respective state of the art. While initially radioactive waste was essentially only collected and sealed in packs, more and more facilities for processing and conditioning were set up and put into operation over time.

At the beginning a number of storage halls and other related facilities were built at NES so different categories of waste (liquid burnable, liquid non burnable, solid burnable, solid non burnable, etc.) could be stored in specifically designed buildings. In 1965 a concrete trench (separated in three boxes) and a temporary storage box (composed of concrete rings) were added for taking up intermediate level waste. A specially designed earth wall bearing low level radioactive waste (actually being reconditioned) was established in the late 1960s and in the early 1970s. An incineration plant as well as a sealed off stainless steel container (for sorting radioactive waste) followed in the late 1970s and a high-force compactor was put into operation in the mid 1990s.

In a large investment project starting in 2008 and still continuing (major parts already completed) most treatment und storage facilities at NES were modernized or completely new built (for example a so called “New Handling Centre” was constructed, where most conditioning equipment was centralized; detailed information see Annex L1).

Consequently all outdated waste treatment facilities have been decommissioned and dismantled. In addition, all disused nuclear research facilities at the entire area of the “historical Seibersdorf research centre” are actually in the process of being decommissioned under contracts with the Republic of Austria and other relevant organizations.

After the installation and comprehensive testing of the new treatment facilities, all existing “historical waste” will be reconditioned accordingly to “state of the art” procedures.

Parallel to the expansion of the processing methods, safety and security precautions and devices have also been increasingly developed and refined (starting with the installation of a water treatment plant in the 1960s). Extensive efforts have been made not only to improve the safe containment of radioactive waste (minimizing the risk of releases or spreading of contamination) but also to prevent unauthorized access to the radioactive material during the last decades.
H3. Siting of proposed facilities – Article 13

Safety, Impact and Information – Article 13 Para 1

Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:

(i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;

(ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;

(iii) to make information on the safety of such a facility available to members of the public;

(iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

The Austrian legislation does not contain detailed provisions for the siting of radioactive waste management facilities for final storage actually, but the General Radiation Protection Ordinance has been amended for transposition of the EC Waste Management Directive (Council Directive 2011/70/EURATOM) in national legislation. The associated national program (and the Strategic Environmental Assessment included) is actually under public participation.

Effects on other Contracting Parties – Article 13 Para 2

In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.

Potential cross border effects are ruled according to international legislation and EC legislation on environmental impact assessments.
H4. Construction, safety assessment and operation – Article 14

Limitation of Radiological Impacts – Article 14 (i)

Each Contracting Party shall take the appropriate steps to ensure that the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases.

The licensing procedure for the construction of a facility for the handling with radioactive material, including waste management facilities, requires the presentation of a safety analysis, which is reviewed by the radiation protection authorities. The safety analysis must demonstrate that human life and health and the environment are protected against the hazards of ionising radiation during normal operation and possible emergencies.

Decommissioning – Article 14 (ii)

Each Contracting Party shall take the appropriate steps to ensure that at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account.

The Radiation Protection Act requires a decommissioning concept for any major facility already when applying for a construction license (for details see Section 0).

Closure of Disposal Facility – Article 14 (iii)

Each Contracting Party shall take the appropriate steps to ensure that at the design stage, technical provisions for the closure of a disposal facility are prepared.

There are no disposal facilities in Austria. However, the required decommissioning concept (see above) includes provisions for the shutdown.

Technologies – Article 14 (iv)

Each Contracting Party shall take the appropriate steps to ensure that the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

The equipment and devices at NES are regularly inspected and, if required or deemed necessary, modernised and back fitted based upon the state-of-the-art.
H5. Assessment of Safety of Facilities – Article 15

Safety Assessment – Article 15 (i)

Each Contracting Party shall take the appropriate steps to ensure that before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out.

According to the Radiation Protection Act the operator has to submit a safety assessment prior to the authorization of the construction of the facility. This safety assessment has to outline the radiation risks for the installation itself and its surrounding. Furthermore an Environmental Impact Assessment (EIA) for large-scale projects is required prior to the construction based upon the Environmental Impact Assessment Act (EIA-Act).

Post-Closure Safety Assessment – Article 15 (ii)

Each Contracting Party shall take the appropriate steps to ensure that in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body.

There is no disposal facility in operation or planned. However, an EIA of radiological and non-radiological hazards is a requirement of the EIA-Act.

Update of Safety Assessment – Article 15 (iii)

Each Contracting Party shall take the appropriate steps to ensure that before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

The safety assessment has to be kept up to date. Therefore every change in the authorized operation has to be reflected in an updated safety assessment.
H6. Operation of Facilities – Article 16

Design and Safety Requirements – Article 16 (i)

*Each Contracting Party shall take the appropriate steps to ensure that the licence to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements.*

The operation licence for an installation for the handling of radioactive material, including radioactive waste management facilities, is granted based on a safety analysis report demonstrating inter alia the suitability of the site. In the case of radioactive waste management facilities, BMLFUW supervises the construction of the facility and makes sure that the facility is built in accordance with the construction licence.

The Radiation Protection Act does not contain special provisions for disposal facilities; the general rules for the operation of installations for handling with radioactive material are applied. The operation license is granted if the licensee has successfully demonstrated the compliance with all legal and administrative requirements including the suitability of the site. Further radiation protection measures can be required by the licensing authority if findings gained during construction make them necessary for radiation protection reasons. The operation licence is issued after the test operation in the framework of the construction license which has demonstrated that the facility fulfils all safety and other requirements.

Defining and Revising Operational Limits and Conditions – Article 16 (ii)

*Each Contracting Party shall take the appropriate steps to ensure that operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary.*

BMLFUW supervises and inspects the commissioning and operation of the only radioactive waste management facility NES. In general minor facilities are inspected and supervised by the Federal Provinces. All inspections are based upon § 17 of the Radiation Protection Act and include the review and approval of operational conditions for the particular installation. According to the Radiation Protection Act any changes to operational limits and conditions require a permission of the competent licensing authority which has the competence to revise operational limits and conditions as necessary for reasons of safety.

Accordance with Established Procedures – Article 16 (iii)

*Each Contracting Party shall take the appropriate steps to ensure that operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure.*

Operation, maintenance and monitoring of installations for the handling of radioactive material, including radioactive waste management facilities, are specified in the operation licence. The corresponding procedures, as described in the facility operation documents, are reviewed by the competent regulatory authority. Their adequacy is a condition for the issuance of the operation license. BMLFUW is entrusted with the supervision of radioactive waste management facilities and carries out annual inspections. BMLFUW is empowered to enforce compliance with all requirements.
Engineering and Technical Support – Article 16 (iv)

Each Contracting Party shall take the appropriate steps to ensure that engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility.

According to the Radiation Protection Act, the fulfilment of requirements regarding the staff and the organisation is a prerequisite for the granting of the operation licence for an installation for the handling with radioactive material. The requirements concerning staff and organisation are outlined in the Radiation Protection Ordinance.

Characterisation and Segregation of Radioactive Waste – Article 16 (v)

Each Contracting Party shall take the appropriate steps to ensure that procedures for characterisation and segregation of radioactive waste are applied.

Since conditioning of radioactive waste is handling with radioactive material it is subject to the licensing process. The approval depends, among other things, on the measures taken to ensure that the properties of the waste and its characterisation are optimal in view of the further waste management steps. The producer of radioactive waste is obliged to segregate and label the waste according to the following categories: liquid-combustible, liquid-non-combustible, solid-combustible, solid-non-combustible, gaseous, biogenous waste, sealed radioactive sources considered waste, bulky waste, composed waste and different hazardous wastes.

During the waste treatment at NES all procedures according to the state of the art are applied for segregation and characterisation of the waste.

Reporting of Incidents – Article 16 (vi)

Each Contracting Party shall take the appropriate steps to ensure that incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body.

During the annual inspections according to § 17 of the Radiation Protection Act incidents which have occurred, are to be reported. In addition the Radiation Protection Act requires that the licence holder immediately reports any incident that could have led to an exposure of a radiation worker.

Collection and Analysis of Operating Experience – Article 16 (vii)

Each Contracting Party shall take the appropriate steps to ensure that programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate.

During the annual inspections conducted by the regulatory authority all relevant operating experiences are analysed. If the experience during operation or new scientific evidence reveals that additional radiation protection measures are required, the licence holder can be obliged by the regulatory authority to fulfil these additional requirements taking into account acquired rights.
Decommissioning Plans and Closure of Disposal Facility – Article 16 (viii)-(ix)

*Each Contracting Party shall take the appropriate steps to ensure*

(viii) that decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.

(ix) that plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

The general requirements for the operation of an installation for the handling with radioactive material, including radioactive waste management facilities are applied. Annual inspections of the regulatory authority (BMLFUW in case of radioactive waste management facilities) ensure that the decommissioning plans including a shut-down and radioactive waste management scheme are updated and revised during the operation of the facility.

The closure and decommissioning of the radioactive waste management facility NES is scheduled for 2045 and is regulated by the Joint Agreement between the Republic of Austria, the Community of Seibersdorf and NES.

H7. Institutional measures after closure – Article 17

Keeping Records – Article 17 (i)

*Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility records of the location, design and inventory of that facility required by the regulatory body are preserved.*

In Austria no disposal facility is in operation. The Austrian legislation does not yet contain specific legal requirements for a closure of such a disposal facility. There are currently no plans for closure of NES interim storage and pre-disposal management facilities.

Institutional Controls – Article 17 (ii)

*Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility active or passive institutional controls such as monitoring or access restrictions are carried out, if required.*

Specific regulations of the institutional controls after closure have not been decided yet since there are no disposal facilities operated. The Radiation Protection Act allocates the corresponding decisions to the federal government.

Intervention Measures – Article 17 (iii)

*Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.*

Austria has implemented a national monitoring programme of the radioactivity in the environment. This monitoring is performed by the BMLFUW. The intervention measures to be taken in the case of increased environmental radiation are established by the radiation protection legislation. The responsibility for such potential intervention measures lies with the Federal State.
I. Transboundary Movement – Article 27

11. General Requirements - Article 27 Para 1

Each Contracting Party involved in a transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provision of this Convention and relevant binding international instruments.

IAEA’s Regulations for the Safe Transport of Radioactive Material (SSR-6 former TS-R-1) are incorporated in the UN Recommendations on the Transport of Dangerous Goods. They are put into legally binding force by following modal conventions to which Austria is a party:

- the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR)
- the Regulation Concerning the International Carriage of Dangerous Goods by Rail (RID), Annex C to the Convention Concerning the International Carriage by Rail (COTIF)
- the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN)
- the SOLAS Convention with the International Maritime Dangerous Goods (IMDG) Code

All these regulations are applicable for national and international transport of dangerous goods in Austria

- either by themselves
- or by reference
  - in the Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 or

This Act also establishes the institutional framework for the administration and enforcement of the said regulations.
Authorisation by State of Destination – Article 27 Para 1 (i)

In so doing, a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination.

The import, export and transit of radioactive waste (including spent fuel declared as waste) are subject to an authorisation issued under the Ordinance on the Supervision and Control of Shipments of Radioactive Waste into, out of or through the Austrian Federal Territory, which implements the Council Directive 2006/117/EURATOM. Transportation of fissionable material on Austrian territory is generally prohibited unless under an international agreement. Fissionable material for the purpose of peaceful use if not for the production of nuclear power can be transported. The transport of fissionable material arising from the nuclear energy production is also prohibited if the purpose is final disposal.

According to this Ordinance, every crossing of the Austrian border by radioactive waste needs an approval by the competent Austrian authority. The Annexes to the Ordinance define, inter alia, the form of the applicable standard documentation and the list of quantities and concentration levels for radioactive waste. The Standard Document according to the Council Directive 2006/117/EURATOM has to be used.

According the Ordinance on the Supervision and Control of Shipments of Radioactive Waste an approval can be granted if following requirements are fulfilled:

- no legal reason for exclusion exists (see I2)
- no indirect or imminent danger for the human life or health including human descendants from ionising radiation
- the State of Destination and the States of Transit (if any) have agreed to the shipment for the stated purposes within the framework of an international agreement or within the applicable European Community or EURATOM Law
- the exporter has entered into a binding written agreement with the importer of the radioactive waste which stipulates that the exporter shall take back the waste if the shipment cannot be completed according to the relevant legal provisions or the conditions attached to the approval

Movements through States of Transit – Article 27 Para 1 (ii)

In so doing, transboundary movement through states of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized.

No additional requirements necessary (see General Requirements – Article 27 Para 1)
Requirements for State of Destination – Article 27 Para 1 (iii)

In so doing, a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention.

According to the Radioactive Waste Shipment Ordinance the approval of a shipment of radioactive waste into the Austrian territory has to be refused in cases

- of an imminent or indirect danger for the human health or life including human descendants from ionising radiation, or
- where no licence for the intended or predicted use or handling has been issued according to the radiation protection legislation, or
- the competent national authorities have not been supplied with a takeover agreement between the licensee and an appropriate facility for the treatment of radioactive waste, or
- a take-back declaration of the holder of the waste is missing in case the transportation procedure cannot be completed or
- the data and specifications or the comments of the competent authorities in the standard document are apparently missing or incomplete

Meeting the Requirements for State of Destination – Article 27 Para 1 (iv)

In so doing, a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement.

According to § 9 and § 17 of the Radioactive Waste Shipment Ordinance, an authorization is required for the transboundary movement of radioactive waste from Austria to another state. The conditions are explained in detail therein, as can be seen above in “Article 27 Para 1 (i)”, which ensures that the respective requirements of the Convention are fulfilled.

Re-entry in case of non-conformity – Article 27 Para 1 (v)

In so doing, a Contracting Party which is a State of origin shall take the appropriate steps to permit a re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

In case of a shipment of radioactive waste from Austria to a destination out of the Austrian territory the Radioactive Waste Shipment Ordinance explicitly requires a written and legally binding agreement between the holder and the consignee obliging the holder to take back the radioactive waste in case the shipment procedure cannot be accomplished or the conditions attached to the approval of the shipment are not fulfilled.

The competent national authorities which approved the transit for a shipment may not refuse the reshipment if the initial shipment was approved for treatment or reprocessing purposes and if the reshipment concerns radioactive waste or other products equivalent to the original material after treatment or reprocessing when all relevant legislation is respected. In case of a shipment failure, the national authorities must allow the repatriation of the radioactive waste, if a transboundary movement cannot be completed in conformity with the relevant legislation and the reshipment is undertaken in a safe manner on the same conditions and with the same specifications as stated in the initial application.
I2. Shipments south of Latitude 60 – Article 27 Para 2

A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees south for storage or disposal.

According to § 6 of the Ordinance on the Supervision and Control of Shipments of Radioactive Waste, the competent authorities have to refuse granting of a license for shipments:

- to a destination south of latitude 60 degrees south or
- to a State Party to the Cotonou ACP-EC Agreement which is not a member of the European Community, taking into account reshipments or
- to a third country, which does not have the technical, legal or administrative resources to safely manage the radioactive waste in the opinion of the competent authorities of the country of origin (provisions and criteria for reshipment must be taken into account).
J. Disused Sealed Sources – Article 28

J1. Possession, Remanufacturing and Disposal – Article 28 Para 1

Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.

The further handling of disused sealed sources can be derived from § 4 (1) of the Radiation Protection Act (ordaining minimisation of dose expositions to humans) and § 75 (4) of the General Radiation Protection Ordinance (ordaining minimisation of radioactive waste). The preferred management option concerning disused sealed sources is the return to the manufacturer. In cases of disused sealed sources where this is not possible, recycling (e.g.: reuse by a third party) is encouraged.

If no reasonable further use possible, they have to be declared radioactive waste and transferred to NES for conditioning and interim storage according to § 36c of the Radiation Protection Act.

J2. Re-entry into Territory – Article 28 Para 2

A Contracting Party shall allow for re-entry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed source.

In Austria the re-entry of disused sealed sources into its territory is allowed. Import and export of all radioactive sources need prior licensing if their activity is above the exemption limit set in the Radiation Protection Ordinance implementing the Basic Safety Standards Directive. The requirements for a shipment of radioactive sources are laid down in the EU Council Regulation No 1493/93/EURATOM of 8th June 1993 on the shipment of radioactive substances between Member States which is directly applicable for the import and export of radioactive sources.
K. General Efforts to Improve Safety

As shown in the present report, the safety of radioactive waste management in Austria complies with the obligations of the Convention. However, Austria strives for continuing improvements of safety (especially in accordance to the Challenges and Suggestions identified at the Fifth Review Meeting – “Rapporteur’s Written Report”).

- Austria has drafted a National Waste Disposal Program, which will be subject of a Strategic Environmental Assessment according to § 36b of the Radiation Protection Act (planned for autumn 2017). It is warranted with this measure that the public has the necessary opportunities to participate in the pertinent proceeding (Challenges 1, 2 + 3 and associated Suggestion).

- All facilities at NES which have been licensed according to the Radiation Protection Act are monitored and inspected on an annual basis. In the frame of these inspections, the practice of the license holder is examined on compliance with the applicable regulations, licenses and the terms of the licences (Challenge 4).

- All already existing drums with conditioned radioactive waste will be taken from the storage facilities and inspected. The content will be removed and put into new 200-litre-drums, which will be of flange-type and equipped with a liner made of reinforced plastic on their interior. After drying and precise documentation for each container, the drums will be put back to the storage facilities, where they will be arranged horizontally (additional conditioning). The content of very old containers, which partly even lack an appropriate documentation, will be conditioned according state of the art before putting the waste into new drums. By conditioning of this very old waste using modern facilities, a reduction of the waste volume is expected (re-conditioning) (Challenge 5).

- According to INFCIRC/604/Rev.3; Section K – 37, NES and BMLFUW make available all relevant information to the public appropriately. This is a legal obligation according to § 79a of the General Radiation Protection ordinance for NES and BMLFUW. All voluntary practices according to INFCIRC/604/Rev.3 (Annex) regarding publicly available information have been implemented in Austria (e.g. the last Joint Convention report and the corresponding questions and answers have been published on the web).

- Currently Austria transposes the European Basic Safety Standards (Council Directive 2013/59/EURATOM) in national legislation. This transposition implicates that the Radiation Protection Act and the corresponding ordinances will be revised.

- The modernisation of the central radioactive waste management and interim storage facility is ongoing. Some related projects have already been completed or are near completion.

- In 2018 Austria will perform a peer review (IRRS) of its regulatory framework for radiation protection and nuclear safety.
L.  Annexes

L1. Nuclear Engineering Seibersdorf GmbH (NES)

The following chapters describe in short the existing radioactive waste management facilities of the Austrian centralized pre-disposal and interim storage facility NES.

Materials Reception Building

The Materials Reception Building is arranged next to the Waste Water Treatment Facility. The whole material transfer to and from the NES waste management plant (radiation area) is carried out via this building. Hence one part of the building is foreseen as a large air-lock for trucks. The second part of the Materials Reception building is used for pre-classification und buffering of incoming waste.

Segregation

Pre-sorting of radioactive waste is required from the waste producers. For specific tasks, such as dismantling of larger equipment, a special room (“sorting box”) equipped with a negative pressure ventilation system is used. This sorting-box was refurbished to improve material flow and radiation protection. Depending on the hazards involved, work is carried out in supplied-air suits or full-face masks.

Waste water treatment facility

In this facility, waste water from the Seibersdorf site is treated. The four waste water sources include incinerator operations, operation of other waste treatment facilities and laboratories with radioactive material, all other laboratories on site (theoretically inactive waste water), and the IAEA Nuclear Materials Lab (NML) delivering potentially $\alpha$-contaminated waste water.
The Figure shows a schematic depiction of the facility. As a first step, waste water is delivered via direct pipeline connections from the point of origin into separate admission basins. Then Measurements are performed to determine the activity of the waste water. If below the regulatory limits, the water is transferred directly into the collecting basin and, after repeated measurements, discharged into the environment. In the opposite case, the water is pumped into the storage tanks and after that decontaminated by filtration using diaphragm techniques (microfiltration in cross flow mode). This process is able to remove the radionuclides from the waste water omitting the addition of chemical reagents and filter aid, thus a large reduction of waste volume is achieved. The microfiltration process yields a concentrate, which is further treated by flocculation and sedimentation, the resulting sludge is dried and conditioned in the high force compactor. The liquid is pumped back into the storage tanks, rechecked for activity, and transferred into the collecting basin.

As alternative to the microfiltration process described above a former used precipitation/filtration process can be applied. Thereby the contaminated waste water is also pumped to the storage tanks, some equipped with stirrers, where a precipitation is performed by addition of a suitable reagent like $[\text{Fe(CN)}_6]^{4-}$ for Cs$^+$ precipitation. The active precipitate is separated from the liquid in a special “Filtrox®” filtration unit (resulting sludge is further conditioned as described above). The liquid is pumped back into the storage tanks, rechecked for activity, and transferred into the collecting basin. Occasionally, a second precipitation may be called for to comply with the regulatory limits.
High-force compactor

Non burnable solid radioactive waste can be treated using the high-force compactor. In the year 2016 a new 1500 t compactor in vertical design, which is fully remote controlled, started operation. The produced pellets are transferred into 200-litre-drums by the automatically handling system via double cover airlocks.

Depending on the waste characteristics, a volume reduction factor of 2 to 10 can be reached.

Cementation equipment

Cementation (grouting) is a conditioning and immobilisation method which was commonly used at NES but has decreasing importance for the last years. Homogeneous cementation is carried out in-drum by a dedicated in-drum mixer (waste with cement and water).
Interim storage

Conditioned radioactive waste is stored within three dry engineered construction storage facilities (storage facilities no. 12, 12A and 13).

In the “old” storage buildings LH12/12A the drums are tightly packed (see picture 1), in the new storage building LH13 the drums are stored horizontal on special designed racks (see picture 2). This configuration enables the inspection of each drum at all times.

In the year 2016 the new storage hall LH14 was commissioned and in the next years an additional facility LH15 will be erected. All new buildings are equipped with a thermal insulation and a heating- and dehumidification-system in order to reduce the risk of corrosion for the steel drums.

All waste drums will be stored in a new configuration. After removal of all drums from LH12/12A this facility will be decommissioned.

As of end of 2016 11 223 waste packages (mainly 200-litre-drums) were stored in the interim storage (the capacity of LH13, 14 and 15 together will be approximately 18 000 drums in the future).

*Picture 1: Conditioned waste in interim storage facility 12A*

*Picture 2: Conditioned waste in interim storage facility 13*
Incinerator

The shaft incinerator of the “Karlsruhe” type is an excess air unit having a capacity of about 40 kg per hour and a combustion volume of 1 m diameter and 5 m height. The off-gas cleaning system consists of a set of ceramic hot gas filters, quench, two stage wet scrubber and HEPA-Filters.

Over the years a number of modifications to the original design have been carried out in order to improve safety, to keep up the technical standard and to meet requirements of changing regulations. Especially the off-gas cleaning system has been changed considerably compared to the original design.

In addition, modifications to the shaft have been carried out, where for example additional openings were introduced in order to facilitate effectively the incineration of powdery material.

In 2007 a modern, online-monitoring-system for the exhaust-air of the incinerator-building was installed. The system consists of an isokinetic sampling-system installed in the stack, an aerosol-monitor as well as separate monitors for tritium and iodine.

*Simplified Diagram of the Excess Air Incinerator*
Technical data of the incinerator:

- Excess air incinerator
- Shaft type, single chamber
- Combustion chamber: 1 m diameter, 5 m high
- Combustion temperature: 1000 °C
- Capacity: ~ 40 kg/h solid burnable waste (calorific value: average 21x10^6 J/kg = 5000 kcal/kg)
- Negative pressure in the combustion chamber: 10^3 Pascal = 10 mbar
- Air flow: 300-600 m³ variable, depending on negative pressure in combustion chamber
- Feeding from top batch wise (2-3 kg) through airlock, liquids through burner
- Feeding of powdery material by blowing system into combustion chamber
- Hot gas filter, in brick-lined filter box, Silicon-carbide candles, mean porosity : 20 µm
- Quench, spray cooler with nozzles, decreases off-gas temperature from 700 °C to 70 °C
- Two stage scrubber (one trickle flow, one spray) using caustic soda solution to pH 8.1
- Heater, raises off-gas temperature to ~ 100 °C
- HEPA filters
- Off-gas draft fan, radial blower, regulated by negative pressure of combustion chamber
- Mixing chamber
- Stack, 35 m high

Operation:

Depending on the amount of radioactive waste to be combusted the incinerator is operated in campaigns (in average 3 months a year). It is operated in two shifts a day, i.e. from 6h00 till 22h00 5 days a week, with two operators in one shift.

The treatment of the wastes results in a volume reduction of about 50:1 comparing raw material to ashes. But operating such a facility creates secondary waste, changing the picture of volume-reduction significantly. Apart from operational waste as hot gas- and HEPA-filters, contaminated parts from maintenance and repairs, a number of replacements have to be included.

Activity throughput:

Apart from specific experiments, when waste with known radionuclides and known activity was fed to the incinerator in order to find out retention factors, it was not possible to obtain an activity balance or a decontamination factor at treating institutional wastes by activity measurements of ashes, hot-gas filter, HEPA filter and waste water.

The activity of institutional waste is very low. Due to its characteristics, routine measurements and reported activity values of the raw waste are very inaccurate. So, the activity of waste fed into the incinerator is badly known and cross contamination within the incinerator unit causes an additional problem, i.e. the surfaces of the plant exposed to the off-gas adsorbs radioactive particles from the passing off-gas and simultaneously releases such particles into it. These factors together indicate that activity balancing is nearly impossible.
Drum drying system

Before placing the drums to the interim storage, most conditioned drums of NES are dried to ensure the long term chemical stability of the content and to minimize the risk of internal corrosion in the drum.

For this purpose a drum-drying-system is in operation; main technical data are as follows:

- **capacity**: Simultaneous drying of up to 32 pcs. 200-litre-drums (drying of containers with other geometry is also possible)
- **drying temperature**: Adjustable up to a maximum of 140 °C
- **fully automatic operation** (except loading-/unloading-procedures controlled/performed manually)
- **drying performed at slight under pressure** (kept for radiological reasons)
- **electric heating**

Due to the works for the "New concept for future radioactive waste-management at NES", the drum drying system was out of operation since April 2011 and started up again end of 2016.
Measuring facility

Low-level measurement facility

To minimise waste, NES carries out clearance measurements of slightly radioactive materials like concrete and soil by using a modern, automatic measurement facility. Thus, low-level materials can be disposed of as inactive waste as long as the activities measured are below the legally stipulated clearance thresholds.

Waste assay system

Due to the fact that gamma-emitting raw and conditioned radioactive waste shows a high variability both in terms of nuclide composition and physical make-up (raw waste versus the different forms of conditioned waste) and form (i.e. different geometries and drums) a flexible approach is needed together with an assay system that is configurable and uses various assay methods.

The assay system on site therefore supports various methods and can for instance act as an Integral Gamma Scanner (IGS) for homogenous matrix types using a single far-field emission spectra for the assay, a Segmented Gamma Scanner (SGS) for data acquisition for more heterogeneous matrix types using a number of near-field emission spectra or as a Tomographic Gamma Scanner (TGS) for three-dimensional transmission and emission images respectively.

Measurement-time constraints also weigh in on which assay methods are used. To allow for a higher throughput the system also supports automated supervisor functions allowing the drums staged to be assayed automatically according to a preloaded table.
The assay system consists of the following components:

- Collimated, coaxial p-type high purity germanium (HPGe) detector mounted on a vertical detector lift assembly
- Digital Signal Processor (DSP), a reference pulser as well as an acquisition interface board providing a full featured Multi-Channel Analyser
- A highly collimated $^{60}$Co transmission source (9.25 GBq nominal activity) with tungsten shutter and lead storage shield atop a vertical lift assembly
- Drum rotator, translation assembly and conveyor system for automated measurement of up to six 200-litre-drums

![Image](image.png)

*Waste Assay System in the measuring facility at Seibersdorf*

**Documentation**

All relevant data from the information of the customers across all levels of processing and conditioning steps to interim storage are stored in a comprehensive database system. This system, called “DOKURAD”, has been completely newly designed, programmed and optimized in the recent years.
New concept for future radioactive waste-management at NES

In compliance with the Joint Agreement between the Republic of Austria, NES and the Community of Seibersdorf, long-term interim storage (“transfer-storage”) of radioactive waste has to be assured until 2045. This extension of the storage time for the existing (and future) radioactive waste required significant investments in new buildings and machinery and additional measures for the stored containers with radioactive waste (additional- and re-conditioning) at NES. In the following section the main items of this renewal concept are briefly described (main buildings and machinery associated to the new concept are already erected/installed and in operation).

New Manipulation Centre including equipment

The existing Workshop Building was extended to a New Handling Centre (NHC). In this new building NES concentrated most of its conditioning facilities for radioactive waste. The NHC also provides for radiation safety according state of the art and for an optimized flow of material.

In the new building the following equipment was installed:

- two Caissons (“sorting/manipulation boxes”) made of stainless steel: One caisson will mainly be used for the additional- and re-conditioning works (as described thereinafter), the second caisson will mainly be used for conditioning and decontamination of bulky materials
- a new vertical High-Force-Compactor (1500 t)
- a new Hot Cell (with underground storage) replacing existing Hot cells (will be decommissioned)
- a centre for manipulation of radiation sources
- a drum drying system
- cementation equipment
- laboratories (Measurement and quality assurance)
Storage concept
A new storage concept for the 200-litre-drums was already implemented in storage facilities no.13 and 14: All drums are stored horizontally in a way that will enable individual drum inspection at all time.

The existing storage facilities no.12 and 12A will be decommissioned after all drums are transferred to the new storage buildings.

Storing the drums following the new concept (with possibility for individual inspection of each drum) will require more space compared to former storing-practise. The future storage capacity at Nuclear Engineering Seibersdorf will approximately be 18000 drums (planned facility LH15 included).

Reconstruction of existing Incineration plant
This facility will be refurbished in the years 2017-2019 to further reduce the risk of contamination-carryover to achieve an improved flow of material and works and to improve (non-radiologic) off-gas characteristics.

Additional- and Re-Conditioning
The storage time (up to 2045) requires measures to be taken for the waste in stock:

- **Additional conditioning:**
  All drums will be taken from the storage facilities and inspected. The content will be removed and put into new 200-litre-drums, which will be of flange-type and equipped with a liner made of reinforced plastic on their interior. After drying and precise documentation for each container, the drums will be put back to the storage facilities, where they will be arranged horizontally (each drum can be inspected individually over the whole time of storing).

- **Re-conditioning:**
  The content of very old containers, which partly even lack an appropriate documentation, will be conditioned according state of the art before putting the waste into new drums. By conditioning of this very old waste using modern facilities, a reduction of approximately 1350 200-litre-drums at NES is expected.

Safety Measures:
The erection of a new Central Access Building – which is already in operation - allowed a clear separation between active and inactive areas minimizing the risk of contamination-carryover and additionally connected the Incineration Plant and the Waste Water Treatment Facility. It acts – similar to the Materials Reception Building for material transfer - as a central air lock for all personnel entering or leaving the premises of NES waste management plant (radiation area).

In addition an improved perimeter security system for the fence around the premises of NES (radiation area) was installed to ensure physical- and/or video-detection of potential intruders.
L2.1. References to international Regulations and Directives


L2.2. References to national Laws and Ordinances


- **Ordinance on Interventions in Case of Radiological Emergencies or in Case of Lasting Exposure** ("Interventionsverordnung"), Federal Gazette II no. 145/2007 of 26th June 2007.
