DRAFT
NATIONAL RADIOACTIVE WASTE MANAGEMENT PROGRAMME
ACC. ART. 36b RADIATION PROTECTION ACT

BUNDESMINISTERIUM
FÜR NACHHALTIGKEIT
UND TOURISMUS

LEGAL INFORMATION

Owned and published by:
AUSTRIAN FEDERAL MINISTRY
FOR SUSTAINABILITY AND TOURISM
Stubenring 1, 1010 Vienna
www.bmnt.gv.at

TABLE OF CONTENTS

SUMMARY

COUNCIL DIRECTIVE 2011/70/EURATOM of 19 July 2011, which institutes a Community framework for the responsible and safe management of spent fuel and radioactive waste, obliges Member States to establish a National Radioactive Waste Management Programme. This document formulates a draft Radioactive Waste Management Programme for Austria.

This "National Radioactive Waste Management Programme" sets out the current principles, the existing legal framework and the practice of the management of radioactive waste in Austria and gives an overview of the currently existing and expected future quantities of radioactive waste. It describes how radioactive waste is currently managed as well as future steps including possible disposal options, taking into account the envisaged waste inventory.

Regarding the final disposal of radioactive waste, the Austrian Federal Government is setting up a Task force "Disposal". This will involve ministries, representatives of the Federal provinces, experts in the subject matter and stakeholders and will address disposal-related issues and tasks in an efficient and transparent manner, and in accordance with the principles of Article 36b of the Radiation Protection Act.

The Austrian radioactive waste management policy aims at responsible predisposal management and safe disposal of the radioactive waste generated within the Federal territory. Radioactive wastes generated in Austria arise from the use of radioisotopes in medicine, industry and research and are thus limited to the low- and intermediate-level categories. As there are no operational nuclear power plants in Austria, there is no generation of high level radioactive waste, or spent nuclear fuel for management or disposal. The fuel elements of the research reactor at the Atomic Institute of the TU Wien (Vienna University of Technology), will be returned to the supplier (US Department of Energy) based on legal obligations and a take-back agreement with the supplier.

Radioactive waste which cannot be cleared for release, or in the case of sealed radiation sources, cannot be returned to the supplier must be handed over to Nuclear Engineering Seibersdorf GmbH (NES), which is the only official entity approved by the Republic of Austria as the operator of a radioactive waste management facility. NES is contracted to provide sorting, conditioning, as well as long-term interim storage of radioactive waste at the Seibersdorf location. At NES, radioactive waste is converted into a stable form utilising international best practice and state-of-the-art processing methods, which are also focussed on ensuring optimised volume reduction.

Austria's conditioned radioactive waste is stored at the interim storage facility of NES, which currently contains around 11,200 waste containers (200 litre drums). Only a minor increase to the currently stored inventory is foreseen in the future. The stored waste will remain in interim storage at the NES Facility at Seibersdorf, until a final decision is taken regarding disposal. Thus, interim storage is contractually secured until 2045.

1 INTRODUCTION

THE COUNCIL DIRECTIVE 2011/70/EURATOM ESTABLISHING a Community framework for the responsible and safe management of spent fuel and radioactive waste (hereinafter referred to as "Directive 2011/70/Euratom") has been fully transposed into national law with the amendment of the Radiation Protection Act (StrSchG), Federal Law Gazette I no. 133/2015, thus creating the legal framework for the establishment of a national radioactive waste management programme (hereinafter referred to as the "National Radioactive Waste Management Programme").

The objective of Directive 2011/70/Euratom is to ensure that the Member States of the European Union ensure a high level of safety in radioactive waste management and a continuous improvement of their management regime. Another aim is to ensure that citizens have access to all relevant information and are able to participate effectively in deciding on how and where radioactive waste is to be disposed of.

For this purpose, the Article 36b of the StrSchG requires the Austrian Federal Government, with the participation of the public and by conducting a Strategic Environmental Assessment, to establish a National Radioactive Waste Management Programme that contains the strategy and steps for the responsible and safe management of radioactive waste. In order to ensure an efficient development of the National Radioactive Waste Management Programme, for the purpose of coordination, the Federal Ministry of Agriculture, Forestry, Environment and Water Management has established an inter-ministerial Task force. In 2018, the competence was passed to the Federal Ministry of Sustainability and Tourism.

Based on the preliminary National Radioactive Waste Management Programme of August 2015, which describes the current practice of the management of radioactive waste in Austria, the updated National Radioactive Waste Management Programme presented here, also illustrates the steps that Austria will take to achieve radioactive waste disposal.

The National Radioactive Waste Management Programme is in line with the "*Guidelines for the establishment and notification of National Programmes*, ENEF Working Group Risk, January 2013".

2 AUSTRIAN RADIOACTIVE WASTE MANAGEMENT POLICY

RADIOACTIVE WASTE ORIGINATES from applications of radioactive substances in medicine, industry, education and research. Waste originates also wherever unneeded radiation facilities 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, Article 36b (1) to (4) of the StrSchG 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 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, Federal Law Gazette III no. 169/2001, will be considered.

A key element of the Austrian radioactive waste management policy is that **no spent fuel arises for disposal in Austria**. This is because, according to the Federal Constitutional Act for a Nonnuclear Austria, no nuclear facilities for energy generation can be either constructed or operated. Further, 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 increases 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 storage. 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 for the long-term. 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. In addition to the scope of the safety measures themselves, the documentation of the decision-making

process, insofar as it relates to safety aspects, should also be linked to the risk level and provide a basis for decisions on the management of the radioactive waste. 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 Article 36c StrSchG, Nuclear Engineering Seibersdorf GmbH (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 precautionary 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.

3 LEGAL FRAMEWORK FOR RADIOACTIVE WASTE MANAGEMENT

BASED ON THE GENERAL PRINCIPLES, Austria has established a legal and regulatory framework for all aspects of radioactive waste management with clear allocation of responsibilities to the various organizations. This legal basis for the management of radioactive waste and spent fuel is formed by the following laws and regulations:

- Federal Constitutional Act for a Nonnuclear Austria;
- Radiation Protection Act (StrSchG);
- General Radiation Protection Ordinance (AllgStrSchV);
- Ordinance on the Shipment of Radioactive Waste 2009 (RAbF-VV 2009);
- Ordinance on Natural Radiation Sources (NatStrV).

FEDERAL CONSTITUTIONAL ACT FOR A NONNUCLEAR AUSTRIA

According to the Federal Constitutional Act for a Nonnuclear Austria, Federal Law Gazette I no. 149/1999, installations which serve the purpose of energy production by nuclear fission may neither be constructed nor operated in Austria. Research reactors are not affected by this prohibition. However, operators of such a nuclear installation are required to conclude a take-back agreement with the supplier of the fuel elements in accordance with Article 87 (2) of the General Radiation Protection Ordinance (AllgStrSchV). This ensures that no spent fuel arises for final disposal in Austria from the operation of research reactors.

RADIATION PROTECTION ACT

The Radiation Protection Act (StrSchG), Federal Law Gazette no. 227/1969, dates from 1969 and the corresponding regulations have been amended several times, in particular after the accession to the EU, in order to integrate the European Union legislation into national legislation. The latest amendment from 2015, Federal Law Gazette I no. 103/2015, had the purpose, among other things, to implement Directive 2011/70/Euratom.

Regarding radioactive waste, the following European Union directives are relevant:

- Council Directive 96/29/Euratom 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation ("Basic Safety Standards Directive", Official Journal L 159/1 of 29 June 1996);
- Council Directive 2003/122/Euratom on the control of high-activity sealed radioactive sources and orphan sources (Official Journal L 346/57 of 31 December 2003);
- Council Directive 2006/117/Euratom on the supervision and control of shipments of radioactive waste and spent fuel (Official Journal L 337/21 of 5 December 2006);
- Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste (Official Journal L 199/48 of 2 August 2011).

The Radiation Protection Act is aimed at: anyone who works with radiation sources or with natural sources of radiation; all those who have been or can be affected by radiological emergency interventions; and the relevant authorities.

Article 36b of the StrSchG standardizes the principles and objectives regarding the management of radioactive waste generated in Austria and creates the legal basis for the National Waste Management Programme pursuant to Article 11 of Directive 2011/70/Euratom. In addition to these provisions, the necessary trans-

parency required by the Directive has also been legally anchored in the preparation of the National Waste Management Programme.

The implementation of a Strategic Environmental Assessment (SEA) as defined in and required by Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (Directive 2001/42/EC) has also been legally anchored in Article 36b of the StrSchG. As the National Waste Management Programme covers all stages of radioactive waste management from the generation to final disposal, it provides, in accordance with Article 3 (2) (a) of the SEA Directive, the framework for the future approval of a project as set out in Annex I of Directive 2011/92/EC, as amended by Directive 2014/52/EC, ("Annex I Z 3 lit b/iv: Installations for the exclusive purpose of the final disposal of radioactive waste").

Article 36c StrSchG establishes the legal basis for the commissioning of a suitable facility for the disposal of radioactive waste generated in Austria and its financing. In agreement with the Federal Minister of Finance, the Federal Minister for Sustainability and Tourism is authorized, to conclude contracts for the disposal of radioactive waste corresponding to the state-of-the-art with a suitable institution, which has the appropriate expertise and the necessary technical and personnel equipment.

Article 41 of the StrSchG regulates the responsibilities of the first-instance radiation protection authorities. The regulatory responsibilities regarding radioactive waste management are divided between:

- The Federal Minister for Sustainability and Tourism (BMNT), which is the supervisory authority for Nuclear Engineering Seibersdorf GmbH (NES) concerning radioactive waste;
- The Federal Minister for Education, Science and Research (BMBWF), which is the supervisory authority for the nuclear facilities and particle accelerators in the field of universities and the research institutes of the Austrian Academy of Sciences (including spent fuel);
- The heads of the Provincial Governments, which are in most cases the supervisory authorities for these and other waste producers.

GENERAL RADIATION PROTECTION ORDINANCE

The Radiation Protection Act envisages that some of its provisions are to be effected through specific ordinances. The most important one concerning radioactive waste is the General Radiation Protection Ordinance (AllgStrSchV), Federal Law Gazette II no. 191/2006. This ordinance was amended in 2012 and most recently in 2015. With the most recent amendment, parts of Directive 2011/70/Euratom have been transposed into national law.

The General Radiation Protection Ordinance regulates exposures to ionizing radiation including the handling of radiation sources (except those specified in the Medical Radiation Protection Ordinance).

Regarding radioactive waste, the General Radiation Protection Ordinance contains, in particular, the following provisions:

In accordance with the general provisions, radioactive waste is defined as materials that contain, or are contaminated with, radioactive substances which originate from handling of radiation sources, and

- which are no longer used in the intended or in any other permissible way and which the owner/proprietor wishes to dispose of or has disposed of; or
- whose disposal as radioactive waste is in the public interest.

Radioactive waste management covers all activities related to the processing, conditioning, interim storage and disposal of radioactive waste, other than off-site transport. The storage of conditioned radioactive waste with the option to retrieve the material is designated as interim storage whereas the storage of conditioned radioactive waste without the option to retrieve the material is designated as final disposal.

Pursuant to Article 75 (4), holders of a licence to handle radioactive substances or users of devices containing radioactive substances have to submit to the licensing authority a management concept, which describes

what is to be done with the radioactive waste resulting from this practice. Waste minimization, waste volume reduction and the reuse of radioactive materials must be taken into account.

Licence holders must collect and label radioactive waste according to specific categories (Article 76). Radioactive waste can also be temporarily stored in the plants where it arises (Article 77). This has the purpose of allowing the waste to decay so far that its activity can be neglected from the point of view of radiation protection and can be disposed of via the conventional waste cycle.

Article 78 defines where radioactive waste has to be handed over. As a rule, radioactive waste generated in Austria, provided it is not discharged, released or transferred abroad under certain conditions, has to be handed over to NES.

Article 79a ff contains provisions for the operation of radioactive waste management facilities. In addition to informing the public, operators have to develop and apply a safety report as well as an integrated management system. The aim of this management system is to ensure the safe and proper operation of the facility at all times. In particular, the aspects of radiation protection, quality assurance, occupational safety, health protection and environmental protection must be addressed.

ORDINANCE ON NATURAL RADIATION SOURCES

The Ordinance on Natural Radiation Sources (NatStrV), Federal Law Gazette II no. 2/2008, contains provisions for the protection when working with natural sources of radiation. The regulations also concern increased exposures of individuals of the population due to residues (for example sludge, dusts, sands) which exhibit enhanced radioactive material of natural origin. In principle, these residues can be disposed of at landfills. However, residues, which would cause an excessive radiation exposure when disposed in a landfill, must be disposed of as radioactive waste.

ORDINANCE ON THE SHIPMENT OF RADIOACTIVE WASTE 2009

The Ordinance on the Shipment of Radioactive Waste 2009 (RAbf-VV 2009), Federal Law Gazette II no. 47/2009, contains regulations for the monitoring and control of transboundary shipments of radioactive waste and spent fuel for treatment or disposal. The procedures for the approval of shipments of radioactive waste and spent fuel from, to and through the territory of Austria are regulated. This concerns both the shipments within the European Union as well as the shipments where the country of origin and/or the country of destination is a third country. Since NES is only licensed to take over radioactive waste generated in Austria, shipments to the Austrian Federal territory are only permitted if the imported waste originates from material previously exported from Austria for treatment. With regard to shipments of radioactive waste to other countries, Amendment 2015 (Federal Law Gazette II no. 22/2015), in accordance with the Waste Directive, stipulates the conditions under which an export can be approved for disposal in another country.

4 INVENTORY OF RADIOACTIVE WASTE IN AUSTRIA

IN AUSTRIA, NO SPENT FUEL arises for domestic disposal. Since the construction and operation of nuclear power plants in Austria is prohibited by constitutional law, only research reactors are considered as sources of spent fuel.

The AllgStrSchV stipulates that the operation of research reactors will only be permitted if the operator has ensured that the manufacturers or suppliers of the fuel elements undertake to take them back.

Austria's only research reactor is operated at the Atomic Institute of the Vienna University of Technology. For this facility, a contract between the Vienna University of Technology, the US Department of Energy and the Euratom Supply Agency provides for the return of the spent fuel back to the supplier (US Department of Energy) after the reactor has been decommissioned (planned for 2025 or later).

Current and future radioactive waste generated in Austria comes and will come from two types of waste producer namely institutional users (medicine, industry and research) and decommissioning (decontamination and dismantling) of radiation facilities. The amount of waste generated is low when compared to that produced by nuclear power plants. In addition, radioactive waste generated in Austria is limited to the low and intermediate level radioactive waste categories.

From the two waste streams (medicine/industry/research and decommissioning), NES produces, after using extensive treatment steps, about 200 drums (200 litre drums) of conditioned radioactive waste annually, which is stored in the local storage facility.

WASTE FROM MEDICINE, INDUSTRY AND RESEARCH

The annual amount of radioactive raw material in Austria is around 10-20 tonnes. The following are examples of producers and origin of the waste:

Medicine

– Medical diagnostics;

– Laboratory tests;

– Medical and pharmaceutical research;

– Radiotherapy.

To a large extent, this waste is combustible material such as protective gloves, syringes, used dressings, medical equipment, etc. Only a small fraction of the waste from medicine is not combustible.

Industry

– Radiation sources from measuring and control devices in industrial plants (for example equipment for level or flow measurements);

– Radiation sources for quality assurance (for example equipment for non-destructive testing of safety-relevant welds such as in district heating pipes);

– Ionization smoke detectors;

– Waste from laboratory activities.

Industrial waste mainly consists of sealed radioactive sources, non-combustible waste, such as contaminated parts, but also combustible waste (similar to medicine).

Research

– Basic scientific research and applied research;

– Medical, physical, chemical, biological research, etc.

Most of the radioactive waste from research is combustible (e.g., protective clothing, cleaning material, vials, chemicals). In addition to this, non-combustible waste, such as contaminated equipment or parts of the facility, may occur.

The following Table 1 lists the quantities of radioactive waste (raw material) received by NES from medicine, industry and research:

TABLE 1: RECEIVED RADIOACTIVE WASTE 2010 - 2015

Year	Mass (t)
2010	17.2
2011	15.6
2012	22.3
2013	10.5
2014	11.5
2015	107.6

In 2015, an extremely large amount of (largely liquid) waste occurred during the dismantling of an old laboratory building in an Austrian university. Otherwise, the average annual volume of institutional waste is around 15 tonnes.

In the following Figure 1 the radioactive waste is broken down according to the producers such as medicine, industry, research and the IAEA laboratories based in Austria. The main share of radioactive waste comes from medical applications.

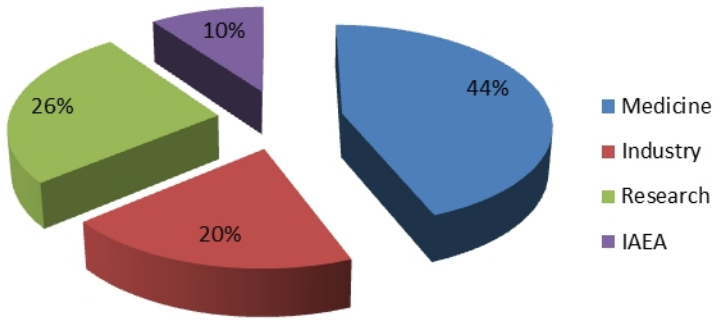

Figure 1: Occurrence of radioactive waste in the years 2010 - 2014 according to polluter groups

WASTE FROM DECOMMISSIONING

At the Seibersdorf site (founded in the 1950s as the "Austrian Research Association for Atomic Energy") extensive nuclear research was carried out over several decades. Since the end of these activities, there remains a need to dismantle the installations and facilities used at the time and to process the radioactive waste. This consists, for example, of contaminated facility parts, laboratory equipment and building rubble. One of the largest of these projects was the dismantling of the 10-megawatt ASTRA research reactor, which was completed in 2006. A number of other decommissioning projects have still to be carried out by NES at the site and are being carried out successively.

The amount of waste generated during decommissioning varies greatly, as it depends on the number and type of projects being dealt with. On the average, 80-120 tonnes of raw material can be assumed annually, so that approximately 2,000 tonnes will have to be treated until the final completion of the decommissioning projects at Seibersdorf (presumably in 2030). Most of this raw material consists of contaminated plant components, construction material, etc. ,a large proportion of which can be disposed of conventionally by targeted treatment and decontamination. In this way, the volume of remaining radioactive waste is significantly reduced.

Figure 2: Dismantling the research reactor ASTRA and the spent fuel pool

Some radioactive waste will also be generated outside of the Seibersdorf site by, for example, the future decommissioning of the research reactor at the Atomic Institute of the Vienna University of Technology and the management of legacy waste sites.

CLASSIFICATION OF RADIOACTIVE WASTE

According to Article 2 (32) StrSchG, radioactive waste is "material containing or contaminated by radioactive substances for which no use is foreseen".

Since no nuclear power plants or other large nuclear facilities are operated in Austria, there is no high-level radioactive waste, but only low and intermediate level radioactive waste, produced in medicine, industry, research and decommissioning of radiation facilities.

THE CHARACTERIZATION AND CLASSIFICATION OF RADIOACTIVE WASTE IN NES

The characterisation and classification of the radioactive waste at NES is based on the recommendation of the EU Commission (*Commission Recommendation of 15 September 1999 on a classification system for solid radioactive waste 1999/669/EC, Euratom*):

LILW-SL:

Low and Intermediate Level Waste - Short Lived; Waste with radionuclides with half-life of less than about 30 years (such as Cs-137 or Sr-90) with a limited concentration of long-lived alpha radionuclides.

According to the recommendation of the EU Commission, the limiting concentration of long-lived radionuclides for the category LILW-SL is 4,000 Bq/g in an individual waste package and 400 Bq/g averaged over the entire waste volume.

LILW-LL:

Low and Intermediate Level Waste - Long Lived; Waste with a concentration of long-lived radionuclides exceeding the above limit values for LILW-SL.

Transition radioactive waste:

Waste containing radionuclides with half-lives <100 days; such waste is stored until the radioactivity has decayed and the waste can be disposed of as inactive conventional waste after clearance measurement and clearance by the authorities.

WASTE INVENTORY AT NES

In the Austrian interim storage facility at NES ("Transferlager"), the following inventory of conditioned radioactive waste is stored as of December 31, 2015:

LILW-SL: approx. 2,240 m³ with an activity of approx. $9.95 \cdot 10^{15}$ Bq

LILW-LL: approx. 60 m³ with an activity of approx. $4.57 \cdot 10^{12}$ Bq

The amount of LILW-LL is comparatively low. This waste comes largely from medical and research activities that took place decades ago and have since then been discontinued; it consist mainly of radioactive sources with radium-226. Some of these old sources are currently stored together with their casing in barrels. It can be assumed that this waste mix can be separated using modern waste treatment methods. The volume of long-lived waste would thus be significantly reduced.

A total of 11,200 drums (mainly 200 litre drums) and 10 special containers (type "Konrad" and "Mosaik®") are located in the interim storage facility.

Table 2 lists the radionuclides with the highest activities in the interim storage. By far the largest contribution to total activity is from the radionuclide tritium (H-3).

TABLE 2: RADIONUCLIDES WITH THE GREATEST CONTRIBUTION TO TOTAL ACTIVITY IN THE INTERIM STORAGE OF NES

Nuclide	Activity (Bq)
H-3	9.8E+15
Fe-55	5.2E+13
Ni-63	2.7E+13
Cs-137	1.2E+13
Co-60	6.5E+12
Am-241	3.8E+12
Ag-108m	2.7E+12
Kr-85	2.0E+12
Sr-90	1.5E+12

The special containers contain mainly waste from the decommissioning of the Seibersdorf research reactor ASTRA and the operation of the TRIGA research reactor at the Vienna University of Technology.

In the so-called “Konrad” container, a container type originally designed for use in the planned German repository Konrad, mainly larger, bulky parts have been placed.

The so-called “Mosaik®” containers are approved radioactive waste containers made of cast iron, which have a high shielding effect due to their large wall thickness. In these, wastes with high dose rate and/or high specific activity (e.g., strongly activated components from the ASTRA reactor, beryllium reflector elements with high tritium content from the ASTRA reactor) have been placed.

OTHER INVENTORY (OUTSIDE OF THE INTERIM STORAGE FACILITY)

On the NES site, radioactive waste, which must be conditioned in the future, is also located in the hot-cell laboratory, outside the interim storage facility. These are of two types: first, enclosed radioactive substances (radiation sources) currently stored in the hot cells for radiation protection and shielding purposes and, secondly, small amounts of fissionable material (nuclear material).

The fissionable materials are mainly residues from previous research projects (such as samples, measurement standards, chemicals, etc.), materials seized by the Republic of Austria (e.g., materials not declared according to transport regulations) and shielding containers made of depleted uranium.

ESTIMATION OF FUTURE WASTE

Estimation of the amount and type of future radioactive waste is, of course, subject to uncertainties, since future developments, new applications of radioactive substances or the replacement of existing applications cannot be conclusively foreseen.

As of today, it seems likely that the amount of waste from decontamination and dismantling activities will decrease significantly in the 2030s. The quantity of waste from medicine, industry and research will in any case decrease, because the general trend in many areas is to make the use of radioactive substances unnecessary by use of new methods and all users are implementing measures to respect the principle of waste minimization.

The following Table 3 provides an estimate of the amount of radioactive waste by 2045:

TABLE 3: ESTIMATED AMOUNTS OF CONDITIONED RADIOACTIVE WASTE BY 2045

Waste origin:	**Number of 200 litre drums**
Stock in interim storage 2015:	11,200
Reduction by reconditioning[1]:	-1,500
Waste from medicine, industry & research by 2045:	900
Decommissioning by 2045[2]:	7,000
Decommissioning TRIGA research reactor:	500
Total until 2045	**18,100**

[1] In the years 2012 - 2020, some of the waste already held in interim storage will be reconditioned so as to achieve a significant volume reduction.

[2] Largely dismantling of old installations at the Seibersdorf location

The amount of waste to be disposed of in Austria is estimated to be around **3,600 m^3 short-lived** (**LILW-SL**) and **max. 60 m^3 of long-lived waste** (**LILW-LL**).

In the period up to 2045, the activity inventory will not change significantly compared to the current level.

5 RADIOACTIVE WASTE MANAGEMENT

IN AUSTRIA, THE HANDLING OF RADIOACTIVE SUBSTANCES is subject to regulatory approval. Within the framework of the licensing procedure, the applicant for a license has to submit a waste management concept, which shows what is to happen to the radioactive waste resulting from the practice. The principle of waste minimization as well as volume reduction and reuse practices must be taken into account in the management concept. Pursuant to Article 75 (5) of the General Radiation Protection Ordinance, the waste management concept shall contain at least the following information:

- The type and maximum amount of radioactive waste, in particular indication of the nuclides generated, the expected activities and volumes per unit of time;
- The intended type of disposal;
- The procedure for a possible cessation or termination of working with radioactive materials.

Pursuant to Article 76 (1) and (2) of the General Radiation Protection Ordinance, radioactive waste must be segregated, collected and labelled by the waste producer according to the following categories:

- Liquid – combustible
- Liquid – not combustible
- Solid – combustible
- Solid – non-combustible
- Gaseous
- Biogenic waste
- Sealed radioactive sources, for which the waste criteria apply
- Bulky waste
- Composite waste
- Hazardous waste, in particular infectious material, pyrophoric material, explosive material, highly reactive material, substances which emit corrosive gases during storage or combustion, substances that release radionuclides into the gas phase during storage.

Radioactive waste shall be collected and labelled separately according to the following categories:

- Waste containing radionuclides with half-lives of less than 100 days;
- Waste containing radionuclides with half-lives of more than 100 days.

If alpha-emitting radionuclides arise as radioactive waste, they must be collected and stored separately and labelled accordingly by the waste producer.

DISPOSAL ROUTES

Depending on the activity and half-life of the radioactive substance, the following disposal methods are currently permissible:

DISCHARGE VIA AIR OR WATER PATHWAY

Radioactive substances may be discharged with the operating wastewater or the exhaust air from facilities licensed under radiation protection law. In this context, the amount of activity discharged must be limited such that the exposure of members of the public does not exceed an effective dose of 0.3 mSv per year due to these discharges (Article 74 AllgStrSchV).

CLEARANCE

Radioactive waste can be disposed of as inactive waste, recycled or reused when it can be demonstrated that the exposure of members of the public will not exceed 0.01 mSv per year. The clearance of radioactive substances is an administrative act, i.e. the holder of the licence must seek permission from the competent authority. If the application is accepted, the substances no longer fall under the radiation protection regime (Article 13a StrSchG in conjunction with Article 79 AllgStrSchV) and may be released.

DECAY STORAGE

Radioactive waste with a short half-life (e.g., from the nuclear medical field) must be stored at the premises of the waste producer or in an approved facility until the activity is below the legally specified clearance values and subsequently disposed of as conventional waste (Article 77 AllgStrSchV) .

RETURN OF RADIOACTIVE SUBSTANCES

The return of radioactive substances after their use to the manufacturer or supplier for their local re-use or disposal is a further possibility to minimize the amount of waste. This approach is, in any case, binding for owners of high-level radioactive sources. Before acquiring the source, they must conclude a take-back agreement with the manufacturer or supplier for the subsequent return of the source (Article 64 (6) AllgStrSchV). This is to avoid “a priori” the necessity of disposing of the spent/disused radiation source in Austria.

HANDOVER OF RADIOACTIVE WASTE TO NES

Radioactive waste, which cannot be disposed of by the above-mentioned routes, is finally to be handed over to Nuclear Engineering Seibersdorf GmbH (NES) in accordance with Article 78(1) AllgStrSchV.

WASTE VOLUME REDUCTION IN FOREIGN FACILITIES

The volume of certain types of radioactive waste can be effectively reduced by special methods: for contaminated metal scrap, the process of melt decontamination can be applied, for which installations exist in several European countries. The metal scrap is melted together with slag formers, the bulk of the contamination being enriched in the slag. The molten metal can be recycled as a raw material. The radioactive slag produced is radioactive waste, having no further use and is returned to Austria for disposal. Provisions for this are contained in the Ordinance on the Shipment of Radioactive Waste 2009 (RAbf-VV 2009), Federal Law Gazette II no. 47/2009.

TREATMENT AND INTERIM STORAGE AT NUCLEAR ENGINEERING SEIBERSDORF

Nuclear Engineering Seibersdorf GmbH (NES) has two main tasks, both carried out on behalf of the Republic of Austria:

- Treatment of all radioactive waste arising in Austria (from medicine, industry and research) from collection to sorting, processing, conditioning to interim storage; and
- Decommissioning and decontamination of installations, equipment and materials from 45 years of nuclear research & development activities at the Seibersdorf location.

Conditioning means the conversion of the waste into a chemically and physically stable form and placement into a container (normally 200 litre drum), so that it can be safely stored over longer periods of time and is suitable for the later final disposal. NES uses state-of-the-art methods to bring the radioactive waste into a stable and, above all, safe form, while also achieving the greatest possible volume reduction.

NES has an integrated management system (IMS), where regulations for quality management (QM) are integrated that also include environmental and health aspects as well as occupational health and safety. IMS is certified according to ISO 9001 (QM), ISO 14001 (environment protection) and OHSAS (ISO) 18001 (occupational health and safety). NES also operates an ISO 17025 accredited test centre.

Every NES employee, who is dedicated to work in radiation areas, receives basic radiation protection training as well as theoretical and practical workplace-related training. Even after the initial training, regular training is an essential point for all employees at NES.

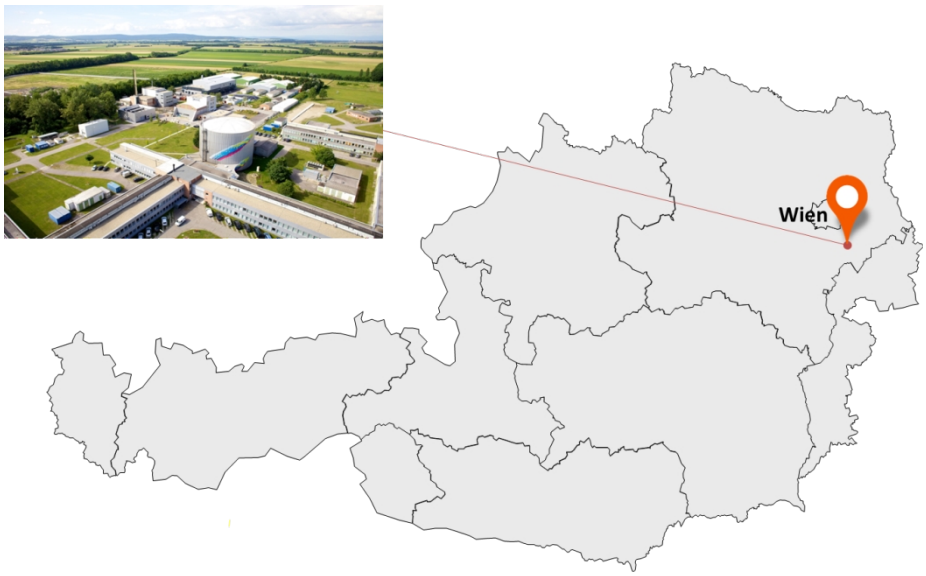

Figure 3: Operational site NES at the Seibersdorf location

The company premises of NES are located about 40 km southeast of Vienna on the site of the local research center. NES systems meet the highest technical standards. In the treatment and storage of radioactive waste, the main focus is on optimizing material flow, work safety and radiation protection as well as waste volume reduction. For treatment of bulky items, the NES “New Handling Centre” is available, in which state-of-the-art structural and house engineering measures minimize the risk of radioactive material release (for example, double door systems or a ventilation system that maintains a graded vacuum in all sections of the building).

WASTE TREATMENT

At NES, all efforts are being made to reduce the volume of radioactive waste (to be subsequently put into the final repository) as far as possible. All materials and objects are decontaminated as far as technically and economically possible and meaningful, in order to transfer them again into the conventional material circuit after official clearance and release or to dispose of them as inactive material (e.g., landfill).

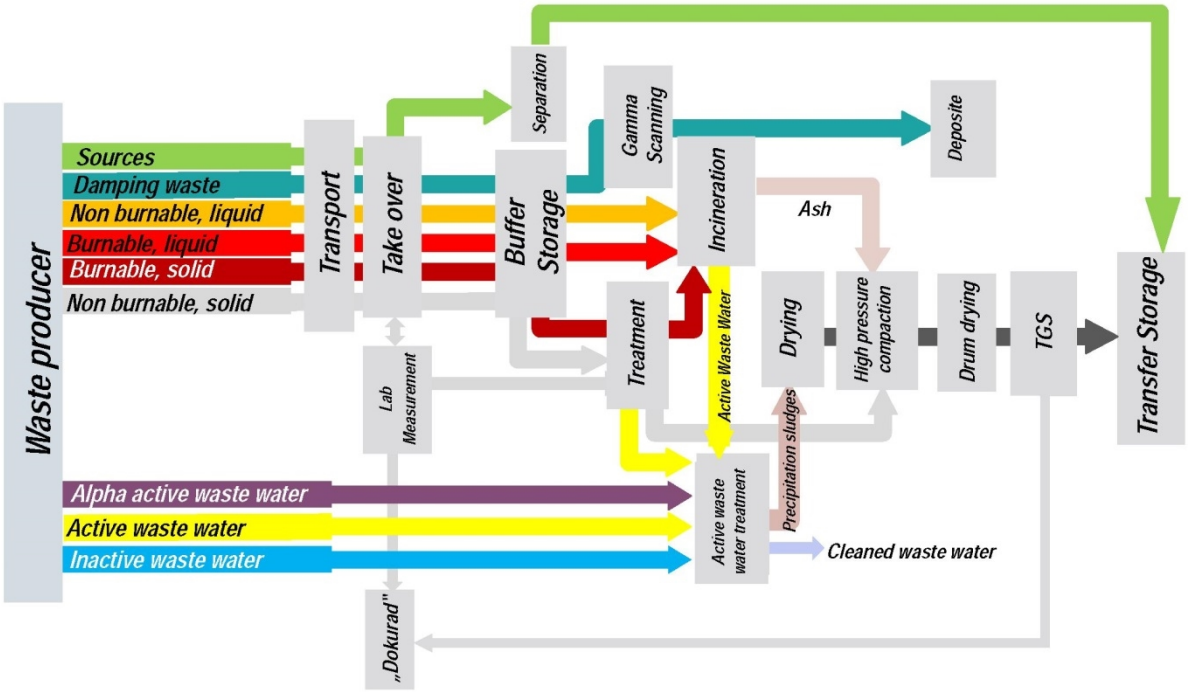

Figure 4: Material flow of radioactive waste treatment in NES

In the above Figure 4, the essential management steps are shown, which are executed according to the type of waste. The following phases can be distinguished:

- Takeover of the waste up to sorting;
- Conditioning;
- Drying to interim storage.

Takeover of the waste up to sorting

Takeover:

The transfer of the waste to the facilities at NES takes place in the takeover hall. There, the radioactive waste, which is usually delivered in 100 litre drums, is unloaded from the transport vehicle and initial characterization (e.g., control measurements on the containers, sampling of liquid waste) of the waste takes place.

Buffer storage:

From the takeover building, the waste is transferred to the buffer storage sheds, where it is stored - as far as possible homogenous - for further treatment.

Sorting:

The next process step is the sorting of the radioactive waste. Here the assignment to the respectively necessary subsequent processing steps takes place.

Waste conditioning

Larger, bulky waste such as, for example, contaminated equipment or building components, must be dismantled and reduced to smaller pieces for conditioning. In order to reduce the volume of waste, contaminated items and materials are, to the extent practicable, decontaminated so that they can be cleared for release for recycling or disposal. For this work at NES, two stainless steel containments are designated, in which the material can be dismantled, decontaminated and prepared for further conditioning by personnel wearing externally ventilated protective suits. The radioactive waste generated in these activities will be further treated by the methods listed below.

Depending on the category and type of the waste, the following process steps are possible.

Incineration:

In the incineration plant, all combustible solid and liquid radioactive waste is incinerated. The radioactive substances are concentrated in the ash, which is then further conditioned (usually welded in stainless steel cartridges placed into a 200 litre drum).

High pressure compaction:

Since volume reduction is one of the main objectives in the conditioning of radioactive waste, non-combustible, compactible waste is compacted within metal cartridges using the high-pressure compactor to form so-called pellets, which are introduced into 200 litre drums.

Cementing:

In cases where incinerating or compacting of the waste is not possible, cementing can be carried out to embed the material in a solid matrix. The radioactive waste is homogeneously distributed in the concrete and inserted into a 200 litre drum.

Source processing:

Disused sealed radioactive sources, which could not be returned to the manufacturer, are dismantled, documented, sorted according to nuclides and further processed and conditioned according to the radionuclide and its activity.

At the end of the conditioning process, the radioactive waste is in a stable form and enclosed in a container (usually a 200 litre drum).

Drying to interim

Drying:

As a rule, ready-conditioned waste drums are dried in the dryer before being transferred to the interim storage facility. As a result, the waste is also chemically stabilized.

Drum measuring system:

All ready-conditioned waste drums are characterized radiologically using the drum measuring system. The measured values provide important information for future steps in management.

Interim storage:

After the characterization of the drums, they are transferred to the NES air-conditioned interim storage. In order to ensure that the drums can be inspected and accessed at any time, the waste drums are stored horizontally on steel shelves (drum pallets).

Figure 5: Interim storage of the conditioned 200 litre drums

DOCUMENTATION OF CONDITIONED RADIOACTIVE WASTE

During the conditioning and interim storage of radioactive waste, a complete documentation of the waste and the respective processing steps is essential. The exact knowledge of the contents of the containers is necessary for the later treatment of the waste, for the future final disposal or any subsequent release (after decay of the radioactivity). Likewise, traceability of the conditioned waste back to the incoming raw waste should be strived for.

With the DOKURAD software, NES uses a database in which all necessary information on waste management is stored and documented.

Each incoming and temporary container, as well as every ready-conditioned waste container, has a unique number with which it is mapped in DOKURAD; this means that all information and data can be retrieved at any time in the system. It is therefore possible to reproduce the entire conditioning process from the incoming container up to the finished stored drum and also to trace the path of the waste from the finished drum back to the incoming container and the waste generator.

FINAL DISPOSAL

The entire radioactive waste inventory, which is currently stored at NES, will, finally, need to be disposed of. A decision on the location and type of the required disposal facility has not yet been made in Austria - as in many other countries around the world.

As experience in other countries shows, decisions about the final disposal of radioactive waste are not reached quickly.

In the view of comparatively low levels of waste (around 3,600 m³ of short-lived waste and a maximum of 60 m³ of long-lived waste) and the low risk potential (exclusively low and intermediate level radioactive waste), the current storage of radioactive waste in the interim storage facility at NES is a good starting point to find an optimal and accepted solution for the final disposal for Austria.

To achieve this goal, a decision-making process must be defined. 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. Accordingly, it is to be understood that a complex multi-stage process will be required. In Annex I of this programme, an example roadmap is presented. This is based on the procedures used by some other countries and is intended to be illustrative.

The aim of this roadmap 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 their own 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 used, which are suitable for different types of waste. The IAEA publication NW-G-1.1 “Policies and Strategies for Radioactive Waste Management” may be referenced here as an example. A brief analysis of possible disposal options for Austrian waste can be found in Annex II of this document. Since Austria does not have to dispose of highly radioactive waste or spent 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, even complying with 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. An international cooperation for the establishment of a common disposal facility for this waste in a European country may be a feasible alternative to final disposal in Austria. In the international community, regional or international cooperation is now 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.

In the event that part of this future solution should involve radioactive waste from Austria being disposed of in a repository in another country, clear provisions have been made for this in Directive 2011/70/Euratom: The facility must already have operating approval before transferring the waste and meet the same standards in accordance with the requirements of the directive that would also apply to a repository in Austria.

The internationally specified safety provisions for the safe transportation of radioactive waste must be observed. Compliance is required with the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention).

TASK FORCE "DISPOSAL"

The Austrian Federal Government is to set up a Task force "Disposal". This body will address the issues and tasks relating to final disposal in an efficient and transparent manner and make recommendations for further steps. The Task force will consist of ministerial representatives, representatives of the Federal provinces, experts in the subject matter and stakeholders. The Task force will be coordinated by the Federal Ministry of Sustainability and Tourism.

The Task force will develop proposals for the final disposal of short- and long-lived waste taking into account technical, economic and social aspects. It will do this through studies and workshops and also in cooperation with foreign institutions and experts. A concept for the comprehensive information and involvement of the public is to be created.

In particular, the Task force shall set up the following activities.

- Proposals for changes to the legal framework and the financial framework for the disposal of radioactive waste;
- Monitoring of the activities of other countries with a comparable waste inventory;
- Requirements for the participation and information of the public as well as for ensuring transparency;
- Initiation and monitoring of research and development activities, which should lead to an assessment of the feasibility of introducing new technologies and concepts, waste minimization, etc.;
- Development of a conceptual project for the waste disposal facility; but also for all other relevant elements, e.g. transport, processing, follow-up monitoring, etc.;
- Requirements to be placed upon the operator of a disposal facility;
- Safety and security requirements for the facility;
- Concept for decommission of unneeded facilities at NES
- Monitoring the implementation and updating of the National Radioactive Waste Management Programme.

The Task force "Disposal" will regularly report to the Federal Government on its activities and submit its recommendations for a decision. In order to ensure sufficient time for the construction and commissioning of the installation(s) for final disposal, the decision on the final disposal of the radioactive waste shall be taken no later than 10-15 years before the end of the interim storage contract.

6 RESEARCH AND DEVELOPMENT

TREATMENT OF RADIOACTIVE WASTE

TO ENSURE CONTINUOUS DEVELOPMENT and optimization of the management of radioactive waste, NES implements numerous projects dealing with safety, radiation protection or optimal reduction of the volume of radioactive waste. Therefore, despite not being a designated research entity in the strict sense, research and development are an important part of the duties and responsibilities of NES. Several examples of such projects conducted at NES are:

DEVELOPMENT OF AN ULTRAFILTRATION SYSTEM

In the past, the chemical precipitation process used for the wastewater treatment at the Seibersdorf site resulted in the production of radioactive contaminated sludge, which had to be removed with a filtration device. Because of the necessary addition of a filter aid, a considerable amount of radioactive secondary precipitation was produced in this process. As an alternative, NES has developed a process in which the radioactive contaminated wastewater is subjected to a two-stage filtration process by means of an ultrafiltration system (membrane filtration system), which does not require any filter aid.

Figure 6: Filtration unit of the ultrafiltration system

The operational experience has shown that with this system the use of chemicals for the precipitation could be drastically reduced, because in general no preparative chemical precipitation is necessary in the wastewater treatment. In this way, the amount of radioactive waste produced during the wastewater treatment could be reduced by a factor of 20.

DEVELOPMENT OF A SOIL MEASURING SYSTEM

In order to minimize the radioactive waste during the ongoing decommissioning and dismantling projects, NES is currently developing and constructing a soil measuring system which can be used to separate low contaminated rubble, soil material, etc. in radioactive waste and conventional waste. The system performs an automated activity measurement and separation of the (previously crushed) material, which optimally minimizes the amount of radioactive waste.

Figure 7: Soil measuring system (right material application, left measurement and separation)

FINAL DISPOSAL

A number of projects have already been carried out in relation to the disposal of radioactive waste. In addition, in the future, waste management will have to be continually developed and optimized in order to ensure maximum safety. An effective and extensive research and development activity, especially with respect to final disposal, is also needed. In this context, the results of previous studies in Austria as well as of the relevant international references (for example IAEA, NEA/OECD documents) should be taken into account in order to cover the basic questions already addressed by the international community. Participation in conferences and international working groups will also take place. Contributions from other organizations, such as universities and research institutes, as well as relevant foreign institutions are expected, as these institutions have in-depth knowledge in specific areas for the selection and planning of waste disposal facilities. In addition, the research and development activities will also include activities on geological, geotechnical, spatial planning and technical aspects, general safety analysis of the facilities, environmental research, radiation protection, as well as deterministic and probabilistic risk analyses.

7 TRANSPARENCY AND PUBLIC PARTICIPATION

TRANSPARENCY PLAYS A KEY ROLE in the management of spent fuel and radioactive waste. Therefore, the amendment of the Radiation Protection Act in 2015 explicitly enshrined public participation in the national law. All stakeholders concerned are to be given the opportunity to participate effectively in the decision-making process concerning the disposal of the radioactive waste.

PUBLIC INFORMATION

SUPERVISORY AUTHORITY

Public information on radioactive waste in Austria is provided on the homepage of the Federal Ministry of Sustainability and Tourism at www.strahlenschutz.gv.at. This provides information on radioactive waste, including: waste storage at NES, the Ordinance on the Shipment of Radioactive Waste 2009 and the latest national reports to the "Joint Convention on the Safety of Spent Fuel and on the Safety of Radioactive Waste Management", Federal Law Gazette no. 169/2001 which, as a contracting party, Austria must provide periodically.

NES

Pursuant to Article 79a AllgStrSchV, NES has to provide information to the public on the management activities carried out in its facilities. In this regard, information can be found at www.nes.at. On the website, among other things, information about the company's tasks, the organization as well as the products and services offered can be obtained. For radioactive waste generators, the website contains the document „*Übernahmebedingungen und Preisliste für die Verarbeitung, Konditionierung und Zwischenlagerung von radioaktiven Abfällen*" as well as all information necessary for storage at NES (order form, transport information, etc.).

Information according to the accident information regulation

Pursuant to the provisions of the Hazardous incident information ordinance (Störfallinformations-Verordnung), Federal Law Gazette no. 391/1994, the interim storage facility for radioactive waste is a facility with a reporting requirement. The information obligation in this respect is implemented by means of publication of a notice at the porter's lodge of the Seibersdorf site and the municipality offices of the surrounding municipalities. The information is also communicated to the competent authorities and must be. The hazardous incident information shall be revised and re-submitted in regular periods not exceeding five years.

Multifunctional information centre

The NES premises in accordance with the radiation protection regulations are a radiation area. Because access to this area is permitted to a limited extent only and only for a certain group of people and in compliance with elaborated formalities, the "Multifunctional Information Center" has been set up outside this secure area. Topics such as the handling of radioactive substances and waste, radiation protection, processing and conditioning processes, interim storage etc. can be brought to a broader range of interested parties (interested groups, stakeholders, decision-makers, emergency personnel, political bodies, international expert groups, etc.). The information centre has been equipped with exhibits from the history of radioactivity and measurement technology, but offers above all a suitable space, in which even larger groups of visitors can be informed by means of lectures, presentations, and information events or similar.

STRATEGIC ENVIRONMENTAL ASSESSMENT

Within the framework of the preparation of the National Radioactive Waste Management Programme and in the event of future major changes to this programme, a Strategic Environmental Assessment pursuant to Article 36b of the StrSchG has been and is being implemented under the appropriate application of Article 8a (4) to (7), in conjunction with Annex 7, Part 2 of the Waste Management Act 2002 (AWG 2002) Federal Law Gazette I no. 102/2002. The impact of the National Radioactive Waste Management Programme on the environment is assessed with the participation of the public. The neighbouring States may participate in cross-border consultations within the framework of the Strategic Environmental Assessment.

8 FINANCING

FINANCING OF WASTE MANAGEMENT

NUCLEAR ENGINEERING SEIBERSDORF GMBH (NES), which carries out the processing, conditioning and interim storage of radioactive waste, is commissioned by the Republic of Austria to deal with the radioactive waste generated in Austria in accordance with Article 36c (1) of the StrSchG. In June 2003, a contract was concluded between NES, the municipality of Seibersdorf and the BMLFUW, which regulates the tasks of NES and its financing.

FINANCING BY THE POLLUTER

The ongoing financing of the management of radioactive waste takes place according to the polluter pays principle. Holders of a licence according to the Radiation Protection Act, owners of radioactive waste from work with natural radiation sources, as well as authorities, who have seized radioactive sources or to whom orphan radioactive sources have been handed over, must, on the one hand, pay a processing fee for the processing and interim storage and, on the other hand, a precautionary fee ("Vorsorgeentgelt") pursuant to Article 36c (2) no. 2 of the StrSchG. The latter is to be used by the Republic of Austria as dedicated revenue exclusively to finance a subsequent final disposal of this waste.

NES has to check the cost estimates of the processing and precautionary fees annually in order to ensure the safe operation of the facility financially. The calculations are to be reported to the BMLFUW (Article 36c (2) no. 1 StrSchG).

FINANCING BY PUBLIC AUTHORITIES

Based on the provisions of the StrSchG in connection with the agreement between NES, the municipality of Seibersdorf and the BMLFUW, the Republic has to bear a significant financial burden for the management of radioactive waste. In concrete terms, the Federal Minister for Agriculture, Forestry, Environment and Water Management, in agreement with the Federal Minister of Finance, is obliged to pay the costs for the establishment and adaptation of treatment plants and storage facilities. In addition, the costs of post-conditioning and reconditioning for the old containers stored at NES are also to be covered.

A contract between NES and the Federal Ministry of Transport, Innovation and Technology exists for the facilities and radioactive substances, which have been left by Seibersdorf's nuclear research activity, according to which NES is responsible for the successive remediation of these contaminated sites and the federal government is responsible for the costs.

FINANCING OF FINAL DISPOSAL

PRECAUTIONARY FEE

The precautionary fee for final disposal to be paid by the polluters is to be transferred to the Federal Government and used exclusively for the later final disposal of the conditioned radioactive waste. The precautionary fee is determined according to current estimates of the costs of final disposal and the associated preparatory and transport costs.

FINANCING BY PUBLIC AUTHORITIES

Article 36c StrSchG lays down the legal basis for the commissioning of suitable institutions for the disposal of the radioactive waste generated in Austria and its financing. The Federal Minister for Sustainability and Tourism, in agreement with the Federal Minister of Finance, is authorized to conclude service contracts with a suitable institution, which has the appropriate expertise and the necessary technical and personnel equipment required for the state-of-the-art disposal of radioactive waste.

Since no final decision has yet been made on the future disposal option, a cost estimation of the disposal facility(ies) is very uncertain. The Republic of Austria has the ultimate responsibility for the final disposal of existing and future radioactive waste and undertakes to ensure the timely availability of sufficient financial resources for the final disposal of the entire inventory.

9 MILESTONES AND TIME HORIZON

Modernization of treatment facilities at NES

Comprehensive modernization of the facilities at NES has been ongoing since 2009. With this, the treatment and interim storage of radioactive waste is being brought to the state-of-the-art. This project will be completed around 2020.

New conditioning of waste packages

All older packages with conditioned waste stored at NES, whose contents have not been conditioned according to the current state-of-the-art, are subject to a new conditioning in the modernized facilities of NES. The use of new treatment methods, made possible by the modernization project, will result in a considerable reduction in the volume of waste. The project is to be completed by the year 2020.

Task force "Disposal"

The Federal Government is to set up a Task Force "Disposal" consisting of ministerial representatives, representatives of the Federal provinces, experts in the subject matter and stakeholders. This is expected to work in an efficient and transparent manner in accordance with the principles of Article 36b StrSchG to elaborate the National Radioactive Waste Management Programme.

Interim waste storage in NES

The treatment and interim storage of radioactive waste by NES is secured by a contract between the BMNT, NES and the municipality of Seibersdorf until 2045.

Update and review of the National Radioactive Waste Management Programme

As experience in other countries shows, a decision on the final disposal of radioactive waste will not be reached quickly. As part of the decision-making process, appropriate adjustments to the legal provisions will have to be made. Similarly, the National Radioactive Waste Management Programme must also be regularly updated, also in accordance with the provisions of Directive 2011/70/Euratom.

TABLE OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ABBREVIATION	FULL PHRASE
AllgStrSchV	General Radiation Protection Ordinance
BMNT	Federal Ministry of Sustainability and Tourism
DOKURAD	Waste documentation system of NES
IAEA	International Atomic Energy Agency
ISO	International Organization for Standardization
Bq	Becquerel (SI derived unit of radioactivity – nucleus decays per second)
NatStrV	Ordinance on Natural Radiation Sources
NEA/ OECD	Nuclear Energy Agency of the Organization for Economic Cooperation and Development
NES	Nuclear Engineering Seibersdorf GmbH
RAbf-VV 2009	Ordinance on the Shipment of Radioactive Waste
StrSchG	Radiation Protection Act
RAW	Radioactive Waste

ANNEX I

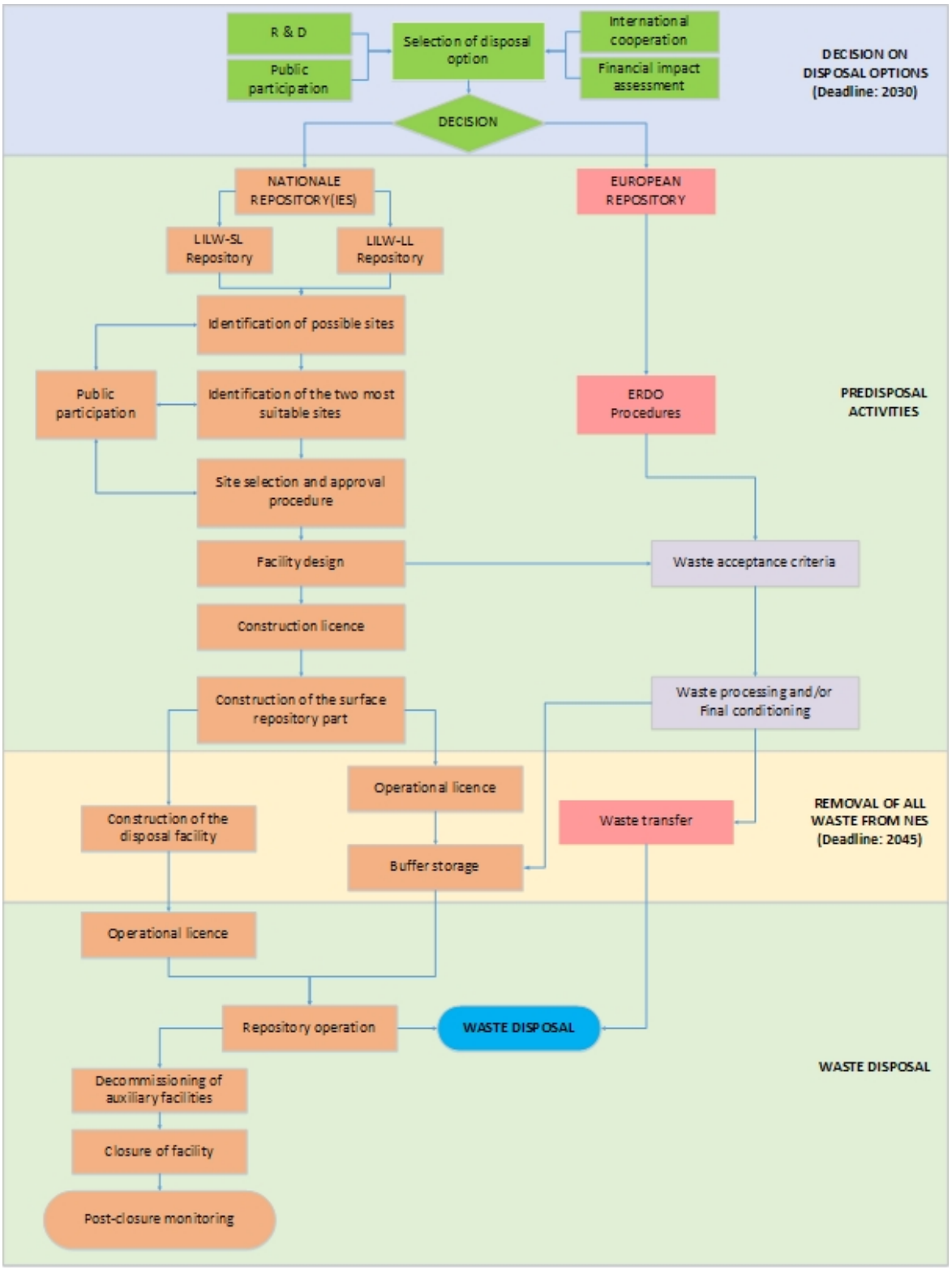

Figure 8: Illustration of the sequence of steps within the multi stage process for radioactive waste disposal in Austria

ANNEX II

The applicability of the possible technical solutions for the disposal of radioactive waste in a repository, as described in the IAEA publication NW-G-1.1 "Policies and Strategies for Radioactive Waste Management", was analysed taking into account the Austrian characteristics. The results of the analysis are shown in Table 4.

TABLE 4: SUMMARY OF POTENTIAL DISPOSAL OPTIONS FOR RADIOACTIVE WASTE IN AUSTRIA

RAW classes	Characteristic of waste	End point				
		Surface trench	Engineered near surface facility	Borehole facility	Intermediate depth facility	Geological repository
LILW-SL with very low activity/LILW-LL with very low activity		++	NR	NT	NR	NR
LILW-SL		+	++	NT	NR	NR
LILW-LL		N	N	+	++	++
Disused Sealed Radioactive Sources	Short-lived nuclides	+	++	NR	NR	NR
	Long-lived nuclides	N	NR	++	++	++
	High Activity Sources	N	N	++	++	++

Legend:

		N	not possible for safety reason
+	acceptable solution	NT	not possible for technical reason
++	preferable solution	NR	possible but not recommended for technical or economic reason

Disposal in a **trench-type repository** is basically equivalent to the disposal of conventional waste in a conventional landfill. The waste is disposed of in a trench and covered with soil. No additional safety surveillance or radiation monitoring is required. The trench type repository can be recommended from the safety and economy point of view for the disposal of waste with very low activity as well as for the disposal of disused sealed radioactive sources with very low activity. For the disposal of long-lived radioactive waste and disused sealed sources with long-lived radionuclides, this design is not suitable for safety reasons.

An **engineered near-surface facility** is a system of technically designed trenches or concrete vaults, into which the waste is placed. An engineered cap that minimizes the penetration of surface water is placed over the waste containers. The facility is built on the ground surface or up to several meters below the surface. The facility is subject to surveillance and radiation monitoring until the hazard associated with the waste declines to acceptable levels. A near-surface facility is suitable for the disposal of radioactive waste and disused sealed sources with short-lived radionuclides. The disposal of small quantities of sealed radioactive sources with long-lived radionuclides together with large quantities of short-lived radionuclides is possible

under certain safety conditions, but is generally not recommended. Disposal of waste with higher levels of long-lived radionuclides or of sealed sources with high activity is not recommended from the safety point of view for this type of facility.

A **borehole disposal facility** consists of one or more boreholes with a depth of several tens to a few hundred meters. Borehole facilities are suitable for the disposal of small volumes of long-lived waste, in particular, disused sealed sources (long-lived radionuclides and high activity sources). Disposal of disused sealed sources together with short-lived waste is not recommended for economic reasons.

An **intermediate depth disposal facility** consists of caves, vaults or silos, which are usually a few tens of meters to a few hundred meters below the surface. Such a facility can also be established by digging an adit into a mountain, where the smallest distance from the surface must be more than 100 m. A number of abandoned mines have already been converted into disposal facilities of this type worldwide. **Deep geological facilities** are built several hundred meters below the surface, usually in the form of tunnels, vaults or silos. In these two types of facilities, any kind of waste or disused sealed sources can be disposed of. However, since the construction of these facilities is costly, they are normally recommended for the disposal of large quantities of waste with long-lived radionuclides.

With reference to the radioactive waste disposal strategies recommended by the IAEA, the following provisional result can be obtained for Austria, taking into account the waste inventory by 2045.

For the disposal of the 3,600 m³ of **short-lived** conditioned radioactive waste stored in the interim storage facility by the year 2045 a near-surface facility would be preferable. Disposal of these wastes in an intermediate depth or deep geological facility is not recommended from an economic point of view. For the disposal of the 60 m³ (or even less) **long-lived** waste the establishment of an intermediate depth or a deep geological facility can also not be recommended since the investment costs of such installations can not be justified for the small amount of waste. Nor could the costs of a combined deep disposal of short-lived waste together with the small amounts of long-lived waste be justified by the higher level of safety, since for short-lived wastes this is very marginal and not necessary. Therefore, for the disposal of long-lived waste, a borehole facility is considered the preferred option. Alternatively, the long-lived waste could also be sent abroad for final disposal in compliance with the requirements of Directive 2011/70 /Euratom

BUNDESMINISTERIUM
FÜR **NACHHALTIGKEIT**
UND TOURISMUS

bmnt.gv.at