ENVIRONMENTAL REPORT

NATIONAL RADIOACTIVE WASTE MANAGEMENT PROGRAMME IN ACCORDANCE WITH 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 Wien
www.bmnt.gv.at

Text and editing: Ingrid Klaffl, Markus Leitner, Barbara Birli, Iris Buxbam, Robert Konecny, Andreas Scheidleder, Anton Huber (Environment Agency Austria)
Bildnachweis: ENCO (p. 33), Environment Agency Austria (p.24, 26) BMLFUW (p. 25, 29)

Vienna, 2018

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INTRODUCTION

THE RADIATION PROTECTION ACT and European specifications stipulate that the radioactive waste generated in Austria must be managed responsibly and safely. A "National Radioactive Waste Management Programme" to be created by the Federal government provides the basis for these regulations and describes all the waste management steps. The Federal Ministry for Sustainability and Tourism (BMNT) has a coordinating role in creating this programme.

In accordance with Art. 36b of the Radiation Protection Act, a Strategic Environmental Assessment with public participation according to the specifications of the European SEA Directive is to be performed for this National Radioactive Waste Management Programme.

The aim of the Strategic Environmental Assessment (SEA) is to incorporate environmental considerations when developing the National Radioactive Waste Management Programme and to identify significant impact on the environment at an early stage in order to prevent them.

1 NON-TECHNICAL SUMMARY

THIS SECTION includes the information that must be presented in accordance with ANNEX 1, lit. j) of the SEA Directive (Directive 2001/42/EC). The summary is focused on the core content of the environmental report.

Radioactive waste generated in Austria is limited to the low- and intermediate-level categories. The existing and future radioactive waste in Austria arises from two waste streams: waste from medicine, industry and research, and waste from decontamination and dismantling facilities (decommissioning). The amount of waste generated is low compared to that produced by countries which use nuclear power plants for energy production. As no nuclear power plants are operated in Austria, there is no generation of high level radioactive waste, or spent nuclear fuel for management or disposal within the country.

The collected and conditioned radioactive waste in Austria to date is located in interim storage at NES (Nuclear Engineering Seibersdorf), which currently contains about 11,200 waste containers (200-litre drums). At NES, radioactive waste is converted into a stable and safe form utilising state-of-the-art processing methods, which are also focussed on ensuring optimised volume reduction. Interim storage at NES is contractually secured until 2045.

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 repositories 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 view of the comparatively low amount 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 promote the process of decision making for the safe waste management, the Austrian Federal Government is going to set up a "Disposal" task force, which regularly reports to the federal government on its activities and presents results and suggestions for further decision-making.

According to the present state of the art, various types of facility can be used as repositories which are suitable for different types of waste. The applicability of possible types of facilities for the waste management of future and current radioactive waste generated in Austria in a repository was analysed in the National Radioactive Waste Management Programme[1], taking into account the special characteristics of Austria. The possible environmental impacts of these types of facilities are addressed in the Strategic Environmental Assessment.

Collaboration at a European or international level should be sought to prepare for future waste management. The possibility of cooperation is explicitly provided for in Art. 36b of the Radiation Protection Act. In the case of countries such as Austria, which do not use nuclear power for energy production and therefore have less infrastructure in this field and lack the financial resources of nuclear power plant operators, such cooperation can be of huge benefit. Collaboration therefore not only offers foreseeable financial advantages, it can also help to find the best possible safe solution more quickly.

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[1] See: BMNT (Federal Ministry for Sustainability and Toursim) (2018): Draft National Radioactive Waste Management Programme according to Art. 36b of the Radiation Protection Act, Annex II

1.1 ENVIRONMENTAL OBJECTIVES

The National Radioactive Waste Management Programme (NRWMP) outlines the implementation of a national strategy for a responsible and safe management of radioactive waste and, in particular, sets the following environmental objectives:

- The responsible and safe management of the radioactive waste generated in Austria
- To limit radioactive waste to the reasonably achievable minimum extent in terms of activity and volume
- To protect the life and health of humans including that of their offspring from harm caused by ionising radiation

Additionally, environmental objectives that are based on the protected goods and protected interests according to the SEA Directive were defined as part of a scoping process. The environmental objectives take into account national and international legislation. The protected goods considered in the SEA are soil and landscape, water, air, animals, plants, habitats, biodiversity and humans. The possible types of disposal facilities for radioactive waste will be assessed with regard to the above-specified protected goods.

For humans, the protection of their life and health including that of their offspring from harm caused by ionising radiation in conjunction with the NRWMP is an absolute focus and therefore the most important environmental objective. A meaningful indicator is exposure to radiation (incl. food chain).

A key environmental objective for the protected goods of soil and landscape is the qualitative and quantitative protection and conservation of a location-typical soil condition and conservation of landscape features. The proportion of areas that have lost their natural soil functions/soil consumption/land consumption was selected as meaningful indicator to illustrate the environmental status of the protected good soil.

A major environmental objective for the protected good water is the protection, conservation and improvement, where appropriate, of water quantity and quality to sustainably safeguard the water supply and water-dependent ecosystems. The quality of groundwater and surface water was selected as meaningful indicator to illustrate the environmental status of the protected good water.

A major environmental objective for the protected good air is the preservation of the statutory limits and targets to protect ecosystems, human health and vegetation. Air quality was selected as meaningful indicator to illustrate the environmental status of the protected good air.

A key environmental objective is the protection, preservation and re-establishment of native flora and fauna and their habitats. The meaningful indicator animal species as indicators of habitat quality was selected to illustrate the state of the environment of the protected good animals, plants, habitats and biodiversity.

1.2 SCOPE OF THE ASSESSMENT

Within the scope and taking into account statements from environmental bodies[2], the spatial, temporal and factual assessment framework was defined[3].

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[2] Authorities that may be affected in their environmental remit by the environmental impact caused by implementing the plan or programme
[3] BMLFUW (2017): Scope as part of the Strategic Environmental Assessment in accordance with Directive 2001/42/EC of the National Radioactive Waste Management Programme in accordance with Art. 36b of the Radiation Protection Act

The assessment framework of the Strategic Environmental Assessment (SEA) for this NRWMP is fundamentally defined by the national even if the development of future disposal should seek cooperation at European or international level. The defined period of the assessments for the environmental report is assumed to be until 2045 – based on the contractually secured interim storage of radioactive waste at NES. The factual system definition is determined by the likely significant environmental impact on relevant protected goods of the possible types of facility for the disposal of radioactive waste.

1.3 CURRENT ENVIRONMENTAL STATUS AND RELEVANT ENVIRONMENTAL PROBLEMS

For each of the relevant protected goods and based on available data, the current environmental status is shown by means of indicators[4]. It cannot be part of the remit of this environmental report to give an independent and complete overview of the environmental status of the whole country. We therefore refer to the findings of the Eleventh State of the Environment Report (ENVIRONMENT AGENCY AUSTRIA, 2016). These are summarised in the following for the respective protected goods.

1.3.1 SOIL AND LANDSCAPE

Soil as a production factor is the basis for producing food and feed as well as biomass. Furthermore, it is an important carbon and water store. Due to biogeographic and topographic factors, arable soil in Austria is a scarce resource. By increasing the amount of land used for housing and transportation, arable land in particular used for agriculture will be continually reduced. Land consumption in Austria at an average of 14.7 ha/day between 2014 and 2016 is lower than in previous years.

1.3.2 WATER

There has been a decrease in nitrate levels in groundwater since 1997. Throughout Austria the chemical status of the ground water can be described as good, the exception being a few regional problems from nitrate and pesticide entry (ENVIRONMENT AGENCY AUSTRIA, 2016).

1.3.3 AIR

In recent decades, the air quality has improved as a result of measures taken in Austria and Europe. The primary concerns in terms of health are fine particulates (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2) and ozone (O_3). PM_{10} pollution in Austria shows a decreasing trend in general, however this varies greatly from year to year. The development of PM_{10} pollution over time is not only determined by Austrian PM_{10} emissions (ENVIRONMENT AGENCY AUSTRIA, 2017b) and the (likewise decreasing) emissions of the precursors of secondary particles (esp. SO_2, NO_x, NH_3), it is also determined by meteorological conditions and the emissions of neighbouring countries.

1.3.4 ANIMALS, PLANTS, HABITATS, BIODIVERSITY

As a result of its climatic and biogeographic conditions, Austria is home to a rich biodiversity and compared with other central European countries, it is one of the most species-rich countries. The assessment of the level of danger to animal and plant species in the Red Lists reveals that about a third of the assessed animal species is considered to be endangered. Assessment in accordance with the EU nature conservation directive deems 16 % of species and 14 % of habitats to be in a favourable conservation status. The conservation status is better in alpine regions than in continental regions (ENVIRONMENT AGENCY AUSTRIA, 2016).

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[4] See table 4 in Section 6

1.3.5 HUMANS

In addition to the natural radiation exposure of humans/public, radiation is also caused by man-made radioactive substances reaching the environment, for example by the atmospheric atomic bomb tests in the 1950s/60s and the Chernobyl reactor accident in 1986. The Chernobyl reactor accident in 1986 caused a significant increase in the local gamma dose rate, which could be identified along with the subsequent decline in levels. From 1990, the local gamma dose rate had returned to the same range as before the reactor accident (BMLFUW, 2016). The core meltdowns in the Fukushima nuclear reactors in 2011 have contributed virtually nothing to the exposure to radiation in Austria as a result of the great distance between Austria and the country of accident.

1.4 ASSESSMENT OF ALTERNATIVES: TYPES OF FACILITIES AND THEORETICAL ZERO ALTERNATIVES

The NRWMP presents the possible types of facilites for the final disposal of Austrian radioactive waste according to the current state of the art. The application of possible disposal facility types was analysed taking into account the special features of Austrian radioactive waste and referencing the IAEA publication NW-G-1.1 *"Policies and Strategies for Radioactive Waste Management"*[5] . This NRWMP does not contain any information on future individual or multiple sites for the final disposal of Austrian radioactive waste.

Therefore, a comparison of different site alternatives is not included in this environmental report. A specific site search should be supported by a Strategic Environmental Assessment and transparent public participation. The environmentally relevant advantages and disadvantages should be clearly taken into account comprehensibly when making the decision for one or more sites.

It is possible that further treatment or waste management options (types of facility) may be available in the future. For this reason, the decision-making process also will include a scientific analysis of the treatment and waste management methods, including the results of international research and development activities.

1.4.1 TYPES OF FACILITIES

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.

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.

From today's view, the amount of waste to be managed in 2045 is estimated to be approx. 3,600 m^3 short-lived (LILW-SL) and a maximum of 60 m^3 long-lived waste (LILW-LL).

[5] BMNT (Federal Ministry for Sustainability and Tourism) (2018): Draft National Radioactive Waste Management Programme according to Art. 36b of the Radiation Protection Act, Annex II

The characterisation and classification of radioactive waste at NES is based on the recommendation of the EU Commission.[6]

- **LILW-SL**: Low and Intermediate Level Waste - Short Lived; low- and intermediate-level waste with radionuclides with half lives of approx. 30 years maximum;
- **LILW-LL**: Low and Intermediate Level Waste - Long Lived; low- and intermediate-level waste that contains long-lived radionuclides

In the interim storage facility at NES (transfer storage), the following inventory of conditioned radioactive waste is stored as of December 31, 2016:

- LILW-SL: approx. 2,240 m^3 with an activity of approx. $9.95 \cdot 10^{15}$ Bq
- LILW-LL: approx. 60 m^3 with an activity of approx. $4.57 \cdot 10^{12}$ Bq

According to the present state of the art, various types of repositories are used, which are suitable for different types of waste.

Disposal in a **trench-type repository** is comparable in principle to the disposal of conventional waste in a conventional landfill site. The waste is disposed of in a trench and covered with soil. No additional safety surveillance or radiation monitoring is required due to the low level of radioactivity.

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 metres below the surface. It is subject to surveillance and radiation monitoring until the waste has lost its hazardous potential.

A **borehole disposal facility** consists of one or more boreholes with a depth of several tens to a few hundred metres. Borehole facilities are suitable for disposing of low volumes of long-lived waste.

An **intermediate depth disposal facility** consists of caves, vaults or silos, which are usually a few tens of metres to a few hundred metres 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.

Deep geological repositories are set up several hundreds of metres below the surface, generally in the form of tunnels, vaults or silos.

According to the current state of the art, the following disposal facilities are under discussion for the final disposal of Austrian radioactive waste in the NRWMP[7].

Table 1 summarises an analysis of the applicability of possible types of facility for the waste categories of radioactive waste generated in Austria based on the IAEA publication NW-G-1.1 *"Policies and Strategies for Radioactive Waste Management"*.

[6] Commission Recommendation of 15 September 1999 on a classification system for solid radioactive waste 1999/669/EC, Euratom
[7] See: BMNT (Federal Ministry for Sustainability and Tourism) (2018): Draft National Radioactive Waste Management Programme according to Art. 36b of the Radiation Protection Act, Annex II

TABLE 1: SUMMARY OF THE POSSIBLE TYPES OF FACILITIES FOR AUSTRIAN RADIOACTIVE WASTE

Type of waste	Characteristic of waste	End point				
		Trench type	Engineered near-surface facility	Borehole facility	Intermediate depth facility	Deep 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	+	++	++
Used sealed radioactive sources	Short-lived nuclides	+	++	NR	NR	NR
	Long-lived nuclides	N	NR	++	++	++
	High activity radiation sources	N	N	++	++	++

Key:

		N	not possible for safety reasons
+	acceptable solution	NT	not possible for technical reasons
++	preferred solution	NR	possible but not recommended for technical or economic reasons

1.4.2 THEORETICAL ZERO ALTERNATIVES

As a result of the specifications of the Radiation Protection Act it is legally impossible to not implement the NRWMP. A zero alternative can therefore only present a theoretical frame of reference to evaluate the environmental impact of the considered alternatives. A theoretical zero alternative is assumed to be an indefinite storage of radioactive waste (beyond 2045) at Nuclear Engineering Seibersdorf, without further modernisation to the facilities or further treatment of the stored waste.

The current interim storage at NES conforms to the latest safety requirements and has a quality management system that also integrates environmental and health protection aspects. However, from an environmental perspective, this (theoretical) zero alternative would be the worst option. Both the buildings and facilities of NES and the waste drums used at present are not designed for indefinite storage and for this reason could cause a local negative impact at a later date on the protected goods of water and air. There is also a continuous comparatively higher risk of an incident or additional radiation exposure to humans as a result of the ageing of parts of the facility or waste drums than for a repository. However, no impact on the soil or landscape (land consumption) or on animals, plants, habitats or biodiversity is expected.

1.5 DESCRIPTION AND EVALUATION OF THE LIKELY SIGNIFICANT ENVIRONMENTAL IMPACT OF THE TYPES OF FACILITIES

A detailed assessment of the impact on the SEA-protected goods primarily depends on the site selection and the size of the facility. The various possible environmental impacts naturally depend on the type of facility and also the location of the final repository/repositories. As the NRWMP does not include any sites, only the likely significant environmental impact of the possible types of facility can be assessed in the construction and operating phase until closure, and impacts that are associated with transporting the radioactive waste from the interim storage site to the repository.

The period following closure is no part of the assessment in this environmental report. In principle, an environmental monitoring programme is provided after closing a facility. Depending on the type of facility, relevant safety and radiation monitoring and monitoring of the environmental impact shall be provided. The monitoring programme must comply with international standards (IAEA 2014b). In any case specific parameters must be monitored that demonstrate the status of the protected goods (e.g. groundwater, hydrology, geology, seismology, air, soil). The specifications of the IAEA Safety Standards provide guidance (see Table I-1, p. 51ff)[8].

In the event of a key future amendment to the waste management programme (for example for a site search), a supporting Strategic Environmental Assessment shall always be conducted. If the site/sites and type of facility are certain, it shall in any event be ensured as part of an environmental impact assessment (EIA) that there is no significant environmental impact for setting up and operating this type of facility.

An assessment of the possible positive or negative impact of the implementation of the NRWMP on the affected protected goods is conducted gradually based on

- an illustration and assessment of the current environmental status,
- its likely development if the programme is theoretically not implemented (indefinite interim storage at NES) and based on this,
- the assessment of the environmental consequences of SEA-relevant types of disposal facilities

1.5.1 CONSTRUCTION PHASE

Setting up waste management facilities involves a primarily local and temporary impact caused by construction work on site and the construction site traffic on access roads in the vicinity of the facility. Local noise and dust pollution needs to be considered as well as vibrations caused by construction work and conventional waste and residue (incl. excavation material). Depending on the site and type of facility (especially for borehole facilities, intermediate depth facilities and deep geological facilities), a possible impact on deep rock strata, tectonics and groundwater aquifers cannot be excluded. Depending on the design of the facility (construction directly at the surface or several hundred metres below the surface) and duration of the construction phase, it is not possible to exclude any impact as a result of land consumption during construction and operation on animals, plants and their habitats, on biodiversity and change in the landscape. Neither is it possible to exclude any impact as a result of accidents involving construction machinery and vehicles on the groundwater or entry into receiving water. Depending on the depth of the facility, groundwater could be adversely affected by excavation work. These impacts are comparable to other construction sites of the same scale and have only very local impacts.

1.5.2 OPERATING PHASE AND CLOSING

During the operating phase the facility is filled with radioactive waste. The facilities must conform to the highest safety requirements to prevent radioactive substances escaping into the biosphere. The duration of the operating phase depends on the quantity of radioactive waste introduced. It is not possible to exclude any

[8] IAEA: Safety Standards – Monitoring an Surveillance of Radioactive Waste Disposal Facilities Link

local impact on deep rock strata, tectonics and groundwater aquifers during the operating phase of deep facilities.

Despite the most rigorous safety precautions it is not possible to entirely exclude accidents when dealing with radioactive waste during the operating phase. Based on the assumption made in the Austrian National Radiation Emergency Plan[9] for NES, the worst-case accident scenario for all the types of facilities would be a major passenger aircraft crash with subsequent kerosene fire. If you compare the worst-case scenarios for the various facilities with that for NES, you can assume a lower radiological impact and exposure on a smaller scale for all cases, as each scenario relates to a lower quantity of radioactive waste than in the NES storage.

Once the facility is completely filled it is closed and the surface is sealed. For intermediate depth facilities, borehole facilities or deep geological facilities, no subsequent effects on the surface can be identified and therefore there should not be any or very little permanent land consumption (receiving warehouse or office building). For facilities at or near the surface it is assumed that the surface will be recultivated. The operation of near-surface facilities necessitates long-term local land consumption, sealing and changes to the terrain. It is not possible to exclude any local impact on animals, plants, habitats, biodiversity and groundwater and changes to the landscape.

1.5.3 TRANSPORT

The local noise and dust pollution caused by transporting the radioactive waste from the Seibersdorf site needs to be considered. In the event of a transport incident, only minor radiological impact and small-scale pollution in the vicinity of the accident site can be assumed as this only relates to a small quantity of radioactive waste.

1.6 MEASURES AND MONITORING

The prevention and minimisation of radioactive waste is considered a basic principle when dealing with radioactive substances and the management of radioactive waste. Radioactive waste must be isolated from humans and the environment also in the long-term (safe disposal). In this respect, aspects of passive safety must also be taken into account for the long-term. The safety measures for a facility or an activity related to radioactive waste management are determined in a graded approach according to the risk.

Monitoring- measures

A possible impact of the programme on the environment should be monitored to detect unforeseeable negative effects at an early stage and to be able to take suitable corrective measures. Existing monitoring mechanisms are used if appropriate.

Environmental monitoring programme

Monitoring must comply with international standards (IAEA, 2014b) and fundamentally depends on the hazard potential of the radioactive waste in conjunction with the type of repository over time. Besides this, in any case specific parameters must be monitored that demonstrate the condition of the protected goods (e.g. groundwater, hydrology, geology, seismology, air, soil).

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[9] Austrian National Radiation Emergency Plan -Link

Soil and Landscape

Land consumption or soil sealing in Austria will be recorded by the Federal Office of Metrology and Surveying from the regional information of the land-register database and will be processed and published by the Environment Agency Austria.

Water

Programmes to monitor the condition of water bodies are specified by the Federal Water Act (WRG) 1969 as amended and implemented nationally according to common standards based on the Water Condition Monitoring Regulation (GZÜV) Federal Law Gazette 479/2006. A concept for long-term water monitoring (especially groundwater) should be created for the repository site(s).

Air

The protected good air is monitored on an on-going basis as part of the implementation of the Immission Control Act - Air (IG-L)[10] and the Ozone Act[11] or the regulation on measurement concepts[12] for the IG-L and the Ozone Act[13] and the air pollutants specified in the Ozone Act.

Animals, plants, habitats and biodiversity

In accordance with the Habitats Directive[14], every six years a report is submitted to the European Commission with information on the conservation measures and conservation status of the habitats of Annex I and of the species of Annex II as well as the key monitoring results. In accordance with the Birds Directive[15], a report is submitted to the European Commission every six years on the defined conservation measures and the assessment of the current status and the calculated trend of the protected goods.

Humans

In Austria, there is a nationwide automatic radiation early warning system of currently more than 300 local dose rate measuring points and 10 air monitors to record the activity concentration in ground-level air. The measurements of the radiation early warning system are available online in the alarm centres of the BMNT, of the Federal Ministry of the Interior (BMI) and of the federal states. Approximately 100 local dose rate measuring points are available online to the public as a representative cross-section.[16]

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[10] Immission Control Act - Air (IG-L; Federal Law Gazette I 115/1997 as amended): Austrian Federal Law for the protection against immissions caused by air pollutants, which amends the 1994 Trade Act, the Clean Air Act for Boilers, the 1975 Mining Act, the Waste Management Act and the Ozone Act.

[11] Ozone Act (Federal Law Gazette No. 210/92 as amended): Austrian Federal Law on measures to safeguard against ozone pollution and public information about high ozone pollution, which amends the Smog Alert Act, Federal Law Gazette No. 38/1989, (Federal Law Gazette I No. 34/2003).

[12] Air quality measurement concept for the Immission Control Act 2012 (IG-L-MKV 2012; Federal Law Gazette II 127/2012): Regulation of the Federal Ministry for Agriculture, Forestry, Environment and Water Management on air quality measurement concept for the Immission Control Act – Air (IGL-L-MKV 2012)

[13] Ozone measurement concept regulation (Ozon-Messkonzept-VO; Federal Law Gazette II No. 99/2004): Ozone measurement concept regulation of the Federal Ministry for Agriculture, Forestry, Environment and Water Management

[14] Habitats Directive: Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

[15] Birds Directive (2009/147/EC): Directive of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds

[16] http://sfws.lfrz.at/

2 DESCRIPTION OF THE CONTENTS AND OBJECTIVES

THIS SECTION COVERS the information that needs to be submitted in accordance with ANNEX 1, lit. a) and e) of the SEA Directive (2001/42/EC) and presents the contents, aims and environmental objectives of the National Radioactive Waste Management Programme (NRWMP), the significance and consideration of international and national environmental objectives as well as links to other relevant plans and programmes.

2.1 CONTENTS

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 future steps including possible disposal options, taking into account the envisaged waste inventory.

Radioactive waste generated in Austria is limited to the low- and intermediate-level categories. There are two streams of waste: waste from medicine, industry and research, and waste from decontaminating and dismantling facilities (decommissioning). As there are no operational nuclear power plants in Austria, no high-level radioactive waste or spent nuclear fuel is produced for management or disposal. The amount of waste generated is low when compared to that produced by countries using nuclear power plants for energy.

The collected and conditioned radioactive waste in Austria is located in interim storage at NES (Nuclear Engineering Seibersdorf), which currently contains about 11,200 waste containers (200-litre drums). At NES, radioactive waste is converted into a stable and safe form utilising state-of-the-art methods, which are also focussed on ensuring optimised volume reduction.

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 will submit recommendations for future steps.

The Task force will develop proposals for the final disposal of short- and long-lived waste taking into different 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[17].

When developing proposals for the disposal of Austrian radioactive waste, a scientific analysis of the treatment and waste management methods, including the results of international research and development activities must be carried out. Research and development results must be taken into account accordingly.

As experience in other countries shows, decisions on the final disposal of radioactive waste will not be reached quickly and are the result of a long-lasting process.

In a first step, possible types of facilities for the disposal of radioactive waste, generated in Austria, in a repository are presented in the NRWMP. The applicability of possible types of facilities was analysed taking

[17] BMNT (2018): Draft National Radioactive Waste Management Programme according to Art. 36b of the Radiation Protection Act , p. 24

into account the Austrian characteristics and referring to IAEA publication NW-G-1.1 "*Policies and Strategies for Radioactive Waste Management*"[18].

WASTE INVENTORY AND PREDICTION OF FUTURE QUANTITIES UNTIL 2045

In the Austrian interim storage facility at NES (transfer storage), the following inventory of conditioned radioactive waste is stored as of December 31, 2016:

- LILW-SL: approx. 2,240 m^3 with an activity of approx. 9.95·1015 Bq

- LILW-LL: approx. 60 m^3 with an activity of approx. 4.57·1012 Bq

The characterisation and classification of radioactive waste at NES is based on the recommendation of the EU Commission. [19]

- **LILW-SL:** Low and Intermediate Level Waste - Short Lived; low and intermediate-level waste with radionuclides with a 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 container and 400 Bq/g averaged over the entire waste volume.

- **LILW-LL:** Low and Intermediate Level Waste - Long Lived; low and intermediate-level waste with a concentration of long-lived radionuclides exceeding the above mentioned limit values for LILW-SL.

The amount of waste to be disposed of in Austria in 2045 is estimated to be around 3,600 m^3 short-lived (LILW-SL) and max. 60 m^3 long-lived waste (LILW-LL). In the period up to 2045, the activity inventory will not change significantly compared to the current level.

2.2 OBJECTIVES

The National Radioactive Waste Management Programme was primarily developed taking into account the following principles and objectives (Art. 36b (1-4) Radiation Protection Act):

- The Republic of Austria shall bear the ultimate responsibility for the safe management of radioactive waste arising in its territory.

- Considering conditioning and final disposal of radioactive waste, 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.

- There is no generation of high-level radioactive waste, or spent nuclear fuel for management or disposal in Austria.

- The generation of radioactive waste is limited to the reasonably achievable minimum extent in terms of activity and volume.

[18] BMNT (Federal Ministry for Sustainability and Tourism) (2018): Draft National Radioactive Waste Management Programme according to Art. 36b of the Radiation Protection Act, Annex II
[19] Commission Recommendation of 15 September 1999 on a classification system for solid radioactive waste 1999/669/EC, Euratom

- Interdependencies between the individual steps taken during the generation and management of radioactive waste must be considered.
- Radioactive waste is managed safely; aspects of passive safety must also be taken into account for the long term.
- Measures should be taken in a graded approach according to the level of risk.
- A fact-based and documented decision-making process is applied to all radioactive waste management steps.
- The cost of disposing of radioactive waste will be borne by those who have generated it (polluter pays principle). The cost of setting up the disposal facilities is borne by the Republic of Austria.

ENVIRONMENTAL OBJECTIVES

The National Radioactive Waste Management Programme aims to implement the following environmental objectives:

- The responsible and safe management of the radioactive waste generated in Austria
- To limit radioactive waste to the reasonably achievable minimum extent in terms of activity and volume
- To protect the life and health of humans including that of their offspring from harm caused by ionising radiation

In addition, environmental objectives resulting from the protected goods and protected interests of the SEA Directive are defined. These derived environmental objectives are part of the assessment method and take into account national and international requirements (see Table 2).

TABLE 2: PROTECTED GOODS AND ENVIRONMENTAL GOALS ASSIGNED FROM NATIONAL AND INTERNATIONAL PROVISIONS

Protected goods	National/international requirements	Derived environmental objectives
Soil and lands-cape	International: Alpine Convention[20] EU: 7th Environmental Action Programme 2013 National: Soil protection legislation of the federal states	Qualitative and quantitative protection and conservation of a location-typical soil condition and conservation of landscape features
Water	International: Ramsar Convention, 7th Environmental Action Programme 2013 EU: Water Framework Directive (WFD), Groundwater Directive (GWD), Drinking Water Directive (DWD) National: Austrian Water Act (WRG) 1959 as amended, Drinking Water Directive	Protection, conservation and improvement where possible of water quantity and quality to sustainably safeguard the water supply and water-dependent ecosystems
Air	EU: Air Quality Directive, 7th Environmental Action Programme 2013 National: Immission Control Act – Air (IG-L), Austrian Air Emissions Ceiling Act (EG-L)	Preservation of the statutory limits and targets to protect ecosystems, human health and vegetation
Animals, plants, habitats, biodiversity	International: UN Convention on Biodiversity, Alpine Convention, Bern Convention, ICRP (International Commission on Radiological Protection) recommendations EU: Habitats Directive (92/43/EEC), Birds Directive, 7th Environmental Action Programme 2013 National: Austrian Federal Nature Conservation Acts	Protection, preservation and re-establishment of native flora and fauna and their habitats
Humans	EU: Directive 2001/70/Euratom, 7ths Environmental Action Programme 2013, Directive 2013/59/Euratom National: Austrian Radiation Protection Act, Decree on Shipments of Radioactive Waste, General Radiation Protection Ordinance, Food Safety and Consumer Protection Act	To protect the life and health of humans including that of their offspring from harm caused by ionising radiation

2.3 LINKS TO OTHER PLANS AND PROGRAMMES

The content of the National Radioactive Waste Management Programme is related to other existing plans and programmes, particularly the following plans:

Austrian National Radiation Emergency Plan[21]

The Austrian National Radiation Emergency Plan forms the working basis for managing emergencies at a national level in the event of a radiation emergency situation occurring in Austria.

[20] Protocols that are relevant to the SEA: "Nature protection and landscape conservation" and "soil conservation"

[21] Link: Austrian National Radiation Emergency Plan, Link

Radiological emergency management

- International agreements and automatic alert systems for rapidly alerting the responsible authorities and warning the population
- Radiation warning systems that make predictions on the possible impact of radiological emergencies and permanently monitor the environment for radioactive contamination
- Information for the population on recommended actions and protection measures in the event of radiological emergencies
- Plans for lab-based monitoring of the environment for radioactive contamination such as the Austrian-wide sampling plan
- Emergency plans at a national and regional level that include the specific schedules to implement the planned protective measures in critical cases
- Emergency exercises to test emergency plans and reveal opportunities for optimisation
- Legal foundations for efficient planning, preparation and implementation of measures to protect the population such as the Radiation Protection Act and especially the Ordinance on Intervention

Austrian National Radiation Emergency Plan – Accidents in Austrian Facilities

The Austrian National Radiation Emergency Plan presents scenarios of accidents in Austrian facilities amongst other things[22]. There are scenarios and safety analyses for the NES site for potential incidents and corresponding plans of measures. Based on the inventory of low- and intermediate-level radioactive waste, NES is classified as a risk category III facility[23]. Investigations of the Global Research for Safety (Gesellschaft für Anlagen- und Reaktorsicherheit) into the potential radiological effects of a major passenger aircraft with a full tank of fuel crashing into the existing warehouses for the interim storage of radioactive waste and subsequent kerosene fire as the worst-possible incident gave the following results:

Even making extremely conservative assumptions, a possible risk to the population (expected dose greater than 1 mSv) would only be in the immediate vicinity of the plant (maximum range 500 m). The closest residential area is more than 1 km away from the interim storage site (BMLFUW, 2014).

To date, internal operational incidents when treating and conditioning the radioactive waste have not caused any radioactive substances to escape into the biosphere. However, possible repercussions of increased radiation exposure in the course of treating and conditioning radioactive waste, cannot be entirely excluded for NES personnel. For this reason, relevant emergency plans and measures to be taken in the event of an incident have been prepared and are regularly exercised[24].

Further links on radiological emergency management published on the website of the BMNT:

- Radiological emergencies Link
- Protective measures Link

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[22] Austrian National Radiation Emergency Plan, Link
[23] IAEA – Safety Standards. GSR Part 7: Prepardness and response for a nuclear or radiological emergency.
[24] Gem. AllgStrSchV BGBl. II Nr. 191/2006 idgF., §79d

– Official precautions Link

The following conventions/agreements are also particularly relevant:

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management[25]

The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management is an international agreement that was concluded by member states of the International Atomic Energy Agency (IAEA) in 2001 and also signed by Austria. The aim is to create longer term standardised, internationally recognised safety standards for the management of radioactive waste and spent fuel.

Austrian bilateral cooperation agreements with neighbouring countries[26]

Agreements on an exchange of information and experience in the field of radiation protection and nuclear safety have been made between the Republic of Austria and its neighbouring countries of Germany, Switzerland, Slovak Republic, Slovenia, Czech Republic and Hungary.

[25] Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management Link
[26] Austrian bilateral cooperation agreements with neighbouring countries Link

3 ASSESSMENT FRAMEWORK

THE ASSESSMENT FRAMEWORK (spatial, temporal and factual system definition) has been defined as the first step of the Strategic Environmental Assessment for the NRWMP as part of the scoping process.[27] Nevertheless, the environmental report will briefly address or substantiate the assessment framework.

SPATIAL SYSTEM DEFINITION

The assessment framework of the Strategic Environmental Assessment for the present National Radioactive Waste Management Programme is defined by the country borders. In this environmental report, the description of the current environmental status and the impacts therefore refers in principle to Austria, even if the development of future disposal should seek cooperation at European or international level. The option of final disposal abroad could also be checked in future (see also section 6.3).

Possible transboundary impacts or impacts abroad are included as part of the transboundary consultations. The neighbouring states may participate in transboundary consultations within the framework of the Strategic Environmental Assessment.

TEMPORAL SYSTEM DEFINITION – PROJECTION PERIOD

In its strategy, the NRWMP includes a rough period of up to 2045, however, no end time is specifically mentioned. (The interim storage at NES at the Seibersdorf site is contractually secured until 2045 in a waste management contract.) The projection period is therefore assumed to be 2045.

FACTUAL SYSTEM DEFINITION

The factual system definition is determined by the likely significant environmental impact of the types of facilities on relevant protected goods. These protected goods were selected as part of the scope based on the draft NRWMP and as part of an interministerial task force. Revisions were then made when preparing the environmental report and in conjunction with the draft NRWMP as well as taking into account statements on the scoping document.

The National Radioactive Waste Management Programme names possible types of facility for the waste management of radioactive waste generated in Austria currently and in the future. These types of disposal facilities are also addressed in the Strategic Environmental Assessment.

As part of the SEA, these types of facilities are analysed for the disposal of radioactive waste in a repository, taking into account the special characteristics of Austria and referencing the IAEA publication NW-G-1.1 "Policies and Strategies for Radioactive Waste Management".

As this NRWMP does not specify the choice of facility type or site, the long-term safety of the future repository cannot be addressed in the assessment of the possible environmental impact. Once the relevant decisions have been made, it should be ensured as part of a further Strategic Environmental Assessment or for a specific project by means of an environmental impact assessment (EIA), that the disposal of radioactive waste has no likely significant environmental impact, even in the long term. In contrast, the environmental

[27] BMLFUW (2017): Scoping as part of the Strategic Environmental Assessment in accordance with Directive 2001/42/EC of the National Radioactive Waste Management Programme in accordance with Art. 36b of the Radiation Protection Act

impact of constructing and operating these repositories is reviewed as part of this SEA as it is now possible to make a fundamental assessment.

4 CURRENT ENVIRONMENTAL STATUS AND RELEVANT ENVIRONMENTAL PROBLEMS

THIS SECTION includes the information that must be presented in accordance with ANNEX 1, lit. b), c) and d) of the SEA Directive (Directive 2001/42/EC).

The environmental status of relevant protected goods or its trend in recent years is presented and assessed using meaningful indicators. Key trends in past years, for which there are available data and studies, are used as defining factors to evaluate the environmental status. Sources for this information primarily include: surveys carried out by the Environment Agency Austria on land consumption, the Eleventh State of the Environment Report, the National Water Management Plan (2015), annual reports on water quality, the annual report on air quality in Austria 2016, and further current data from the Federal Environment Agency.

4.1 SOIL AND LANDSCAPE

The soil provides several services for society by means of its soil functions. It is an important carbon and water store and a key gene reservoir, it filters pollutants, provides clean drinking water, and is the basis for producing food and feedstuffs as well as biomass. To sustainably fulfil these functions and others requires the soil to be conserved in a sufficient quality and quantity. Statements can also be made on the protected good landscape via soil or land consumption e.g. land consumption as a result of soil sealing.

The status of the soil in Austria is generally assessed as being good. Due to biogeographic and topographic factors, arable soil in Austria is a scarce resource. By increasing the amount of land used for housing and transportation, arable land in particular will be continually reduced. Land consumption in Austria at an average of 14.7 ha/day between 2014 and 2016 is lower than in previous years (ENVIRONMENT AGENCY AUSTRIA, 2016).

4.2 WATER

4.2.1 GROUNDWATER

The key groundwater reserves in Austria are in the valleys and basins (pore groundwater reserves) and in the alpine region (karstic and crevice groundwater reserves). These groundwater resources are a key source of drinking water throughout Austria. Groundwater also contributes significantly to levels in rivers and lakes as well as wetlands. Throughout Austria the chemical status of the ground water can be described as being good, the exception being a few regional problems from nitrate and pesticide entry (ENVIRONMENT AGENCY AUSTRIA 2016).

GROUNDWATER QUALITY

The results of monitoring programmes show that nitrate levels in groundwater continue to breach the quality objective. Based on data from 2012 to 2014, four groundwater bodies overall are identified as likely action areas[28] for nitrate. A further eight groundwater bodies were identified as being so-called “observation areas” for nitrate – which means that in these areas at least 30 % of the measuring sites are considered to be at risk in terms of nitrate concentrations. Regionally, this groundwater contamination occurs predominantly in east-

[28] Groundwater bodies in which at least 50 % of measuring sites are classified as at risk.

ern Austria where agricultural use is high and low rainfall is recorded. The low rainfall impacts both groundwater recharge and dilution (ENVIRONMENT AGENCY AUSTRIA 2016).

There has been a decrease in nitrate levels in groundwater since 1997 with some fluctuations of a few per cent or tenths of a percentage (BMLFUW 2015b).

In addition to nitrate pollution, pesticides or their decomposition products most notably impact groundwater quality. The active substances or decomposition products that cause the most frequent breaches – based on the measuring sites – are: desethyl-desisopropyl atrazine, N,N-dimethylsulfamide, desethyl atrazine, bentazone, atrazine and terbuthylazine. Breaches frequently occur in the extensively farmed areas in Upper Austria, Lower Austria, Styria, Burgenland and Vienna (ENVIRONMENT AGENCY AUSTRIA, 2016).

GROUNDWATER QUANTITY

The total available water resources in Austria amount to approx. 76.3 billion m3/year. Approx. 2.18 billion m3/year of this or approx. 3 % is used (ENVIRONMENT AGENCY AUSTRIA, 2014). The figures on water abstraction are based on well-founded estimations across Austria. There are no specific data on actual abstraction.

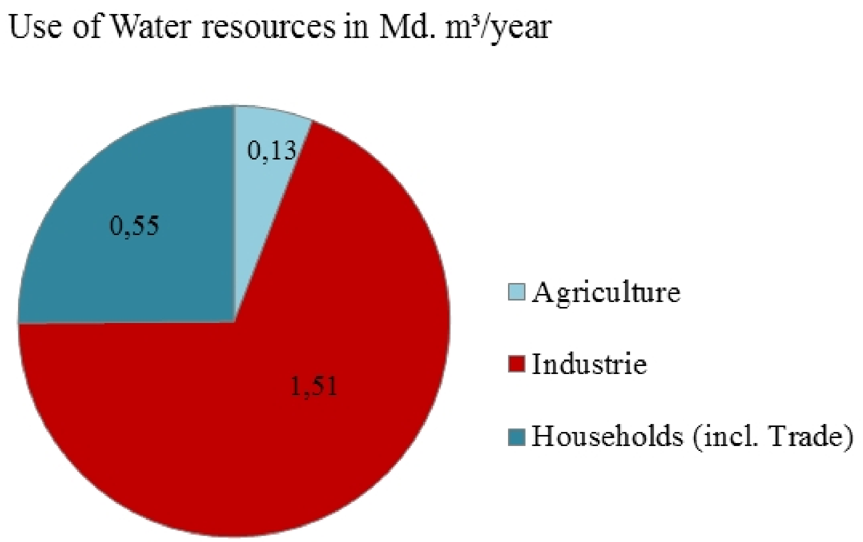

Figure 1: Water utilisation in Austria. ENVIRONMENT AGENCY AUSTRIA (2016)

In Austria all bodies of groundwater have a good quantitative status. To date, in the context of groundwater bodies, they have not been overexploited. Climate change, however, could cause the groundwater recharge rate to decline, which could lead to problems in the quantitative status, at least in eastern Austria.

For two groups of deep groundwater bodies (Styrian and Pannonian Basin, Eastern Styrian Basin) there is a risk of losing the equilibrium between groundwater recharge rates and water abstraction at least locally, which is reflected by pressure declines (BMLFUW 2015c).

Despite the high supply, there have been isolated water supply problems in the past, for instance in some regions of Carinthia and in central areas of the East Styrian Hills. As a result of the effects of climate change, this will intensify in some regions, at least on a small scale (ENVIRONMENT AGENCY AUSTRIA, 2016).

4.2.2 SURFACE WATER

In Austria there are 2,194 watercourses with a catchment area larger than 10 km². These have a total length of approx. 31,466 km. 88 % of these watercourses are natural. The remaining proportion consists of man-made and substantially modified water bodies, which have been significantly changed in their nature by human intervention. Their use means that they cannot be brought up to “good ecological status”. As a quality objective they are considered to have “good ecological potential”.

14 % of watercourses have a “very good”, 21 % have a “good” ecological status which means that there are only minor deviations from an unpolluted status. Almost half of all water bodies (44 %) are described as “moderate”, 8 % as “poor” and 2 % as “bad”. 2 % are in a “good or better” ecological potential, 9 % have a “moderate or worse” ecological potential.

Austria has numerous standing water bodies such as naturally occurring lakes, tarns, smaller water bodies and water bodies in the wetlands, as well as man-made quarry ponds and reservoirs. 62 of these are large lakes with an area of more than 50 ha. The majority of the 43 natural and 19 man-made lakes that are larger than 50 ha, have a “high” (34 %) or “good” ecological status (21 %), 40 % have a “good or better” ecological potential. Only 5 % of lakes are identified as having a “moderate” ecological status.

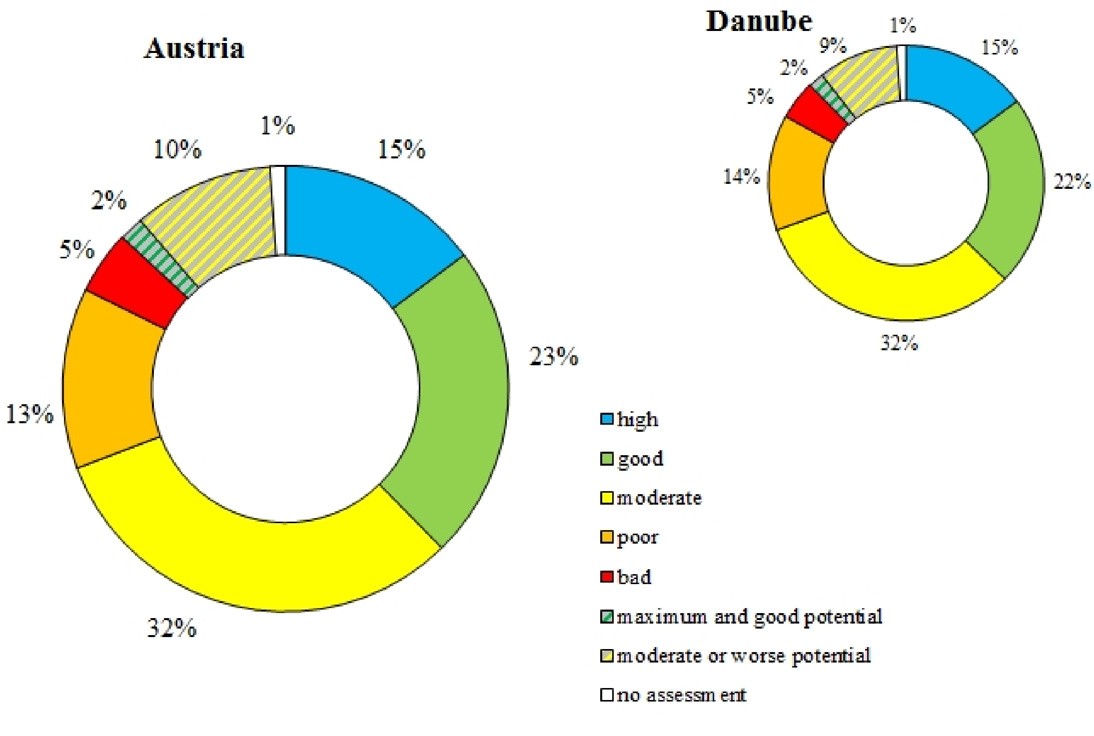

Figure 2: Status of Austrian water bodies, BMLFUW (2015c – NGP)

4.3 AIR

The current status of the protected good of air is important for the NRWMP, especially in terms of the particulate air pollutants and also pollution by PM_{10} and $PM_{2.5}$ as well as dust precipitation. The illustration of the current status is therefore limited to PM_{10} and $PM_{2.5}$ pollution and dust precipitation.

4.3.1 PM_{10} IMMISSION LEVELS

Limit values for the daily and annual mean value are specified in the Immission Control Act – Air (IG-L) for PM10 pollution. The limit for the daily average of PM10 is 50 µg/m³, whereby 25 breaches of this limit are permitted per year. This is in accordance with the EU Air Quality Directive, where 35 breaches of the limit are permitted annually at the EU level. The annual average limit is 40 µg/m³.

PM10-measurement data is available for some measuring sites dating back to 1999. PM10-measurement data dating back to 2013 permits a representative evaluation of pollution for the whole of Austria.

PM10 pollution in Austria shows a decreasing trend in general, however this varies greatly from year to year (Figure 3). The trend of PM10 pollution over time is not only determined by Austrian PM10 emissions (ENVIRONMENT AGENCY AUSTRIA, 2016c) and the (likewise decreasing) emissions of the precursors of secondary particles (esp. SO2, NOx, NH3), it is also determined by meteorological conditions and the emissions of neighbouring countries.

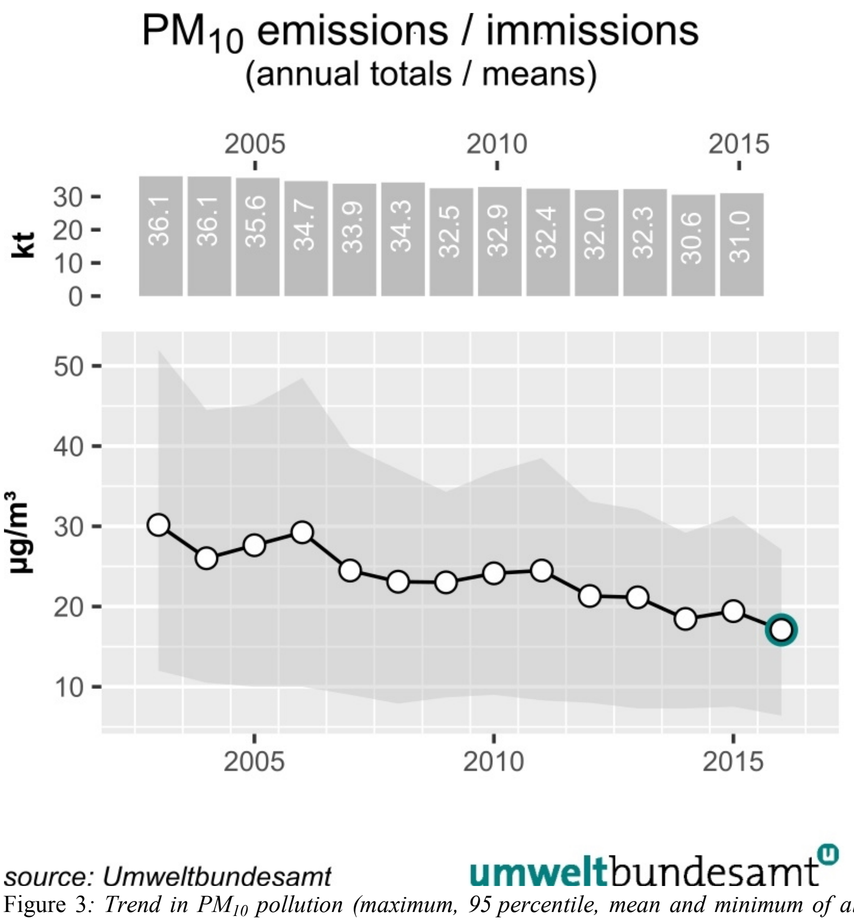

Figure 3: *Trend in PM_{10} pollution (maximum, 95 percentile, mean and minimum of all permanently operated stations). (Umweltbundesamt 2017)*

Peak pollution areas are urban centres and inner Alpine valley and basin locations. The highest PM_{10} pollution levels in recent years have occurred in Graz, Leibnitz and Vienna. The limit (40 µg/m³) defined as the annual average has not been exceeded since 2007. From 2012 to 2016 the number of measuring sites recording more than the permitted number of breaches according to the IG-L has declined. This is primarily associated with the development of advantageous meteorological situations for dispersing air pollutants (comparatively more westerly and southerly weather patterns and the associated higher temperatures and wind speeds) (ENVIRONMENT AGENCY AUSTRIA, 2017b).

4.3.2 $PM_{2.5}$- IMMISSION LEVELS

The IG-L specifies a target and limit value for $PM_{2.5}$[29]. The $PM_{2.5}$ limit to be observed from 2015 of 25 µg/m³ was not exceeded at any measuring site from 2009 to 2016. In general, $PM_{2.5}$ pollution shows a similar development to the PM_{10} concentration, even the spatial distribution of $PM_{2.5}$ pollution essentially corresponds to that of PM_{10}. Peak pollution levels are found in Graz and Vienna.

As per requirements, from 2013 to 2015 the average $PM_{2.5}$ exposure[30] levels must not exceed 20 µg/m³, averaged over these three years. At a mean value over these three years of 14.5 µg/m³, the requirement is definitely satisfied. For the period 2018 to 2020 the average exposure should comply with a value of 15.1 µg/m³[31].

4.3.3 DUST PRECIPITATION POLLUTION

The Austrian dust precipitation measuring network has a relatively heterogeneous geographic distribution. In 2015, there were 135 dust precipitation measuring sites operating in accordance with IG-L. At 84 of these measuring sites the heavy metals lead and cadmium (other heavy metals as well at some measuring sites near industry) in the dust precipitation were analysed.

The limit for dust precipitation (210 mg/m²/day) was exceeded at one measuring site in Graz and Kapfenberg as well at four sites in Leoben in 2016. Industrial emissions may have been responsible for the breaches (ENVIRONMENT AGENCY AUSTRIA, 2017b).

4.4 ANIMALS, PLANTS, HABITATS, BIODIVERSITY

The focus on illustrating the environmental status is on bird species. Since other species, in addition to birds, are linked to diverse, semi-natural habitats being used, the indicator also indirectly illustrates the development of numerous other species.

4.4.1 STATUS OF SPECIES AND HABITATS IN AUSTRIA – FOCUS ON BIRDS

As a result of its climatic and biogeographic conditions, Austria is home to a rich biodiversity and compared with other central European countries, it is one of the most species-rich countries. The assessment of the level of danger to animal and plant species in the Red Lists reveals that about a third of the assessed animal species is considered to be endangered. Red lists are vital for environmental control. They highlight the species that are threatened with extinction in the foreseeable future if nothing is done to stop it. Austria's Red

[29] Target of 25 µg/m³ until 2014, limit of 25 µg/m³ from 2015

[30] For $PM_{2.5}$, in addition to the limit value there is also a commitment for the three-year period 2013–2015 and a percentage reduction goal for the three-year period 2018–2020 compared with 2009–2011, in each case for the average exposure in urban background locations based on a three-year average. This is calculated as the mean of five designated measuring sites.

[31] This value comes from the reduction goal of 15 % in terms of the average exposure 2009–2011 of 17.8 µg/m³.

Lists categorise the risk status for 3,304 species of a total of 20 animal groups, some 1,169 species (approx. 30 %) were assigned a risk category (EDER & HÖDL 2002, RAAB et al. 2006, ZULKA 2005, 2007, 2009).

4.4.2 BIRD SPECIES OF COMMUNITY INTEREST (BIRDS DIRECTIVE

The Birds Directive (Art. 12) stipulates the creation of a report on the measures taken as part of the guidelines. The report provides information on the implemented conservation measures and the evaluation of the current status along with the predicted trend of the protected goods. Austria's current national report covers the reporting period from 2008 to 2012 inclusive (DVORAK & RANNER 2014).

Just over half of the domestic breeding birds showed a stable population in the period 2008 to 2012. Increasing and decreasing trends with 33 species helped to maintain the balance. Bird communities in rocky landscapes or high alpine regions showed predominantly stable populations. This was also the case in forests. Though not unexpected, the relatively high proportion of species with a negative population trend was from cultivated areas. The Farmland Bird Index, which reports the population trend of 22 characteristic bird species of the cultivated landscape since 1998, shows a population decline in these species by about 40 % from 1998 to 2014. However, the Farmland Bird Index 2015 revealed an increase in species (TEUFELBAUER 2015, TEUFELBAUER & SEAMAN 2016). Whether this increase is the start of a trend cannot be predicted after just one year.

A positive development is that bird species that are protected in accordance with the Birds Directive in protection areas[32], have a considerably more positive population trend than other bird species (DVORAK & RANNER 2014). As birds are extremely mobile, however, they are able to recolonise or rapidly colonise new available habitats (ZULKA 2005).

4.5 HUMANS

For humans, to protect their life and health including that of their offspring from harm caused by ionising radiation in conjunction with the NRWMP is an absolute focus and therefore the most important environmental objective. An meaningful indicator is exposure to radiation (incl. food chain).

A measure of the effect of ionising radiation on humans (radiation exposure) is the effective dose. Its unit is the Sievert (Sv). The parameter that describes human exposure to external radiation over time is the ambient dose rate. Its unit is Sievert per hour (Sv/h).

In Austria there is a nationwide automatic measuring system for radioactivity in the environment (radiation early warning system). This currently consists of more than 300 ambient dose rate measuring points and 10 air monitors to record the activity concentration in ground-level air. The measurements of the radiation early warning system are available online in the alarm centres of the BMNT, of the Federal Ministry of the Interior (BMI) and of the federal states. Approximately 100 ambient dose rate measuring points are available online to the public as a representative cross-section.

4.5.1 AMBIENT DOSE RATE

More than 300 stations comprise the measurement system that measures the level of gamma radiation (gamma-ambient dose rate) and therefore enables continuous monitoring. The graph (Figure 4) shows the gamma-ambient dose rate in each case for a district's capital in a federal state and for a measuring site in Vienna. In general, the measurement values reflect the background caused by natural radiation exposure.

[32] These protection areas, together with the areas identified based on the Habitats Directive, form the Natura 2000 network.

This natural radiation background is made up of cosmic and terrestrial radiation. The strength of cosmic radiation depends on factors including the sea level and the latitude. Terrestrial radiation is caused by naturally occurring radioactive substances in the Earth's crust, e.g. uranium, thorium and potassium-40. The dose rate at the Earth's surface depends on the distribution of radionuclides in the soil. In Austria, depending on the geological composition of the subsoil, this dose rate is between several 10 and about 200 nanoSievert/hour (nSv/h). Terrestrial radiation also includes the gamma radiation caused by naturally occurring radioactive substances in construction materials. This effect can often cause an increase in the dose rate locally.

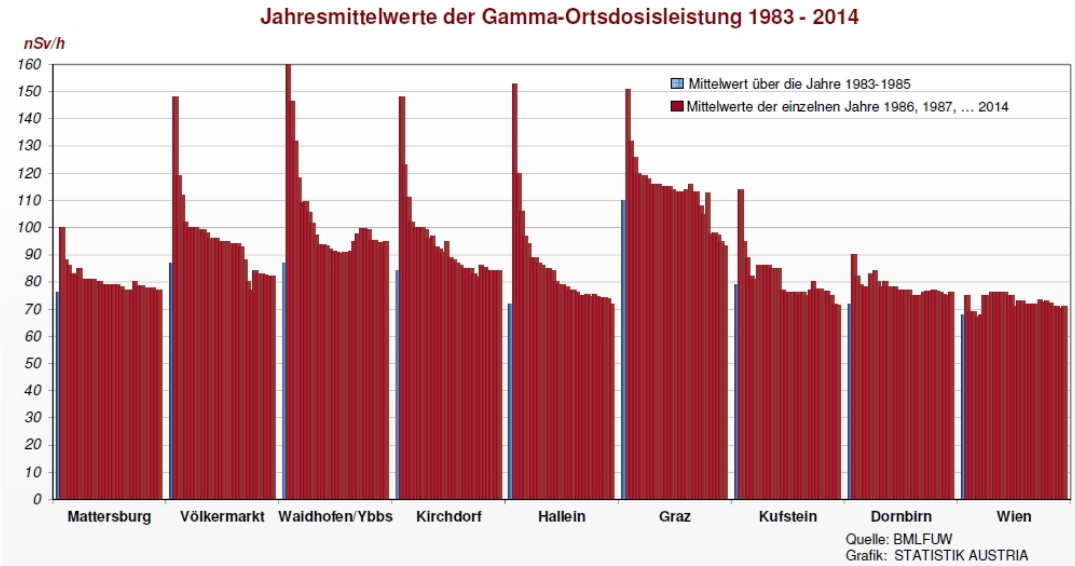

Figure 4: Annual mean values of the gamma-ambient dose rate 1983–2014, source: BMLFUW2015b

In addition to natural radiation exposure, radiation is also caused by man-made radioactive substances reaching the environment, for example by the atmospheric atomic bomb tests in the 1950s/60s and the Chernobyl reactor accident in 1986. The graph also clearly shows the rise caused by the reactor accident in Chernobyl in 1986 and the subsequent drop in values. From 1990 the ambient gamma dose rate had returned to the same range as before the reactor accident (BMLFUW, MONE 2015 – Indicator Report). The core meltdowns in the Fukushima nuclear reactors in 2011 have contributed virtually nothing to the exposure to radiation in Austria as a result of the great distance between Austria and the country of accident.

The cosmic radiation and the naturally occurring radioactive substances in the environment cause nearly three quarters of the average radiation exposure for the population. The vast majority of this comes from the radioactive noble gas radon, which is predominantly found in buildings – though in very different amounts – in the air the occupants breathe. The largest proportion by far of artificial sources of exposure in Austria is caused by medical applications, particularly by X-ray diagnostics (BMLFUW 2016).

4.5.2 AIR CONTAMINATION

In addition to the ambient dose rate measuring systems, which can only measure external radiation (mainly gamma radiation) non-specifically, 10 air monitoring stations are operated in the radiation early warning system, which provide information on the type and concentration of radioactive substances in the air. The systems are equipped with a weather station that provides information on wind direction and speed, temperature and rainfall. These high-performance measuring stations are positioned in the meteorological catchment area of foreign nuclear power stations close to the Austrian border. So-called decision support systems are also used along with meteorological data to make it possible to forecast the spread of radioactively contaminated air masses. On a bilateral basis, ambient dose rate data is exchanged between Austria and all neighbouring states that operate nuclear power stations. Data is also exchanged multilaterally at an EU level, with all EU countries having access to the data of the others.

4.5.3 MEASUREMENT RESULTS FROM THE RADIATION EARLY WARNING SYSTEM

Since the nuclear power station accident in Chernobyl in April 1986, there have been no large-scale emissions of artificial radionuclides detected by the radiation early warning system. The measurements in the reporting period generally correspond, as in previous years, to the natural radiation level at the measuring site. Only in the course of material testing in the immediate vicinity of measurement stations were there isolated cases of temporary increases in the reporting period (BMLFUW 2015e).

4.5.4 MONITORING RADIOACTIVITY IN FOOD

Food has been routinely monitored for radioactivity for many years in Austria. These monitoring measures are as follows:

- Full checks of wild mushroom imports from countries outside the EU
- Regular checks on raw milk from approx. 30 milk audits
- Random checks on other products (in particular beef and game)
- Analysis of specific foods as part of projects (e.g. Austrian wild mushrooms, Austrian fish)

The last three checks are performed based on the Austrian Radiation Protection Act. In recent years there have been no complaints due to possible health problems. [33]

[33] Information at the homepage of the BMASGK , monitoring radioactivity in food Link

5 ASSESSMENT OF ALTERNATIVES: TYPES OF FACILITIES AND ZERO ALTERNATIVES

THIS SECTION INCLUDES THE information that must be presented in accordance with ANNEX 1, lit. h) of the SEA Directive. According to Article 5 (1) of the SEA Directive, sensible alternatives should be given in the environmental report, which consider the objectives and the geographic scope of the plan or programme. The reasons for selecting the assessed alternatives should be briefly provided. In the following, the waste management options (types of repositories) outlined in the NRWMP are compared and details are given on difficulties in compiling the required information for site selection as a result of a lack of current knowledge.

This NRWMP does not contain any information on future individual or multiple sites for the final disposal of Austrian radioactive waste. A comparison of different site alternatives shall therefore be omitted in this environmental report. A specific site search should be supported by a Strategic Environmental Assessment and transparent public participation. The environmentally relevant advantages and disadvantages should be clearly taken into account when deciding on one or more sites.

5.1 TYPES OF REPOSITORIES

The applicability of the possible types of facility 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 and the results presented in Annex II of the NRWMP (see Table 3).

It is possible that further treatment or waste management options may be available in the future.

Taking into account the Austrian waste inventory, the following types of facilities for the final disposal (see Figure 5) are under discussion according to the state of the art:[34]

- Trench-type repository 1
- Engineered near-surface facility 2
- Intermediate depth facility 3
- Borehole facility 4
- Geological repository 5

[34] Source: BMNT (2018): Draft National Radioactive Waste Management Programme according to Art. 36b of the Radiation Protection Act, Annex II

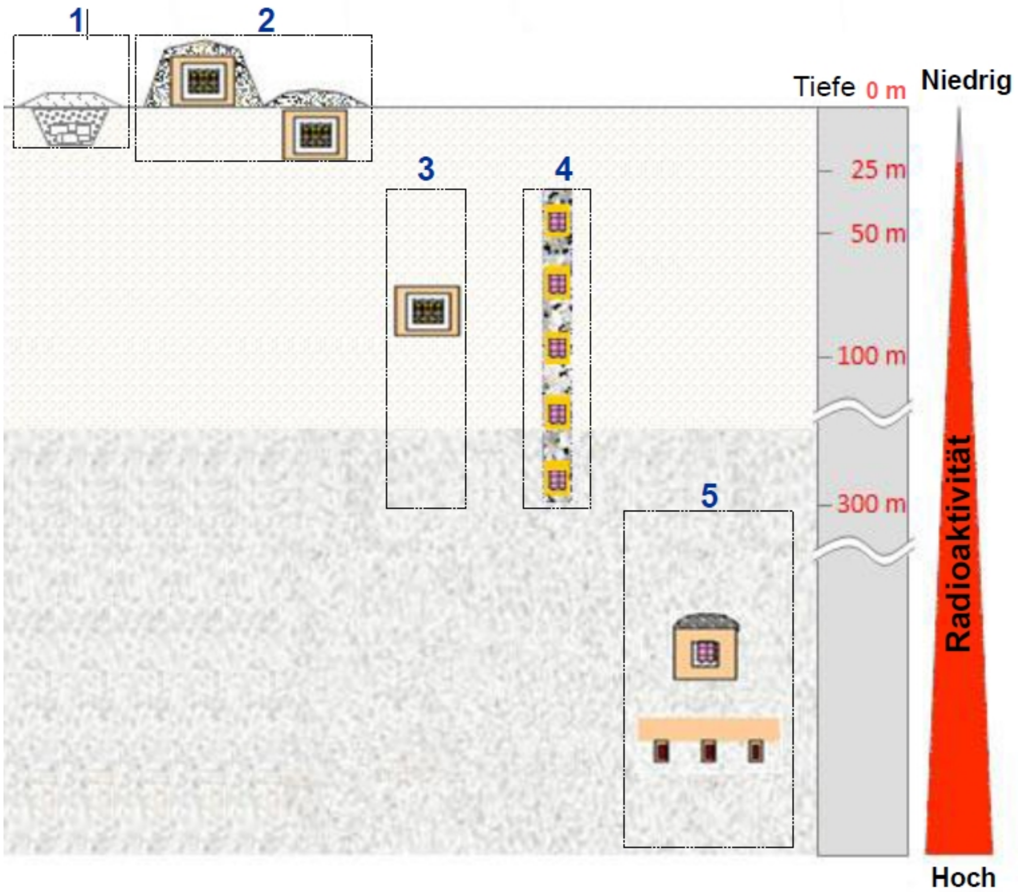

Figure 5: Possible alternatives for final disposal (source: ENCO based on Link)

TABLE 3: SUMMARY OF THE POSSIBLE TYPES OF FACILITIES FOR AUSTRIAN RADIOACTIVE WASTE

Type of waste	**Characteristic of waste**	**End point**				
		Trench type	**Engineered near-surface facility**	**Borehole facility**	**Intermediate depth facility**	**Deep 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	+	++	++
Used sealed radioactive sources	Short-lived nuclides	+	++	NR	NR	NR
	Long-lived nuclides	N	NR	++	++	++
	High activity radiation sources	N	N	++	++	++

Key:

		N	not possible for safety reasons
+	acceptable solution	NT	not possible for technical reasons
++	preferred solution	NR	possible but not recommended for technical or economic reasons

Disposal in a **trench-type repository** (Figure 5/1) is comparable in principle to the disposal of conventional waste in a conventional landfill site. The waste is disposed of in a trench and covered with soil. No additional safety surveillance or radiation monitoring is required due to the low level of radioactivity. 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 sealed sources with long-lived radionuclides or higher activities, this design is not suitable for safety reasons.

An **engineered near-surface facility** (Figure 5/2) 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 metres below the surface. It is subject to surveillance and radiation monitoring until the hazard associated with the waste has lost its hazardous potential. A near-surface facility is suitable for disposing of radioactive waste with short-lived radionuclides (LILW-SL)

An **intermediate depth disposal facility** (Figure 5/3) consists of caves, vaults or silos, which are usually a few tens of metres to a few hundred metres 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. Globally, several disused mines have already been converted to disposal facilities of this kind.

A borehole disposal facility (Figure 5/4) consists of one or more boreholes with a depth of several tens to a few hundred metres. Borehole facilities are acceptable for the disposal of small volumes of long-lived waste, however are particularly suitable for the final disposal of disused sealed radiation sources (long-lived radionuclides and high activity sources).

Deep geological repositories (Figure 5/5) are set up several hundreds of metres below the surface, generally in the form of tunnels, vaults or silos. In these 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.

5.1 THEORETICAL ZERO ALTERNATIVES

According to Annex I, lit. b of the SEA Directive "*relevant aspects of the current state of the environment and its likely development in the event of not carrying out the plan or programm*e", i.e. a zero alternative, should be included in the environmental report. As a result of the specifications of the Radiation Protection Act[35] it is legally impossible to not implement the NRWMP. The zero alternatives can therefore only present a theoretical frame of reference to evaluate the environmental impact of the considered alternatives. A theoretical zero alternative is assumed to be an indefinite interim storage of radioactive waste (beyond 2045) at NES, without further modernisation to the facilities or further treatment of the stored waste.

The current interim storage at NES conforms to the latest safety requirements and has a quality management system that also integrates environmental and health protection aspects. However, from an environmental

[35] BGBl. I Nr. 133/2015

perspective, this (theoretical) zero alternative would be a poor choice. Neither the buildings and facilities of NES nor the waste drums used at present are designed for indefinite storage. Assuming that the facilities are not modernised and there is no further treatment of the stored waste, there could be a local negative impact on the protected goods of water and air. There is also a continuous comparatively higher risk of an incident or additional radiation exposure to humans as a result of the ageing of parts of the facility or waste drums than for a repository. However, no impact on the soil or landscape (land consumption) or on animals, plants or habitats is expected.

6 DESCRIPTION AND EVALUATION OF THE LIKELY SIGNIFICANT ENVIRONMENTAL IMPACT

THIS SECTION includes the information that must be presented in accordance with ANNEX 1, lit. f) of the SEA Directive (Directive 2001/42/EC).

6.1 DESCRIPTION OF THE VALUATION METHOD

The basis for estimating possible environmental impacts is provided by defined environmental objectives, the achievement of which is analysed using relevant indicators. An overarching environmental goal is defined and an indicator specified for each protected good (see Table 4). Indicators are selected according to how informative they are with regard to the SEA-relevant types of facilities, according to the availability of data and the level of detail of the current NRWMP.

INDICATORS TO ESTABLISH WHETHER ENVIRONMENTAL OBJECTIVES ARE ACHIEVED

Indicators are used to show the status of the assessed protected goods and the impact on these protected goods. Environmental indicators should characterise the quality of the affected protected goods as clearly as possible and also specify limit values or benchmarks for possible measures. To check specifically whether the environmental objectives assigned to the protected goods are achieved by implementing the NRWMP or what impact is expected, the following environmental indicators are used:

TABLE 4: INDICATORS

Protected goods and environmental objectives	Indicators to establish achievement of objectives
Soil and landscape *Qualitative and quantitative protection and conservation of a location-typical soil condition and conservation of landscape features*	Proportion of areas that have lost their natural soil functions/soil and land consumption
Water *Protection, conservation and improvement where possible of water quantity and quality to sustainably safeguard the water supply and water-dependent ecosystems*	Quality of surface water and groundwater
Air *Preservation of the statutory limits and targets to protect ecosystems, human health and vegetation*	Air quality
Animals, plants, habitats, biodiversity *Protection, preservation and re-establishment of native flora and fauna and their habitats*	Animal species as indicators of habitat quality
Humans *To protect the life and health of humans including that of their offspring from harm caused by ionising radiation*	Exposure to radiation (incl. food chain)

An assessment of the possible positive or negative impact of the implementation of the NRWMP on the affected protected goods is conducted gradually based on

– an illustration and assessment of the current environmental status (section 4),

– its likely development if the programme is theoretically not implemented (indefinite interim storage at NES) and based on this,

– the assessment of the environmental consequences of SEA-relevant types of disposal facilities.

ENVIRONMENTAL IMPACT

Based on the trend of the environmental status without implementing the NRWMP, estimations are made as to what impact on the environment there would be as a result of the SEA-relevant types of facilities. All conceivable causes (such as use of resources, risk potential, changes to the affected area) of environmental impacts as well as secondary, cumulative, synergetic, short-term, medium-term and long-term, permanent and temporary, positive and negative effects on the individual affected protected goods are considered in an integrative context.

The assessment is based on the defined indicators. In particular, potentially significant negative environmental impacts are considered.

6.2 IMPACT OF SEA-RELEVANT TYPES OF FACILITIES

Possible impacts may arise when setting up and operating facilities, limited to the local area. The extent of the impact on the SEA-protected goods primarily depends on the site selection and the size of the facility. Possible impacts may arise from the start of setting up the facility. An in-depth safety assessment must be performed during the operation of the facilities as well as monitoring the radiation exposure to humans and the environment.

The various possible environmental impacts naturally depend on the type of facility and also the location of the final repository/repositories. As the NRWMP does not include any sites, only the likely significant environmental impact of the possible types of facility in the construction and operating phase until closure can be assessed as part of this SEA, and impacts that are associated with transporting the radioactive waste from the interim storage site to the repository.

The assessment of environmental impact includes a worst-case accident scenario with reference to the Austrian National Radiation Emergency Plan. The worst accident scenario during the operating phase is assumed to be a major passenger aircraft crash with subsequent kerosene fire. If you compare the worst-case scenarios for all types of facility with that for NES, you can assume a lower radiological impact and exposure on a smaller scale for all cases, as each scenario relates to a lower quantity of radioactive waste than at the NES site.

The period following closure is no part of the assessment in this environmental report. In principle, an environmental monitoring programme is provided after closing a facility. Depending on the type of facility, relevant safety and radiation monitoring and monitoring of the environmental impact shall be provided. The monitoring programme must comply with international standards (IAEA 2014b). In any case specific parameters must be monitored that demonstrate the status of the protected goods (e.g. groundwater, hydrology, geology, seismology, air, soil). The specifications of the IAEA Safety Standards provide guidance (see Table I-1, p. 51ff)[36].

[36] IAEA: Safety Standards – Monitoring an Surveillance of Radioactive Waste Disposal Facilities

In any case, in the event of a key future amendment to the waste management programme (for example for a site search), a Strategic Environmental Assessment shall be conducted. If the site/sites and type of disposal facility are certain, it shall in any event be ensured as part of an environmental impact assessment (EIA) that there is no significant environmental impact for setting up and operating this type of facility.

6.2.1 TRENCH-TYPE REPOSITORY

Construction phase: Setting up a trench-type repository involves primarily local and temporary impacts caused by construction work on site and the construction site traffic on access roads in the vicinity of the facility. It is not possible to exclude local potential impacts on animals, plants and their habitats as well as biodiversity and landscape modification as a result of the land consumption of the construction site and facility. Local noise and dust pollution caused by construction work as well as waste and residue (incl. excavation material) also need to be considered. It is not possible to exclude any impact as a result of accidents involving construction machinery and vehicles on the groundwater or entry into receiving water. Depending on the depth of the facility, groundwater may be adversely affected by excavation work.

Operating phase: It is during the operating phase that the facility is filled with waste with very low activity in accordance with the approved acceptance criteria. The facility is operated like a conventional landfill site and following deposit of the waste the surface is covered and recultivated. The operation of a trench-type repository necessitates long-term local land consumption, sealing and changes to the terrain. It is not possible to exclude any local impact on animals, plants, habitats, biodiversity and groundwater and changes to the landscape. Environmental impacts as a result of radioactive radiation can be excluded as it relates to waste with very low activity. Accordingly, the possible impact of a worst-case accident scenario is also very low.

Closing: After closing a trench-type repository it is necessary to monitor the environmental impact – in the same way as after closing a mixed waste landfill site. In all cases compliance with limit values for seepage water from the waste site, air pollutants and the success of recultivation measures are monitored.

Summary: Constructing and operating a trench-type repository may have an impact on the SEA-protected goods, these impacts being limited to a local area around the facility. Relevant environmental standards are provided for setting up and operating this type of facility. Ecological construction supervision can minimise risks. Only negligible impacts are therefore assumed on soil consumption/landscape change, the quality of groundwater and surface water, on air quality and on animal and plant species and their habitats – nationwide. It is not possible to entirely exclude minor local impacts as a result of accidents when preparing the waste being disposed of.

6.2.2 ENGINEERED NEAR-SURFACE FACILITY

The size of an engineered near-surface facility can be assumed to be relatively small. A facility in La Manche, France, was set up in an area of 18 ha for 500,000 m³ radioactive waste.[37] A facility for Austria's waste, which would need to hold approx. 3,600 m³ (less than 1 % of the volume of the waste stored in La Manche), would be correspondingly smaller and would be estimated at a permanent land consumption of 1–2 ha maximum. Recultivation and surface design as well as a possible subsequent use of the surface are not known at present.

Construction phase: Constructing an engineered near-surface repository involves primarily local and temporary impacts caused by construction work on site and the construction site traffic on access roads in the vicinity of the facility. Depending on the design of the facility (construction directly at the surface or several

[37] Austrian Institute of Ecology: Position paper on the storage of Austrian radioactive waste

metres below the surface), it is not possible to exclude any impact as a result of land consumption during construction and operation on animals, plants and their habitats, on biodiversity and change in the landscape. Local noise and dust pollution caused by construction work as well as waste and residue (incl. excavation material) also need to be considered. It is not possible to exclude any impact as a result of accidents involving construction machinery and vehicles on the groundwater or entry into receiving water. Depending on the depth of the facility, groundwater may be adversely affected by the construction work.

Operating phase: It is during the operating phase that the facility is filled with radioactive waste (LILW-SL) and used sealed radiation sources with short-lived radionuclides in accordance with approved acceptance criteria. This kind of facility must conform to safety requirements for a minimum of 300 years[38] to prevent radioactive substances escaping into the biosphere. Once filling is complete, the facility is covered (depending on the design with concrete and soil) and the surface is sealed. It is assumed that the surface will be recultivated according to the state of the art. The operation of an engineered near-surface repository necessitates long-term local land consumption, sealing and changes to the terrain. It is not possible to exclude any local impact on animals, plants, habitats, biodiversity and groundwater and changes to the landscape. An in-depth safety assessment must be performed during the entire operating phase as well as monitoring the radiation exposure to humans and the environment. Incidents dealing with radioactive waste, however, cannot be entirely excluded despite stringent safety precautions. The impact of the worst-case scenario for this type of facility would be lower because the design of the facility makes it more difficult for radioactive substances to be released – compared with storage at NES. In addition, only short-lived radioactive waste can be stored in this type of facility.

Closing: After closing an engineered near-surface facility, it is necessary to monitor safety and radiation as well as environmental impacts (especially on groundwater) until the stored radioactive waste no longer presents a risk (300 years). Monitoring should always include radioactivity in the environment, compliance with limits for any seepage water, air pollutants and the success of recultivation measures.

Summary: Constructing and operating an engineered near-surface repository may have an impact on the SEA-protected goods, these impacts being limited to a local area around the facility. Permanent land consumption of 1–2 ha maximum is expected. Relevant environmental and safety standards are provided for constructing and operating the facility. Ecological construction supervision can minimise potential risks. Only negligible impacts are therefore assumed on soil consumption/landscape change, the quality of groundwater and surface water, on air quality and on animal and plant species and their habitats – nationwide. It is not possible to entirely exclude minor local impacts as a result of accidents when preparing the waste being disposed of.

6.2.3 BOREHOLE FACILITY

Construction phase: Using deep drilling technology, borehole facilities are driven up to several hundred metres into the rock. Setting up a borehole facility involves primarily local and temporary impacts caused by construction work on site and the construction site traffic on access roads in the vicinity of the facility. Local noise and dust pollution as well as vibrations caused by construction work along with waste and residue (incl. excavation material) also need to be considered. The only significant land consumption is during the construction phase and is due to the site equipment. It is not possible to exclude a possible impact on deep rock strata, tectonics and groundwater aquifers. There may be an impact on groundwater or entry into receiving water as a result of accidents with construction machinery and vehicles (spillage of operating fluids). As a short construction phase is predicted, any impact on animals, plants and their habitats, on biodiversity and landscape changes is very unlikely.

[38] As only short-lived nuclides are stored, the activity of these after 300 years is negligible

Operating phase: It is during the operating phase that the facility is filled with radioactive waste (LILW-LL). Operating a borehole facility does not require any permanent land consumption. It is not possible to exclude any impact on deep rock strata, tectonics and groundwater aquifers during the operating phase. It is possible to exclude a local impact on animals, plants, habitats, biodiversity and changes to the landscape. An in-depth safety assessment must be performed during the entire operating phase as well as monitoring the radiation exposure to humans and the environment. Incidents dealing with radioactive waste, however, cannot be entirely excluded despite stringent safety precautions.

As a borehole facility is only suitable for small quantities of waste, the radioactive consequences of a worst-case accident scenario during the storage process compared with the NES accident scenario would be more minor. Once the waste is inserted into the facility, the waste is safely stored at a depth of several tens to hundreds of metres.

Closing: Once filling is complete the facility is closed and the surface sealed, with no identifiable impact on the surface. The facility should be monitored for safety and radiation as well as the environmental impact (especially on the groundwater). Monitoring should always include radioactivity in the environment, compliance with limits for any seepage water, air pollutants and the success of recultivation measures.

Summary: Constructing and operating a borehole facility may have small-scale impacts on the SEA-protected goods, these impacts being limited to a local area around the facility. Applicable environmental and safety standards when constructing and operating the facility must be observed. Ecological construction supervision can minimise potential risks. Only negligible impacts are therefore assumed on soil consumption/landscape change, on air quality and on animal and plant species and their habitats – nationwide. It is not possible to entirely exclude negative impacts on deep groundwater bodies during the construction and operation of the facility. It is also not possible to entirely exclude minor local impacts as a result of accidents when preparing the waste being disposed of.

After closing the facility there should be no identifiable impact to the surface, only during the construction phase is minor land consumption expected. The design of the facility means that waste stored at such depths represents no direct exposure risk to the population.

6.2.4 INTERMEDIATE DEPTH FACILITY

Construction phase: Constructing an intermediate depth facility, which should be at least 100 m below the surface assumes primarily local and temporary impacts caused by construction work on site and the construction site traffic on access roads in the vicinity of the facility. Local noise and dust pollution, vibrations caused by construction work and waste and residue (incl. excavation material) need to be considered. Land is used during the construction phase, generally by the site equipment. It is not possible to exclude a possible impact on deep rock strata, tectonics and groundwater aquifers. Neither is it possible to exclude any possible impact as a result of accidents involving construction machinery and vehicles (spillage of operating fluids) on the groundwater or entry into receiving water. No significant impact is predicted on animals, plants and their habitats, on biodiversity or landscape changes.

Operating phase: It is during the operating phase that the facility is filled with radioactive waste. Operating an intermediate depth facility requires permanent but small-scale land consumption as a result of the receiving warehouse or office building. Possible impacts on deep rock strata, tectonics and groundwater aquifers cannot be entirely excluded during the operating phase. No local impact is expected on animals, plants, habitats, biodiversity or changes to the landscape. An in-depth safety assessment must be performed during the entire operating phase as well as monitoring the radiation exposure to humans and the environment. Incidents dealing with radioactive waste, however, cannot be entirely excluded despite stringent safety precautions.

Only the process of depositing the waste would be associated with possible impacts in the worst-case accident scenario and then only with minor radiological consequences because only a small proportion of the waste being stored is present in the near-surface area of the facility. After inserting the waste it is located several hundreds of metres beneath the surface.

Closing: Once filling is complete, the facility is closed and the surface sealed, with only minor identifiable impacts on the surface. A facility should be monitored for safety and radiation as well as the environmental impact (especially on the groundwater). Monitoring should always include radioactivity in the environment, compliance with limits for any seepage water, air pollutants and the success of recultivation measures.

Summary: Constructing and operating an intermediate depth facility may have small-scale impacts on the SEA-protected goods, these impacts being limited to a local area around the facility. Minor land consumption during the construction and operating phase is expected. Applicable environmental and safety standards when setting up and operating the facility must be observed. Ecological construction supervision can minimise potential risks. Only negligible impacts are therefore assumed on soil consumption/landscape change, on air quality and on animal and plant species and their habitats – nationwide. It is not possible to entirely exclude negative impacts on deep groundwater bodies during the construction and operation of the facility. It is also not possible to entirely exclude minor local impacts as a result of accidents when preparing the waste being disposed of.

After closing the facility, there will only be minor identifiable impacts on the surface. The design of the facility means that waste stored at such depths represents no direct exposure risk to the population.

6.2.5 DEEP GEOLOGICAL REPOSITORY

Construction phase: Constructing a deep geological repository several hundred metres below the Earth's surface assumes primarily local and temporary impacts caused by construction work on site and the construction site traffic on access roads in the vicinity of the facility. Local noise and dust pollution, vibrations caused by construction work and waste and residue (incl. large quantities of excavation material and rock material) need to be considered. Land is used during the construction phase as a result of site equipment. It is not possible to exclude a possible impact on deep rock strata, tectonics and groundwater aquifers. Neither is it possible to exclude any impact as a result of accidents involving construction machinery and vehicles (spillage of operating fluids) on the groundwater or entry into receiving water. It is highly likely that any impact on animals, plants and their habitats, on biodiversity or landscape changes will be minor.

Operating phase: During the operating phase the deep repository is filled with radioactive waste. Operating a deep geological facility requires permanent but small-scale land consumption as a result of the receiving warehouse or office building. Possible impacts on deep rock strata, tectonics and groundwater aquifers cannot be excluded during the operating phase. It is highly likely that any local impact on animals, plants, habitats, biodiversity and changes to the landscape can be excluded. An in-depth safety assessment must be performed during the entire operating phase as well as monitoring the radiation exposure to humans and the environment. Incidents dealing with radioactive waste cannot be entirely excluded despite stringent safety precautions.

Only the process of depositing the waste would be associated with possible impacts in the worst-case accident scenario and then only with minor radiological consequences because only a small proportion of the waste being stored is present in the near-surface area of the facility. After inserting the waste it is located several hundreds of metres beneath the surface.

Closing: Once filling is complete, the facility is closed and the surface sealed, with only minor identifiable impacts on the surface. The facility should be monitored for safety and radiation as well as the environmental impact (especially on the groundwater). Monitoring should always include radioactivity in the environment, compliance with limits for any seepage water, air pollutants and the success of recultivation measures.

Summary: Constructing and operating a deep repository may have small-scale impacts on the SEA-protected goods, these impacts being limited to a local area around the facility. Minor land consumption during the construction and operating phase is expected. Applicable environmental and safety standards when setting up and operating the facility must be observed. Ecological construction supervision can minimise the risk of significant impacts. Only negligible impacts are therefore assumed on soil consumption/landscape change, on air quality and on animal and plant species and their habitats – nationwide. It is not possible to entirely exclude negative impacts on deep groundwater bodies during the construction and operation of the facility. It is also not possible to entirely exclude minor local impacts as a result of accidents when preparing the waste being disposed of.

After closing the facility, there will only be minor identifiable impacts on the surface. The design of the facility means that waste stored at such depths represents no direct exposure risk to the population.

6.3 FINAL DISPOSAL OPTION ABROAD

Collaboration at an European or international level should be sought to prepare for future waste management.

The Radiation Protection Act stipulates that "the possibilities of cooperation relating to waste treatment and management 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, should be considered" (Art. 36b (2) Radiation Protection Act). In the case of countries such as Austria, which do not use nuclear power for energy production and therefore have less expertise in this field and lack the financial resources of nuclear power plant operators, such cooperation can be of huge benefit. Collaboration therefore not only offers foreseeable financial advantages, it can also help to find the best possible safe solution more quickly.

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[39]: 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)[40]. For the safe transport of radioactive waste, the provisions of the Dangerous Goods Transport Act and the international dangerous goods agreements referenced therein must be observed.

6.4 TRANSPORTING THE RADIOACTIVE WASTE

There are possible impacts associated with transporting the radioactive waste at the Seibersdorf site to the repository. Local noise and dust pollution as a result of traffic caused by transportation should therefore be considered for all possible types of facilities. The length of transportation cannot be estimated. It is assumed that the conditioned radioactive waste is transported by train or HGV, whereby the number of journeys will not significantly impact the volume of traffic across Austria. In the event of transboundary transportation the

[39] Article 4 (4) of the Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste
[40] Federal Law Gazette III no. 169/2001 as amended Link

Directive 2006/117/Euratom on the supervision and control of shipments of radioactive waste and spent fuel should be observed.

To ensure the safety of transportation, IAEA safety standard the national and international dangerous goods regulations provide strict criteria for designing the containers used during transportation and a series of administrative regulations (sample testing and certification, identification, labelling, placards etc.) Radioactive waste is mostly transported either in industrial containers (simple containers that can be used to transport low activity materials) or in type A containers (designed for stricter design criteria).

In the event that this country is an EU Member State, transportation is an intra Community transfer, which is subject to the provisions of Directive 2006/117/Euratom on the supervision and control of shipments of radioactive waste and spent fuel, which regulates the method of waste shipment. The Ordinance on the Shipment of Radioactive Waste 2009 as amended implements this directive in Austrian law. Disposal outside of the EU is subject to the provisions of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management ratified by Austria. This convention provides for a similar administrative regulation for the shipment of waste over country borders as per the Council Directive 2006/117/Euratom.

The Dangerous Goods Transport Act regulates national and international transport of dangerous goods, which include class 7 “radioactive substances”. Reference is made in particular to the international rules applicable to each mode of transport (aviation: ICAO-TI, maritime transport: IMDG code, road transport: ADR, rail transport: RID and inland navigation: ADN). All of these provisions are based on the IAEA SSR-6[41] but supplemented by other provisions, such as chemical hazards.

Despite these strict safety precautions it is not possible to fully exclude accidents when loading and removing the radioactive waste.

According to IAEA Safety Guide no. TS-G-1.2[42] (Planning and Preparing for Emergency Response to Transport Accidents involving Radioactive Material) the limit of activity in a type A container is calculated such that it is guaranteed that a person who, for less than 30 minutes, is 1 metre away from a container damaged by a transport incident, is not exposed to more than 50 mSv. This value is within the reference range that should be specified for emergency exposure situations according to the Directive 2013/59/Euratom.

A transportation incident could have a negative environmental impact on the protected goods of soil and potentially also water. Contamination would be within a very small-scale local area as it would only involve a small quantity of radioactive waste.

[41] IAEA (2012): IAEA SAFETY STANDARDS SERIES No. SSR-6: Regulations for the Safe Transport of Radioactive Material. Vienna.
[42] IAEA (2002): IAEA SAFETY STANDARDS SERIES No. TS-G-1.2: Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material. Vienna.

7 MEASURES AND MONITORING

THIS SECTION includes the information that must be presented in accordance with ANNEX 1, lit. g) and i) of the SEA Directive. Firstly, this describes the planned measures to prevent, minimise and as far as possible offset significant negative environmental impacts based on carrying out the NRWMP and secondly, planned monitoring measures (follow-up monitoring and monitoring). Based on the subject matter of the SEA (facility types without specific sites), it is only possible to provide a very general description and plan of measures and monitoring.

7.1 PREVENTION, MINIMISATION AND COMPENSATION MEASURES

Radioactive waste prevention and minimization is considered a basic principle in the NRWMP when dealing with radioactive substances in general and when managing of radioactive waste in particular. This is generally based on ecological, ethical and safety-relevant considerations, given that the potential impact on the environment and the safety risk when treating and storing radioactive waste increases with the volume of waste.

Further, the treatment and final storage of radioactive waste together with volume reduction have important economic advantages, since both the construction and operation of a repository are costly and smaller waste volumes will result in lower costs. As the handling of radioactive substances is subject to regulatory approval in Austria, the licence applicant has to submit a waste management concept as part of the application process, which shows what is to happen to the radioactive waste resulting from the practice. Waste prevention, volume reduction and the reuse of radioactive materials must be taken into account. Radioactive waste passed to NES is conditioned in the NES facilities using the latest methods to convert the radioactive waste into a stable and above all, safe form and also to achieve the greatest possible reduction in volume. This "minimisation principle" for radioactive waste is already embedded in the Radiation Protection Act (Art. 36b (3) StrSchG)

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.

The costs of disposing of radioactive waste should also be borne by the producers. This "polluter pays principle" is embedded in Article 36c (2) no. 1 and 2 Radiation Protection Act. Holders of a licence according to the Radiation Protection Act and owners of radioactive waste from work with natural radiation sources, must, on the one hand, pay a processing fee for the processing and interim storage at NES and, on the other hand, a precautionary fee (Vorsorgeentgelt) pursuant to Article 36c (2) no. 2 of the Radiation Protection Act. The latter is to be used by the Republic of Austria as dedicated revenue exclusively to finance a subsequent final disposal of this radioactive waste.

Radioactive waste must be isolated from humans and the environment in the long term (safe disposal). 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 the state-of-the-art design and construction of a safe repository in such a way that it can be left to itself after the final closure.

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 a repository are much more extensive than for an interim storage facility. 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 or for an activity related to the management of radioactive waste has been achieved.

7.2 MONITORING MEASURES

Any significant impact of the programme on the environment should be monitored to detect unforeseeable negative effects at an early stage and to be able to take suitable corrective measures. Existing monitoring mechanisms can be used if appropriate. The following details existing monitoring mechanisms that are used for the protected goods that are likely affected by the NRWMP.

7.2.1 ENVIRONMENTAL MONITORING PROGRAMME

Monitoring must comply with international standards (IAEA 2014b) and fundamentally depends on the hazard potential of the radioactive waste in conjunction with the type of repository over time. In any case specific parameters must be monitored that demonstrate the condition of the protected goods (e.g. groundwater, hydrology, geology, seismology, air, soil). The specifications of the IAEA Safety Standards parameters provide guidance (see Table I-1, p. 51ff).[43]

The results achieved from monitoring will be used to review the validity of the assumptions made and to make an updated assessment of facility safety.

7.2.2 SOIL AND LANDSCAPE

Land consumption and soil sealing in Austria will be recorded by the Federal Office of Metrology and Surveying from the regional information of the land-register database and will be processed and published by the Environment Agency Austria. This information is available from the following link[44]. This existing information can generally be referred to as part of the NRWMP.

7.2.3 WATER

The implementation of the WFD requires programmes to monitor the status of water bodies in accordance with the Austrian Water Act (WRG) as amended in Art. 59C to 59i and applied nationwide according to standard specifications based on the Water Status Monitoring Regulation (GZÜV) Federal Law Gazette 479/2006. Differentiation is made between the following three types of monitoring programmes in terms of their objectives:

- Surveillance monitoring (Art. 59e WRG 1959)
- Operational monitoring (Art. 59f WRG 1959)
- Investigative monitoring (Art. 59g WRG 1959)

Surveillance and operational monitoring are used to monitor the status of ground water and surface water and are regulated in the Water Status Monitoring Regulation (GZÜV Federal Law Gazette II No. 479/2006). Investigative monitoring is performed as required by the regional water authorities.

Groundwater is monitored both in terms of quantity (status of water tables or spring discharges) and in terms of specific chemical and physical parameters. In principle, all groundwater bodies are subject to surveillance

[43] IAEA: Safety Standards – Monitoring and Surveillance of Radioactive Waste Disposal Facilities
[44] Data on land consumption in Austria -http://www.umweltbundesamt.at/umweltsituation/raumordnung/rp_flaecheninanspruchnahme/

monitoring and all those groundwater bodies that currently do not meet environmental objectives, are also subject to operational monitoring. Surveillance monitoring of the surface water includes monitoring both material and all biological and hydromorphological quality components, operational and investigative monitoring includes those components or parameters that are most informative for the relevant pollution situation or for which parameters the current analysis has determined jeopardise the attainment or continuation of the good status of water bodies.

The monitoring programmes are continued on an on-going basis according to the specifications of the Water Status Monitoring Regulation (GZÜV Federal Law Gazette II No. 479/2006 and the Ordinance on the Monitoring of the Water Cycle (WKEV) Federal Law Gazette II 2006/478. By updating the monitoring programmes, longer term trends can be observed and the correctness of predicted environmental impacts and the effectiveness of implemented measures can be reviewed.

A concept for long-term water monitoring (especially groundwater) should be created for the repository site(s).

7.2.4 AIR

The protected good air is monitored on an on-going basis as part of the implementation of the Immission Control Act - Air (IG-L)[45] and the Ozone Act[46] or the regulation on measurement concepts[47] for the IG-L and the Ozone Act[48] and the air pollutants specified in the Ozone Act. For specific projects, primarily as part of EIA-required initiatives, the project applicants measure immissions as required to determine initial pollution levels; in individual cases a monitoring programme is required by the authorities. Further air pollutants are measured as required as part of special measurement campaigns.

7.2.5 ANIMALS, PLANTS, HABITATS AND BIODIVERSITY

The Habitats Directive[49] (Article 17) commits EU Member States to record the conservation status of all species and habitats for the entire region of the Member State and to submit a report to the European Commission every six years. This report contains particular information on the conservation measures and the assessment of impacts of these measures on the conservation status of the habitat types of Annex I and the species of Annex II and the key monitoring results. Austria's second comprehensive report (ELLMAUER et al. 2013)[50] covers the reporting period 2007–2012. This reports on 74 types of habitat and 209 animal and plant species.

[45] Immission Control Act - Air (IG-L; Federal Law Gazette I 115/1997 as amended): Austrian Federal Law for the protection against immissions caused by air pollutants, which amends the 1994 Trade Act, the Clean Air Act for Boilers, the 1975 Mining Act, the Waste Management Act and the Ozone Act.

[46] Ozone Act (Federal Law Gazette No. 210/92 as amended): Austrian Federal Law on measures to safeguard against ozone pollution and public information about high ozone pollution, which amends the Smog Alert Act, Federal Law Gazette No. 38/1989, (Federal Law Gazette I No. 34/2003).

[47] Air quality measurement concept for the Immission Control Act 2012 (IG-L-MKV 2012; Federal Law Gazette II 127/2012): Regulation of the Federal Ministry for Agriculture, Forestry, Environment and Water Management on air quality measurement concept for the Immission Control Act – Air (IGL-L-MKV 2012)

[48] Ozone measurement concept regulation (Ozon-Messkonzept-VO; Federal Law Gazette II No. 99/2004): Ozone measurement concept regulation of the Federal Ministry for Agriculture, Forestry, Environment and Water Management

[49] Habitats Directive: Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

[50] Ellmauer, T.; Moser, D.; Rabitsch, W.; Zulka, K. P. & Berthold, A. (2013): Preparation of the Austrian report in accordance with Article 17 Habitats Directive, reporting period 2007–2012. Abstract. Study on behalf of the Federal Ministry for Agriculture, Forestry, Environment and Water Management and the Austrian Federal States: 31 S. The document is available on the website of the Environment Agency Austria under Umweltsituation > Naturschutz > Natura 2000 > Nationale Berichte.

The Birds Directive 2009/147/EEC (Article 12) stipulates that every three years the Member States must submit a report to the Commission on the application of the provisions issued based on this directive. The first Austrian report (DVORAK & RANNER 2014) in accordance with Article 12 of the Birds Directive, 2009/147/EC covers the reporting period 2008 to 2012.

7.2.6 HUMANS

In Austria there is a nationwide automatic measuring system for radioactivity in the environment (radiation early warning system). This currently consists of more than 300 ambient dose rate measuring points and 10 air monitors to record the activity concentration in ground-level air. The measurements of the radiation early warning system are available online in the alarm centres of the BMNT, of the Federal Ministry of the Interior (BMI) and of the federal states. Approximately 100 ambient dose rate measuring points are available online to the public as a representative cross-section. [51]

[51] The Austrian radiation early warning system Link

8 PUBLIC PARTICIPATION AND TRANSBOUNDARY CONSULTATIONS

THE ENVIRONMENTAL REPORT for the draft NRWMP is published as part of the public participation[52]. A public edition of the NRWMP and the environmental report is made available for six weeks. During this period, opinions on both documents can be submitted.

The documents can be downloaded from the BMNT website: www.bmnt.gv.at/entsorgungsprogramm.

Opinions of environmental bodies on the scoping document (defining the study framework) and observation of these opinions have been considered in the environmental report (see section 9).

The neighbouring states may participate in transboundary consultations within the framework of the Strategic Environmental Assessment. This participation takes place in the following steps:

- Submission of notification
- Explanation of the participation of the concerned federal states
- Submission of the environmental report
- Public participation in the concerned federal states
- Expert consultations as required

[52] The documents are online available: www.bmnt.gv.at/entsorgungsprogramm

9 OPINIONS ON THE SCOPING-DOCUMENT AND THEIR CONSIDERATIONS

IN ACCORDANCE WITH THE SEA DIRECTIVE, there was no public participation as part of scoping, however, authorities mentioned in accordance with Article 5 (4) (so-called environmental bodies) were consulted when defining the scope and level of detail of the information to be included in the environmental report.

The scoping document was submitted to the regional governments for their opinion as environmental bodies and a scoping deadline at BMLFUW was also provided. It was possible to submit opinions in the period from 10 February to 24 March 2017. This option was used by the following environmental bodies:

- Province of Salzburg
- Province of the Tyrol
- Vienna Environmental Ombudsman

The Federal Ministry, as a programme-creating body, would like to thank these organisations for their constructive comments and additions.

9.1 PROVINCE OF SALZBURG, WATER MANAGEMENT PLANNING BODY

CONTENT OF THE OPINION

The content of the opinion is only available in German. Find the considerations in the environmental report below.

CONSIDERATION IN THE ENVIRONMENTAL REPORT

In the environmental report the likely impacts, primarily on the groundwater as a result of constructing and operating various (however currently unknown) types of repository are addressed, for instance on deep rock strata, tectonics and groundwater aquifers. Furthermore, impacts on groundwater or entry into receiving water as a result of accidents with construction machinery and vehicles (spillage of operating fluids) are considered (see for example 6.2.1 to 6.2.5). There is a particular focus on the impact on water quality as a substantial influence of the water quantity across Austria cannot be assumed by sampling water from one repository site. This is also reflected in the indicator “quality of surface water and groundwater”. The quantity of the groundwater is considered in section 4.2 as part of the description of the current environmental status of the protected good water. However, for a future revision of the National Radioactive Waste Management Programme, for instance at the point of actually searching for a site for one or more repositories, the water abstraction and water use as well as the quantity of affected groundwater bodies should be surveyed.

9.2 PROVINCE OF THE TYROL, ENVIRONMENTAL PROT. DEPT., LEGAL MATTERS

CONTENT OF THE OPINION

The content of the opinion is only available in German. Find the considerations in the environmental report below.

CONSIDERATION IN THE ENVIRONMENTAL REPORT

The NRWMP depicts a route for the final disposal of Austrian radioactive waste as part of a decision-making process and remains at a metalevel in terms of content. The programme does not favour any particular type of facility, nor does it mention specific sites. This environmental report can therefore only remain at a superordinate level. However, for a future revision of the National Radioactive Waste Management Programme and supporting SEA, the detailed suggestions from the opinion of the Province of Tyrol will be incorporated.

The relevance matrix presented in the scoping document was used in principle for the factual system definition, there was no intention to present this matrix in this form for the environmental report. In context terms, however, the comments on the relevance matrix are discussed and incorporated as far as possible.

The effects on soil addressed in the opinion such as particulate air pollutant emissions, liquid and gaseous emissions, landslides, mudslides, avalanches and floods as well as changes to the terrain may only arise as a result of constructing and operating disposal facilities or affect the facilities themselves. Particulate air pollutant emissions are considered when illustrating the current environmental status of the protected good air (see, for example, section 4.3) and when illustrating the impacts as a result of construction work and transportation (see sections 6.2.1 to 6.2.5 and section 6.4). The occurrence of external effects (e.g. landslides, mudslides, avalanches, floods, rockfalls, earthquakes...) that could compromise the safety of the repository, will be included in comments on site requirements.

Changes in terrain can be illustrated by the soil indicator “proportion of areas that have lost their natural soil functions, soil consumption/land consumption”. As a result of the low level of detail, the environmental report is limited to presenting impacts on land consumption and cannot be supplemented to include the soil quality as suggested in the opinion. The cited examples (evaluation of soil functions etc.), however, must be specifically considered in a revision of the NRWMP (e.g. site selection). The soil protection legislation of the federal states has been supplemented.

The point raised in the opinion “conservation of soil functions, particularly in view of protecting erosion and protecting groundwater and spring water” was referred to when illustrating the current environmental status of the protected good soil.

Local water use and water abstraction can be affected by the construction and operation of disposal facilities, for instance at deep rock strata, tectonics and groundwater aquifers. Impacts on groundwater or entry into receiving water as a result of accidents with construction machinery and vehicles (spillage of operating fluids), waste or residues are therefore considered in the environmental report (see, for example, 6.2.1 to 6.2.5). Impacts as a result of vibrations have been considered in the description of the construction phase of the facilities (see sections 6.2.2 to 6.2.5).

The quantity of Austrian groundwater is addressed in section 4.2, in which the current environmental status of the groundwater was presented. Impacts on the quantity of the groundwater as a result of implementing the NRWMP (also a future version incl. site search) are not expected at present.

The Austrian National Radiation Emergency Plan, the Catalogue of Countermeasures for Radiation Emergencies and the Austrian National Sampling Plan are taken into account in the National Radioactive Waste Management Programme.

As the present NRWMP does not consider site alternatives nor does it favour technical disposal options, the causes mentioned in the opinion of impacts on the landscape and on animals, plants, habitats and biodiversity cannot be excluded. The protected good landscape was therefore considered in the environmental report in connection with the protected good soil and the indicator “land consumption”. Impacts on animals, plants, habitats and biodiversity are described in general in the environmental report in sections 6.2.1 to 6.2.5 for various phases (construction, operation and follow-up phases) of individual technical disposal options. More detailed explanations on a possible consideration of landscape, animals, plants, habitats and biodiversity must be given as part of an SEA for a future revised NRWMP.

9.3 VIENNA ENVIRONMENTAL OMBUDSMAN

As the agent for nuclear safety in Vienna

CONTENT OF THE OPINION

The content of the opinion is only available in German. Find the considerations in the environmental report below.

CONSIDERATION IN THE ENVIRONMENTAL REPORT

The NRWMP contains no information on one or more future sites for the final disposal of Austrian radioactive waste. The spatial system definition of the Strategic Environmental Assessment for the present National Waste Management Program, however, takes place through the state border, even if the cooperation on European or international level is to be sought for the preparation of the future disposal. For future revisions of the NRWMP, the study area should be detailed accordingly (see section 3). This also applies to adapting the illustration of the environmental status to altered framework conditions as a result of significant amendment of the waste management programme.

The forecast horizon was specified as until 2045.

Hydrological changes were considered as possible impacts when constructing and operating various repository types (see sections 6.2.1 to 6.2.5). Traffic commotion was considered as a possible impact when constructing and operating repositories (see sections 6.2.1 to 6.2.5 as well as 6.4).

In the opinion of the Vienna Environmental Ombudsman, it suggests expanding the indicator for animals, plants, habitats and biodiversity (“animal species as indicators of habitat quality”) to include flora as well as fauna. It is noted that the focus on presenting the environmental status for these protected goods is on bird species, because these are suitable for illustrating the biodiversity of other groups of organisms and their habitats, this also includes the flora. More detailed explanations must be given for a future revised NRWMP as part of an SEA.

Extensive public participation is conducted according to the requirements of the SEA Directive or the relevant provisions in accordance with Article 36b of the Radiation Protection Act as part of a public edition, with the possibility of submitting opinions (see section 8).

10 INTERPRETATIVE DOCUMENTS AND LITERATURE

BMNT (Federal Ministry for Sustainability and Tourism) (2018): Draft National Radioactive Waste Management Programme according to Art. 36b of the Radiation Protection Act

BMNT (Federal Ministry for Sustainability and Tourism) (2018b): Water Quality in Austria. Annual report (2013-2015). Vienna.

BMLFUW (Federal Ministry for Agriculture, Forestry, Environment and Water Management) (2017): Scope as part of the Strategic Environmental Assessment in accordance with Directive 2001/42/EC of the National Radioactive Waste Management Programme in accordance with Art. 36b of the Radiation Protection Act

BMLFUW (Federal Ministry for Agriculture, Forestry, Environment and Water Management) (2015b): Indicator Report MONE 2015 On the Way to a Sustainable Austria. Vienna.

BMLFUW – Federal Ministry for Agriculture, Forestry, Environment and Water Management (2015c): National Water Management Plan. Vienna. Link

BMLFUW – Federal Ministry for Agriculture, Forestry, Environment and Water Management (2015a): Water Quality in Austria. Annual report 2014. Vienna.

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FORSCHUNGSZENTRUM SEIBERSDORF (ed.) (1992): *Entsorgung radioaktiver Abfälle aus Österreich, Zusammenfassung der Expertendiskussion* (Management of Austria's radioactive waste, summary of the expert discussion). OEFZS-4641, Ela report no.: 74

IAEA (2014a): IAEA SAFETY STANDARDS SERIES No. SSG-29: Near Surface Disposal Facilities for Radioactive Waste. Vienna. Link

IAEA (2014b): IAEA SAFETY STANDARDS SERIES No. SSG-31: Monitoring and Surveillance of Radioactive Waste Disposal Facilities. Vienna. Link

IAEA (2012): IAEA SAFETY STANDARDS SERIES No. SSR-6: Regulations for the Safe Transport of Radioactive Material. Vienna. http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1570_web.pdf

IAEA (2011): IAEA SAFETY STANDARDS SERIES No. SSG-14: Geological Disposal Facilities for Radioactive Waste. Vienna. Link

IAEA (2009a): IAEA SAFETY STANDARDS SERIES No. GSG-1: Classification of Radioactive Waste. Vienna. Link

IAEA (2009b): IAEA SAFETY STANDARDS SERIES No. SSG-1: Borehole Disposal Facilities for Radioactive Waste. Vienna. Link

IAEA (2002): IAEA SAFETY STANDARDS SERIES No. TS-G-1.2: Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material. Vienna. Link

ÖSTERREICHISCHES ÖKOLOGIEINSTITUT (2010): *Positionspapier zur Lagerung des österreichischen radioaktiven Abfalls* (Position paper on the storage of Austrian radioactive waste). Vienna.

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ENVIRONMENT AGENCY AUSTRIA (2017a): Pazdernik, K.; Anderl, M.; Gangl, M.; Haider, S.; Mandl, N.; Moosmann, L.; Poupa, S.; Purzner, M.; Schieder, W.; Stranner, G. & Zechmeister, A.: Emissionstrends 1990–2015. Ein Überblick über die Verursacher von Luftschadstoffen in Österreich (Datenstand 2017). Umweltbundesamt, Wien. An overview of the causes of air pollutants in Austria (data inventory 2017)). Reports, Bd. REP-0625. Federal Environment Agency, Vienna.

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ENVIRONMENT AGENCY AUSTRIA (2013): State of the Environment in Austria. Tenth State of the Environment Report of the Federal Minister of the Environment to the Austrian National Assembly. Reports, vol. REP-0410. Federal Environment Agency, Vienna.

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ZULKA, K. P. (Red., 2007): *Rote Liste gefährdeter Tiere Österreichs. Checklisten, Gefährdungsanalysen, Handlungsbedarf. Teil 2: Kriechtiere, Lurche, Fische, Nachtfalter, Weichtiere* (Red List of Threatened Species in Austria. Checklists, risk analyses, call for action. Part 2: Reptiles, amphibians, fish, moths, molluscs). *Grüne Reihe* of the Federal Ministry for Agriculture, Forestry, Environment and Water Management Volume 14/2: Böhlau, Vienna. 515 pages.

ZULKA, K. P. (Red., 2009): *Rote Liste gefährdeter Tiere Österreichs. Checklisten, Gefährdungsanalysen, Handlungsbedarf. Teil 3: Flusskrebse, Köcherfliegen, Skorpione, Weberknechte, Zikaden* (Red List of Threatened Species in Austria. Checklists, risk analyses, call for action. Part 3: Crayfish, caddis flies, scorpions, harvestmen, cicadas). *Grüne Reihe* of the Ministry of Life, Volume 14/3. Böhlau, Vienna. 534 pages.

LEGAL STANDARDS AND GUIDELINES

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Habitats Directive: Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management - https://www.bmlfuw.gv.at/umwelt/strahlen-atom/strahlenschutz/radioakt-abfall/jointvonvention.html

Water Status Monitoring Regulation – GZÜV: Ordinance of the Federal Ministry for Agriculture, Forestry, Environment and Water Management on the Monitoring of the Quality of Water Bodies, Federal Law Gazette II No. 465/2010

Groundwater Directive (GWD): Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration, OJ L 372, 27 December 2006

Air quality measurement concept for the Immission Control Act 2012 (IG-L-MKV 2012; Federal Law Gazette II 127/2012): Regulation of the Federal Ministry for Agriculture, Forestry, Environment and Water Management on air quality measurement concept for the Immission Control Act – Air (IGL-L-MKV 2012)

Immission Control Act - Air (IG-L; Federal Law Gazette I No. 115/1997 as amended). Austrian Federal Law for the protection against immissions caused by air pollutants, which amends the 1994 Trade Act, the Clean Air Act for Boilers, the 1975 Mining Act, the Waste Management Act and the Ozone Act.

Ordinance on Interventions; Ordinance on Interventions in Case of Radiological Emergencies and in Case of Lasting Exposure (IntV) of 2007, Federal Law Gazette II No. 145/2007 as amended

Air Quality Directive (2008/50/EC): Directive of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. OJ No. L 152.

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Federal law on the transport of dangerous goods (Gefahrgutbeförderungsgesetz - GGBG, Federal Law Gazette. I No. 145/1998)

Directive: 2008/68/EC of the European Parliament and of the Council of September 2008 on the inland transport of dangerous goods ABl. No. L 260

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European Convention on the International Carriage of Dangerous Goods by Road (ADR), Federal Law Gazette No. 522/1973

Convention on International Carriage by Rail (COTIF), Federal Law Gazette III No. 122/2006, Annex C - Regulations for the International Carriage of Dangerous Goods by Rail (RID)

Convention on the International Carriage of Dangerous Goods by Inland Waterways (ADN), Federal Law Gazette III No. 67/2008

Chapter VII of the International Convention for the Safety of Life at Sea 1974, and the Protocol to the International Convention for the Safety of Life at Sea (SOLAS Convention 1978) and the International Maritime Dangerous Goods Code (IMDG Code) acc. § 2 (1) of the Maritime Fulfillment Act (SSEG), Federal Law Gazette No. 387/1996

Annex 18 of the Convention on International Civil Aviation, Federal Law Gazette No. 97/1949, including the Technical Instructions for the Safe Transport of Dangerous Goods by Air of the ICAO (ICAO-TI)

Ozone Act (Federal Law Gazette No. 210/1992 as amended): Austrian Federal Law on measures to safeguard against ozone pollution and public information about high ozone pollution, which amends the Smog Alert Act, Federal Law Gazette No. 38/1989, (Federal Law Gazette I No. 34/2003).

Ordinance on the Shipment of Radioactive Waste 2009 (Rabf-VV 2009), Federal Law Gazette II No. 47/2009 as amended

Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation and repealing directives 89/618/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom, (Official Journal. 13/1 ff of 17.01.2014) – (Basic Safety Standards Directive)

Council Directive 2013/51/Euratom laying down requirements for the protection of the health of the general public with regard to radioactive substances in water intended for human consumption

Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste (Official Journal No. L 199/48 of 2 August 2011).

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 98/83/EC of 3 November 1998 on the quality of water intended for human consumption (Official Journal No. L 300 of 5 December 1998)

SEA Directive: 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

SEA Protocol: Protocol on Strategic Environmental Assessment to the COnvention on Environmental Impact Assessment in a Transboundary Context – link

Radiation Protection Act – StrSchG (Federal Law Gazette I No. 133/2015 as amended): Federal law on measures to protect the life and health of humans including that of their offspring from harm caused by ionising radiation

Convention on Environmental Impact Assessment in a Transboundary Context
(Espoo Convention)

Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters
(Aarhus Convention)

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Federal Water Act 1959 (WRG), Federal Law Gazette No. 215/1959 as amended

LINKS

BMNT – Radiation protection: www.bmnt.gv.at/umwelt/strahlen-atom.html

Radiation Early Warning System:
www.bmnt.gv.at/umwelt/strahlen-atom/strahlen-warn-system/sfws.html

Environment Agency Austria – Radiation protection:
www.umweltbundesamt.at/umweltsituation/kernenergie/strahlenschutz/

Radiation measurement data, Environment Agency Austria:
www.umweltbundesamt.at/umweltsituation/kernenergie/strahlenschutz/sws_daten/

Monitoring radioactivity in food in Austria:
www.bmgf.gv.at/home/Schwerpunkte/VerbraucherInnengesundheit/Lebensmittel/Routinemaessige_Lebensmittelueberwachung_auf_Radioaktivitaet_in_Oesterreich

11 GLOSSARY AND LIST OF ABBREVIATIONS

IAEA: International Atomic Energy Agency

LILW-SL: Low and Intermediate Level Waste - Short Lived; low- and intermediate-level waste with radionuclides with half lives of approx. 30 years maximum;

LILW-LL: Low and Intermediate Level Waste - Long Lived; low- and intermediate-level waste that contains long-lived radionuclides

NES: Nuclear Engineering Seibersdorf, formerly Forschungszentrum Seibersdorf

NRWMP: National Radioactive Waste Management Programme

RA: Radioactive waste

SEA: Strategic Environmental Assessment

StrSchG: Radiation Protection Act

EIA: Environmental Impact Assessment

WRG: Federal Water Act

WFD: Water Framework Directive

ABBREVIATIONS FOR THE PROTECTED GOODS:

S/La: Soil and landscape

W: Ground water and surface water

A: Air

APHP: Animals, plants, habitats and biodiversity

H: Humans