Austria

AUSTRIAN NATIONAL REPORT

under the

JOINT CONVENTION ON THE SAFETY OF SPENT FUEL AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

May 2003

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SECTION A INTRODUCTION

(a) General outline of Austria's national policy on the safety of spent fuel management and on the safety of radioactive waste management

Austria has never operated a nuclear power plant and has no intention to do so in the future. Thus, Austria's high interest in the safety of spent fuel management and on the safety of radioactive waste management is related primarily to valid contracts for reshipment of spent fuel from the remaining two research reactors and on the safety of radioactive waste management concerning radioactive waste from research, medical and industrial use in Austria.

Already in 1978, the Austrian electorate decided in a referendum not to start the operation of the completed nuclear power plant in Zwentendorf. Shortly thereafter, on December 15th, 1978, the Austrian parliament promulgated a law on the prohibition of the use of nuclear fission for energy generation in Austria [BGBl[1] No. 676/1978: *Bundesgesetz über das Verbot der Nutzung der Kernspaltung für die Energieversorgung in Österreich"*]. This position was strengthened by the Chernobyl accident in 1986 which substantially increased the opposition of the political parties and the public at large against nuclear power. Austria was at the time among those countries in Central Europe which were most affected by the Chernobyl accident.

In 1999, the Austrian parliament passed unanimously a constitutional law on a nuclear-free Austria [BGBl. I No. 149/1999: *Bundesverfassungsgesetz für ein atomfreies Österreich"*]. It stipulates, inter alia, that installations which serve for energy generation by nuclear power must not be constructed nor, if they already exist, come on line. Furthermore, the law prohibits the transport of radioactive material for purposes of nuclear power generation or disposal unless this conflicts with international obligations.

In view of the high cross border risks emanating from nuclear installations, especially from close border nuclear power plants, Austria attaches utmost importance to international efforts to harmonise and steadily increase all aspects of nuclear safety including the management of radioactive waste on an international level. Consequently, as Austria has to undertaken a number of bilateral activities with neighbouring countries with regard to the exchange of information on nuclear safety matters including the fuel cycle and the management of radioactive waste.

Austria has contributed and will contribute to all international activities which aim at improving safety levels concerning nuclear matters in general as well as the safety of spent fuel management and the safety of radioactive waste management worldwide. In this respect, Austria regards the Joint Convention on the safety of spent fuel management and on the safety of radioactive waste management a very important tool in developing a global nuclear safety culture in general. Its regular Review Meetings provide a highly welcome opportunity to review progress in the Member States of the Convention and to exchange views on how best to implement its provisions.

[1] [*Bundesgesetzblatt* = Federal Law Gazette]

(b) Main themes of the report

This report provides

- a detailed description of the Austrian policy and the usual practicies concerning the management of spent fuel of the Austrian research reactors and the management of radioactive waste (see Section B);
- a detailed description of the Austrian legal regime concerning the management of spent fuel of the Austrian research reactors and the management of radioactive waste (see Section E).

SECTION B POLICIES AND PRACTICES

Article 32 (Reporting), paragraph 1

(a) Spent fuel management policy

In Austria it is foreseen that spent fuel from research reactors is returned and will be returned in the future to the United States Department of Energy. This means that Austria will not have to deal with high level radioactive waste and therefore Austria has no obligations as regards the interim storage of a greater amount of spent fuel or for the final disposal of spent fuel.

(b) Spent fuel management practices

Spent fuel from the research reactors is stored on site until the return shipment to the United States. Shipment follows applicable transport and safeguards legislation.

Wet interim storage of spent fuel of the ASTRA research reactor of the Austrian Research Centers Seibersdorf was situated in a pool of a specially adapted hot cell of the Hot-Cell-Laboratory at Seibersdorf. All spent fuel from this research reactor has been returned to the United States in 2001.

Dry interim storage of spent fuel of the research reactor of the Austrian Universities at the Atomic Institute in Vienna is situated in the reactor building as usual for TRIGA MARK research reactors.

There is currently no interim storage of spent fuel from the research reactor in Graz on account of its special use as a zero power reactor. The burn-up of the fuel elements is about 10^{-5} percent. The usual power during the experiments is 1 Watt maximum.

Storage of spent fuel follows applicable radiation protection and safeguards legislation. An appropriate license is needed for the storage and annual inspections are performed by the licensing authority.

(c) Radioactive waste management policy

Austrian national authorities take over responsibility for the availability of necessary technical infrastructure and equipment for the treatment of radioactive waste, like sorting, compacting, incinerating, cleaning of contaminated water and conditioning, as well as for the buildings for the interim storage.

Since the beginning of 2003 Austria's radioactive waste management policy follows the polluter pays principle, meaning that producers of radioactive waste have to bear full costs of treatment, interim storage and final disposal, while the necessary equipment for the treatment is financed by the state.

According to the Austrian legal framework all long-lived radioactive waste has to be brought to the "Nuclear Engineering Seibersdorf GmbH" (NES), a company located at the site of the Austrian Research Centers GmbH at Seibersdorf, south of Vienna, or to an equivalent institution for treatment and interim storage.

Radioactive waste with short half-lifes has preferable to be stored in an interim storage by the producers until it has decayed and can be released to the environment, to a waste disposal for non radioactive waste or to a waste treatment facility for infectious waste.

For the later transfer to a final repository, for a possible additional treatment required by the final repository waste acceptance criteria and for long term stewardship of the final repository, the producer has to contribute to a fund financially administrated by Austrian national authorities. The final disposal fee is estimated based on fees assessed by several existing final repositories abroad. Should the collected funds be insufficient to pay for the real costs of final disposal, the Austrian state will cover the difference.

Regarding an Austrian final disposal various studies have shown that the construction as well as the operation of such a disposal requires a minimum amount of radioactive waste, otherwise the economic implications would be unacceptably high from a today's point of view. Based on current knowledge it is extremely unlikely that quantities of radioactive waste sufficient to justify national final disposal from an economic point of view are generated in small countries like Austria without nuclear power plants.
Recent discussions within the European Union highlighted this problem and indicated that there is a common European responsibility. Consequently, Austria is convinced that this sense of responsibility would imply that states operating nuclear power plants cooperate closely with non nuclear power countries to develop solutions to their problem of final disposal of radioactive waste. In this context it should be noted that - at least from an Austrian point of view - nuclear power plants, especially those located in the vicinity of national borders, inflict high risks upon neighbouring counties, forcing them to establish and maintain costly off-site emergency preparedness procedures.

(d) Radioactive waste management practices

Radioactive waste in Austria originates primarily from medicine, research and industry. Only low level and intermediate level waste derives from those sources. Spent fuel from research reactors is being returned to the country of origin. No other high level waste is being produced.

"Nuclear Engineering Seibersdorf GmbH" (NES), a company located at the site of the Austrian Research Centers GmbH in Seibersdorf, is charged by the responsible Austrian Ministry of Agriculture, Forestry, Environment and Water Management to serve as a centralized facility to treat, condition and store all types of low level and intermediate level radioactive waste from Austria.

A number of treatment and conditioning systems are operated by NES. The aim of treatment and conditioning is to transform the radioactive waste into an insoluble form and to safely isolate it from the environment. At the same time it is important to reduce the volume of the raw waste in order to lower the cost of interim and long term storage. The aim is further to have preferably only mineralised, incombustible radioactive waste to be conditioned.

All activities are performed in accordance with Austrian laws and regulations.

Compared to countries using nuclear power, only very small quantities of radioactive waste are produced, but all categories of waste arise (liquids, solids, sealed sources...) and have to be handled, treated, conditioned and stored applying the same safety standards and techniques used for larger quantities of waste. Therefore the fixed costs of waste treatment are high.

The dominant amount of solid waste is combustible waste from hospitals.

Liquid waste originates mainly from the NES incinerator (wet scrubber) operations and, in the past, from reactor operations. Only a small fraction of liquid waste originates from medical facilities and universities.

At present, the decommissioning of the ASTRA research reactor is being carried out. The low and intermediate level waste resulting from decommissioning is being treated and stored at NES. The quantity of radioactive waste that will originate from the ongoing reactor decommissioning is estimated at about 160 tons of low level waste and less then 1 ton of intermediate level waste.

Sealed sources are widely used for industrial purposes. Radionuclides such as ^{60}Co, ^{137}Cs, ^{241}Am and others are in use. Sources containing ^{60}Co and ^{137}Cs are used for medical applications as radiation sources for high dose treatment. Such sources are few in number but their radioactivity dominates the total activity inventory in the NES interim storage. A special category of sources are radium sources used from around 1900 to about 1960 for medical treatment. They were produced in different quality and some showed a tendency for leakage. Due to the high radio toxicity of radium, their usage was discontinued and radium was replaced by safer sources as soon as they were available. More then 13 g of radium were conditioned and are stored in the interim storage facility.

Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) originating from different industrial processes is treated and conditioned at NES.

As an example, more than 3 tons of thorium nitrate in glass bottles were recently discovered in a forgotten cellar. After analysing the content, the material was dissolved in water. Because of the high amounts of radon expected during the dissolution process, the operation was carried out in a glove box. The solution was neutralised with sodium hydroxide solution and the resulting sludge directly solidified with cement to give a solid product (status: “not easily recoverable”). In total, 77 drums of 200 l volume containing the conditioned material were obtained and are stored in the interim storage facility.

The following treatment systems are in operation at NES:

- Sorter;
- Incinerator ;
- Water treatment facility;
- Compactor;
- Cementation;
- Hot cell facility;
- Interim storage facility.

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

- Combustible waste is incinerated, the resulting ash is super compacted and the pellets then loaded into 200 litre steel drums for the interim storage, volume reduction: > 20 : 1.

- Non combustible compactable waste is super compacted, the pellets are loaded into 200 litre steel drums for interim storage, volume reduction: ~ 4 : 1.

- Non combustible non compactable waste is filled into 100 litre steel drums centred into 200 litre steel drums, the gap cemented, volume reduction: ~ 1 : 2.

- Aqueous liquids are treated by precipitation and filtration, the resulting sludge is dried, the powder super compacted, volume reduction: > 30 : 1; non dryable sludge is mixed with cement.
- Filters are super compacted, the pellets are loaded into 200 litre steel drums for interim storage.

- Graphite and beryllium elements formerly used within the reactor core are embedded in dry quartz sand and encapsulated in steel tubes.

- Intermediate level waste originating from reactor decommissioning (near core construction material and in core experimental equipment) is cut in pieces fitting into appropriate shielded containers.

- Radioactive sealed sources produced at NES and sold to different users are taken back after their useful life has elapsed or if there is no longer use for them; if still usable for other purposes they are stored at NES and, following tests and checks, may be reused. Before cementing for interim storage, spent sources are segregated according to their half life, e.g. ^{60}Co, ^{137}Cs, ^{241}Am.

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

- High activity sources can be handled in the hot cell facility and are stored in storage tubes in one of the hot cell boxes.

(e) Criteria to define Categories of radioactive waste

For NES purposes, **low level waste** is defined as having a dose rate of less than 100 μSv/h at a distance of 1m from the unshielded material. Material producing higher dose rates is considered **intermediate level waste**.

SECTION C SCOPE OF APPLICATION

Article 3 (Scope of Application)

As mentioned before in Section A and Section B spent fuel management does not occur in Austria because Austria is operating only research reactors and all spent fuel will be returned to the United States.

Austrian legislation covers the safety of radioactive waste management from civilian applications as well as from military applications. Usually all radioactive waste from military applications is brought to the NES except for radioactive material being damaged and/or lost in case of military dispute.

Austrian legislation declares waste that contains only naturally occurring radioactive materials as radioactive waste if the exposure to the general public exceeds legally binding limits in the case of release of this material to the environment or in case of disposal in repositories for non-radioactive waste.

SECTION D INVENTORIES AND LISTS

Article 32 (Reporting), paragraph 2

(a) Spent fuel management facilities

In Austria, there are no spent fuel management facilities.

(b) Inventory of spent fuel

Only at the research reactor of the Austrian Universities in Vienna 8 spent fuel elements are in interim storage. The table in Section L (a) shows the relevant details.

(c) Radioactive waste management facilities

There is one radioactive waste management facility in Austria:

> "Nuclear Engineering Seibersdorf GmbH" (NES),
> A-2444 Seibersdorf
> Phone: +43 (0) 50550-0
> Fax: +43 (0) 2254-74 0 60

This company, majoritarian owned by the Austrian state, is located at the site of the Austrian Research Centers, south of Vienna. This facility has the obligation to sort, compress, incinerate and condition radioactive waste. The facility also has to clean aqueous liquids and to interim store the conditioned radioactive waste. It is also responsible for the decommissioning of the closed research reactor at the Austrian Research Centers Seibersdorf.

Compared to countries using nuclear power, only very small quantities of radioactive waste are produced in Austria, but all categories of waste arise (liquids, solids, sealed sources...) and have to be handled, treated, and stored applying the same safety standards and techniques used for larger quantities of waste. Therefore the fixed costs of waste treatment are rather high in Austria.

(d) Inventory of radioactive waste

Up to the end of 2002, the following quantities of low and intermediate level waste have been produced in Austria:

- solid waste ~7000 m³ ,
- liquid waste ~ 50000 m³ .

All of this waste has been treated, conditioned, and stored in the NES interim storage facility.

The following activity inventory is present in the NES interim storage facility:

- total activity of low level radioactive waste: ~ 2E+14 Bq,
- total activity of intermediate level waste : ~ 1E+15 Bq.

In the interim storage facility, there are presently about 9500 200-L drums containing conditioned radioactive waste.

It is the intention for the next years to adapt the building of the former ASTRA Research Reactor for interim storage in a way that single drums will be accessible for inspection and/or retrievable for reconditioning if necessary.

The capacity of the existing interim storage is 15000 200-L drums.

For a detailed nuclide inventory of conditioned radioactive waste presently in interim storage in Seibersdorf, see Section L (b).

(e) Nuclear facilities in the process of being decommissioned

As mentioned in Section B the ASTRA research reactor at the Austrian Research Centers Seibersdorf (A-2444 Seibersdorf) has been shut down in July 1999, the spent fuel has been brought back to the United States Department of Energy in May 2001. At the end of 2002 the environmental impact assessment could be finished successfully. Decommission work is going on and will last five years. Resulting waste is being treated by NES.

The reactor building will be used after full decontamination as interim storage in the future.

SECTION E LEGISLATIVE AND REGULATORY SYSTEM

Article 18 (Implementing measures)

Austria has fully implemented the content of the Joint Convention in its legislation.

Article 19 (Legislative and Regulatory Framework)

(a) Introduction

As outlined in the introduction, Austria's use of nuclear energy for peaceful purposes has been significantly influenced by the passing of the law prohibiting the use of nuclear fission for energy purposes in 1978 and by passing the constitutional law on a nuclear-free Austria in 1999.

Austrian legislation in the field of radioactive waste management comprises all legal provisions relating to the safety of spent fuel management for research reactors and on the safety of radioactive waste management. The following areas can be distinguished:

- radiation protection: all rules and measures concerned with the protection of the lives or health of human beings and future generations from damage due to ionising radiation arising from spent fuel or radioactive waste;
- installation safety: all constructional and technical norms and standards designed to afford protection against radiation from spent fuel or radioactive waste.

These matters are dealt with in a variety of laws and regulations and may each involve a number of federal *(Bund)* and regional *(Land)* authorities.

Beyond specific provisions for licensing as referred to in specific laws the General Administrative Procedures Act of 1991 [BGBl No. 51/1991: *Allgemeines Verwaltungsverfahrensgesetz*] applies.

(b) Legal aspects

The Radiation Protection Act of June 11th, 1969 [BGBl No. 227/1969*: Strahlenschutzgesetz,* amended in 2002 taking into account recent EU legislation] and the three Radiation Protection Ordinances, which will replace 1972 Radiation Protection Ordinance in summer 2003 contain detailed provisions concerning the handling of radioactive waste, mainly relating to radiation protection measures but also regulating the financial questions of radioactive waste management.

According to the amendment of the Radiation Protection Act each licensee has to declare in a waste management scheme how he will handle the produced radioactive waste. This declaration is one of the conditions for a license.

<u>Related Instruments:</u>

The 1989 Ordinance on the Specification of Hazardous Wastes [BGBl No. 607/1989: *Verordnung über die Festlegung von gefährlichen Abfällen*] includes radioactive waste within the defined limits of the Radiation Protection Act. Accordingly, radioactive waste is contained in a list of substances to which the 1989 Act on the Rehabilitation of Hazardous Waste Sites applies [BGBl No. 299/1989: *Altlastensanierungsgesetz*].

A further Ordinance on the Transfer of Radioactive Wastes [BGBl No. 44/1997: *Radioaktive Abfälle-Verbringungsverordnung*], relating to the supervision and control of shipments of radioactive waste into, out of and through the national territory, entered into force on March 1st, 1997. It has been issued pursuant to the Radiation Protection Act in order to implement the provisions of Council Directive 92/3/EURATOM of February 3rd, 1992 on the supervision and control of shipments of radioactive waste between Member States and into and out of the Community. The Annexes to the Ordinance define, inter alia, the form of the applicable standard documentation and the list of quantities and concentration levels for radioactive waste.

(c) Radiation Protection

The main focus of Austria's nuclear safety legislation is radiation protection, dealt with primarily in the Radiation Protection Act of June 11th, 1969 [BGBl No. 227/1969*: Strahlenschutzgesetz*, amended in 2002 taking into account recent EU legislation] and three Radiation Protection Ordinances which will replace 1972 Radiation Protection Ordinance in summer 2003.

These instruments define the general measures to protect the lives and health of individuals and their descendants from the hazards of ionising radiation, as well as the licensing conditions for the construction and operation of installations for the handling of radioactive waste.

(d) Radioactive Substances, Nuclear Fuels and Equipment

The main provisions of the Radiation Protection Act of June 11th, 1969 [BGBl No. 227/1969*: Strahlenschutzgesetz*, amended in 2002 taking into account recent EU legislation] relate to the licensing of the construction and operation of installations as far as handling radioactive materials as well as radioactive waste is concerned.

Handling of radioactive materials (work activities with radioactive materials) means the extraction, production, storage, carriage, delivery, supply, import, export processing, use or disposal of radioactive materials or any other activity resulting in the emission of radiation.

Under the Radiation Protection Act, any activities involving radioactive materials or the operation of radiation-emitting devices also require a license if legally binding exemption levels are exceeded. The amendment to the Radiation Protection Act which came into force with beginning of year 2003 demands the introduction of a register for radioactive sources which exceed the exemption levels. This register will help the competent authorities to estimate the potential of future amount of radioactive waste.

The possession of radioactive materials including radioactive waste which is exempted from licensing under the Radiation Protection Act has to be reported. There are exemptions from the requirement to report, e.g. in case that radioactive material is below given limits of activity, or for the transport of radioactive material when it is in compliance with the relevant transport regulations.

(e) Nuclear Installations in Austria

In the 1970s, a nuclear power plant was constructed in Zwentendorf, but as the consequence of the negative vote in a referendum was subsequently it never operated. All nuclear fuel elements were removed in the late 1980s. Currently, Austria operates the following four "nuclear facilities", i.e. three research reactors and a central waste processing and interim storage facility:

- Atominstitut of the Austrian Universities

  The Atominstitut of the Austrian Universities which is administered by the Technical University Vienna operates a TRIGA Mark II research reactor. In operation since March 1962, the reactor has been used exclusively for basic and applied academic research and teaching purposes. The Atominstitut has a total spent fuel storage capacity of 168 fuel elements. Presently there are interimly stored 8 spent fuel elements.

♦ Austrian Research Centers Seibersdorf

The ASTRA research reactor at the Austrian Research Centers Seibersdorf, a 10 MW thermal water-cooled and moderated swimming-pool type reactor, has been in operation since 1960 and has been finally shut down in July 1999. The reactor is in the status of decommissioning. All spent fuel elements have been removed from the reactor and returned to the United States for final storage in May 2001.

♦ Reaktorinstitut Graz (Reactor Institute)

The Graz Reactor Institute has been operating a nominal 10 kW Siemens ARGONAUT reactor since 1965. The fuel enrichment levels are 20% and 90%. The reactor is mainly used for training purposes within the framework of Graz Universities' education programme. It is the intention to shut down the reactor in the near future. Spent fuel will be returned to the United States.

♦ Interim Storage Facility for Radioactive Waste

This waste storage facility together with related waste treatment facilities is operated by the Nuclear Engineering Seibersdorf GmbH" (NES) in order to meet radioactive waste management needs of the Austrian industry, hospitals, other medical institutions and research institutes. The storage facility has a design capacity of 15000 drums of 200 litres each.

(f) Licensing

As a result of Austria's federal structure, the licensing procedures involve federal *(Bund)* as well as regional *(Länder)* authorities.

The construction and operation of installations for the handling of radioactive materials including radioactive waste require a license [Radiation Protection Act, Sections 5-7]. Under the Radiation Protection Act, licensing is a shared responsibility mainly held by the Federal Minister of Agriculture, Forestry, Environment and Water Management *(Bundesministerium für Land- und Forstwirschaft, Umwelt und Wasserwirtschaft).* The distribution of responsibilities is specified in Section 41 of this Act. The issues covered by licensing are primarily based on the Radiation Protection Act and the Radiation Protection Ordinances which will come into force in summer 2003 and will replace Radiation Protection Ordinance of January 12th, 1972 [BGBl No. 47/1972].

The licensing procedure is subject to the provisions of the General Administrative Procedures Act.

An operating license is granted if the installation has been constructed in compliance with the specified conditions and obligations, a radiation protection officer has been appointed and the regular operation of the installation entails no hazard from ionising radiation.

The operation of installations for the handling of radioactive materials including radioactive waste in accordance with the Radiation Protection Act is monitored and inspected at regular intervals by the licensing authority as specified in the pertinent laws.

(g) Radioactive Waste Management

Since Austria does not operate nuclear power plants, there is no major production of high level radioactive waste (HLW). Consequently, there is no need for considering intermediate or final storage capacities in Austria for HLW. The relatively small quantities of HLW resulting from the Austrian research reactors are covered by a framework contract for „US-origin nuclear fuel“ and will be returned to the US during the next years.

Low and intermediate level waste (L/ILW) from hospitals, industries and research laboratories (30-40 tons/year) is collected and treated by the “Nuclear Engineering Seibersdorf GmbH” (NES). These facility is equipped with suitable equipment and infrastructure to treat and condition low and intermedate level waste, e.g. the incinerator, supercompactor and waste water evaporator. As a conditioning process, cementing is predominantly used. A scheme of radioactive waste management in Austria is shown in Section L (d) Figure 1.

On the basis of a joint agreement between the Republic of Austria, the municipality of Seibersdorf and the NES, the intermediate storage facility is currently scheduled to be operated until 2012. This agreement will be replaced by a new agreement in 2003 which guarantees the operation of the radioactive waste treatment conditioning and intermediate storage facilities until 2030. It also guarantees to the NES the necessary financial basis for these tasks, including reconditioning (if necessary) and transfer of the radioactive waste to a final repository.

(h) Emergency Response

According to the Radiation Protection Act, in case of imminent danger from an installation in which radioactive material including radioactive waste is handled the authorities have to take all appropriate measures to avert the danger. They may issue provisional instructions and, after consulting the radiation protection officer of the installation, have to proceed in compliance with Section 4 of the 1950 Act on the Enforcement of Administration Decisions (BGBl No. 53/1991: *Verwaltungsvollstreckungsgesetz*).

(i) Transport

In Austria, the transport of radioactive material including radioactive waste is strictly controlled so as to ensure maximum safety. General safety measures are laid down in the 1969 Radiation Protection Act.

The transport of radioactive material by rail is governed by the provisions of the Regulation Concerning the International Carriage of Dangerous Goods by Rail (RID), an Annex to the Convention Concerning the International Carriage by Rail (COTIF). RID has been applicable to the international transport of dangerous goods in Austria since it became a Party to COTIF. Under the Act on the Carriage of Dangerous Goods[2] of 1998 (GGBG), it also applies to transport operations within Austria.

The international transport of such material by road is primarily subject to the “European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR)” to which Austria is a Party. The provisions of ADR apply directly. In addition to ADR, there are

[2] Bundesgesetz über die Beförderung gefährlicher Güter und über eine Änderung des Kraftfahrtgesetzes 1967 und der Straßenverkehrsordnung 1960 (Gefahrgutbeförderungsgesetz -GGBG), BGBl. I No. 145/1998 idgF

provisions of the GGBG which refer to, implement and complete the ADR. Under the GGBG, ADR is also applicable to the domestic carriage of dangerous goods by road in Austria.

The GGBG also implements several directives of the European Union concerning the carriage of dangerous goods by road, rail and inland navigation, which also refer to, implement and complete the international agreements mentioned above.

As regards air transport, the provisions of the ICAO-Technical Instructions for the Safe Transport of Dangerous Goods by Air are implemented by the GGBG. Furthermore, the Dangerous Goods Regulations of the International Air Transport Association (IATA) constitute an integral part of any carriage contract concluded by an IATA-carrier.

Since the relevant international legal instrument for the transport of dangerous goods by inland navigation (ADN) has not yet come into effect, the transport of radioactive material is subject to the provisions of an ordinance[3] based on the 1997 Federal Act on Inland Navigation[4] and to the provisions of the GGBG, as far as they are common to all modes of transport.

Regardless of the applicable law of the state in which a harbour is located, the transport of radioactive materials by sea ships registered in Austria has to comply with the International Maritime Organisation (IMO) Dangerous Goods Code. The provisions of this IMDG-Code are also referred to in the GGBG.

As far as the international legal instruments mentioned in this item 7.10. (RID/COTIF, ADR, ICAO-TI, IATA-DGR, ADN, IMDG-Code) relate to the transport of radioactive materials, they are mainly based on provisions published by the IAEA (Safety Series No. 6, ST-1 und ST-2).

(j) Nuclear Third Party Liability

The liability for nuclear installations and nuclear substances, previously governed by the Act on Liability for Nuclear Damage of 1964, has been completely reformed by the Act on Liability for Damage Caused by Radioactivity[5] of 1999. The Act on Liability for Nuclear Damage of 1964 still followed the pattern of the Paris Convention, which Austria has signed, but not ratified. Its liability regime for nuclear damage was felt to be inadequate in view of the modern requirements. Thus the Act on Liability for Damage Caused by Radioactivity of 1999 aims at creating an up-to-date regulation, which comes up to the standard of comparable Austrian acts on strict liability.

The Act covers any damage to persons or property resulting from ionising radiation through nuclear installations, nuclear substances and radionuclides. Further coverable damages are the costs of the removal of impairments to the environment and the costs of preventing measures undertaken to avert immediate danger originating from nuclear installations, nuclear substances or radionuclides. In this context, an impairment to the environment is defined as any interference with the environment, which lastingly alters the latter in such a way that it differs noticeably from natural processes either in quantity, in quality or in the temporal respect. Only the impairment which is of some significance is to be compensated.

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[3] Verordnung des Bundesministers für Wissenschaft und Verkehr über die Beförderung gefährlicher Güter auf Wasserstraßen (ADN-Verordnung), BGBl. II No. 295/1997 idgF

[4] Bundesgesetz über die Binnenschiffahrt (Schiffahrtsgesetz), BGBl. I No. 62/1997 idgF

[5] Bundesgesetz über die zivilrechtliche Haftung für Schaden durch Radioaktivität (Atomhaftungsgesetz 1999 - AtomHG 1999).

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

The maximum liability amounts, which were provided for in the Act on Liability for Nuclear Damage of 1964, were eliminated by the Act on Liability for Damage Caused by Radioactivity of 1999. It designates in principle the unlimited liability of the person liable.

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

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

To provide security for the claims of possible injured parties, the Act on Liability for Damage Caused by Radioactivity of 1999 obliges the following persons to effect liability insurances: the operator of a nuclear installation situated in Austria, the carrier of nuclear substances and the holder of a radionuclide with an activity of more than 370 Gigabecquerel. Minimum amounts insured shall guarantee that all foreseeable hazards can be covered.

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

Article 20 (Regulatory Body)

In Austria, legislative and executive powers are divided between the Federation (Bund) and the Federal States (Länder). Under the general clause of Art. 15 of Austria's Constitutional Law, legislative and executive powers are vested in the federal states, with the exception of all matters which are explicitly listed in Art. 10 – 12 of Austria's Constitutional Law.

(a) Federal Authorities (Bund)

The Federal Ministers are responsible for the application of the pertinent provisions of the Radiation Protection Act of 1969 with regard to:

- nuclear reactors;
- production of nuclear fuels or processing of irradiated nuclear fuels;
- particle accelerators for use in medicine;
- design approval for special equipment with radiation sources which can replace a license;
- approval of medical practitioners and hospitals.

♦ The Federal Ministry of Agriculture, Forestry, Environment and Water Management

The Federal Ministry of Agriculture, Forestry, Environment and Water Management *(Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft)* is responsible for radiation protection, with the exception of radiation matters in the medical field and foodstuff.

The Minister is also responsible for issues relating to the treatment and storage of radioactive waste, including the siting, construction and operation of storage facilities. The decision on a specific repository site has to take account of the requirements of the 1993 Environmental Impact Assessment Act [BGBl No. 697/1993: *Umweltverträglichkeitsprüfungsgesetz*] and of the procedure laid down in the land use laws of the *Länder* [1972 Radiation Protection Ordinance].

Finally, the Federal Ministry of Agriculture, Forestry, Environment and Water Management is responsible for general affairs of nuclear co-ordination.

♦ The Federal Ministry for Economy and Labour

In its capacity as the National Nuclear Non-proliferation Authority, the Federal Ministry for Economy and Labour *(Bundesministerium für Handel und Arbeit)* is responsible for nuclear material accountancy and control in accordance with the Non-proliferation Act of 1991.

Also under the Nuclear Non-proliferation Act, the Minister is responsible for export controls regarding fissionable material, non-nuclear material (e.g. heavy water, zirconium, etc.) and equipment.

Under the 1995 Foreign Trade Act *(Außenhandelsgesetz,* BGBl No. 172/1995), the Minister is responsible for the licensing of exports of nuclear-related „dual use“ goods.

Furthermore, the Minister is responsible for a limited number of matters concerning the safety of nuclear installations, e.g. pressure vessels and power engines.

Finally, the Central Labour Inspectorate of the Federal Ministry for Economy and Labour is responsible for the protection of the health of employees carrying out radiation activities.

♦ The Federal Ministry of Education, Science and Culture

The Federal Ministry of Education, Science and Culture *(Bundesministerium für Bildung , Wissenschaft und Kultur)* is responsible for the co-ordination and strategic orientation of energy research and development in general and nuclear research in particular. In addition, it is together with the Ministry of Agriculture, Forestry, Environment and Water Management the competent authority for the construction and operation of University-based nuclear installations.

♦ The Federal Ministry of Finance

As far as nuclear third party liability is concerned, the Federal Ministry of Finance (*Bundesministerium für Finanzen*) decides whether the nature and amount of the financial security offered by the operator is sufficient to cover the operator's liability under the Nuclear Liability Act of 1964.

♦ The Federal Ministry for Foreign Affairs

The Federal Ministry for Foreign Affairs *(Bundesministerium für auswärtige Angelegenheiten)* is the competent authority representing Austria internationally. In particular, it is in charge of all issues related to the negotiation and implementation of all legal instruments concluded with the IAEA.

♦ The Federal Ministry of the Interior

The Federal Ministry of the Interior *(Bundesministerium für Inneres)* is responsible for issuing licenses and for the adoption of security measures in connection with the handling of nuclear material, including protective measures against interference or encroachment by unauthorised third parties [Safeguards Act, Part 3]. In addition, the Federal Ministry of the Interior is in charge of transport safety measures with regard to the carriage of nuclear materials subject to the Act on the Transport of Dangerous Goods by Road.

Finally the Ministry of the Interior is also responsible for the coordination of the national crisis management system.

♦ The Federal Ministry of Justice

The Federal Ministry of Justice *(Bundesministerium für Justiz)* is responsible for all legal matters relating to the Nuclear Liability Act.

♦ The Federal Ministry of Health and Family

The Federal Ministry of Health and Family *(Bundesministerium für Gesundheit und Familie)* is responsible for radiation matters in the medical field and with regard to foodstuff.

♦ The Federal Ministry for Transport, Innovation and Technology

The Federal Ministry for Transport, Innovation and Technology *(Bundesministerium für Verkehr, Innovation und Technologie)* is the authority competent for the carriage of dangerous goods (including radioactive material) by all means of transport and in this regard is also responsible for the approval of packages and shipments of radioactive material. It is the competent authority for the implementation and interpretation of IAEA's regulations for the safe transport of radioactive materials (IAEA Safety Series Nos. 6, 7 and 37 as amended by IAEA Doc. ST-1 and ST-2) as well as for the legislation enforcing these regulations.

(b) District Authorities (Bezirksverwaltungsbehörden)

In general, the district authorities are responsible for the implementation of the administrative parts of the Radiation Protection Act, except the Law explicitly defines the responsibility of the Federal Ministries.

SECTION F OTHER GENERAL SAFETY PROVISIONS

Article 21 (Responsibility of the license holder)

Each work activity with radioactive material exceeding the exemption limits in Austria needs a license. Pre-condition for licensing is a fully elaborated waste management concept. Waste management by a license holder follows the legal requirements supported by relevant standards and follows the guidelines of the waste management facility. The license holder has to keep an activity balance which is reviewed during the periodic inspections. Since 2003 the license holders have to notify the activity balance to a central register which is administrated by the Ministry of Agriculture, Forestry, Environment and Water Management.

The waste management facility is also holder of a license. Annual inspections assure that the facility keeps the state of the art.

Article 22 (Human and financial resources)

Verification of the necessary human resources is part of the licensing process of a waste management facility as well as the annual inspections.

Adequate financial resources for the necessary infrastructure and equipment of the Austrian waste management facility are guaranteed by the Austrian state (see also Section B, Article 32 (c)).

Financial provision for the decommissioning of existing infrastructure and equipment of the Austrian waste management facility is guaranteed by the Austrian state.

Article 23 (Quality assurance)

Legal provisions for quality assurance are part of the licensing process and the periodic inspections by the authority.

The quality management system ISO 9001 is in place.

Moreover the waste management facility is running a special quality assurance program: For single batches of treated and conditioned waste samples are taken for compressive strength tests and for leaching tests. These tests are carried out according to international standards.

Article 24 (Operational radiation protection)

All activities are performed in accordance with radiation protection regulations. The NES employees receive training in handling radioactive materials, are equipped with personal protective devices and dosimeters, and take part in a medical monitoring program. Segregation of incoming radioactive waste is performed in a specific handling box , where the staff is comprehensively equipped with protective cloths (masks, gloves, ventilated suits). Handling of spent sealed sources is carried out in a lead cell. High activated sealed sources are handled in a hot cell facility.

The release of radionuclides by air and water from the waste management facility is monitored by the license holder and surveyed by the licensing authority.

A safety analysis required by the national authorities is reviewed time by time and is audited by the authority.

Article 25 (Emergency preparedness)

Different emergency considerations and requirements were analysed for the different waste treatment and storage units. An emergency plan was developed for internal purposes and another one including external organisations. Emergency planning was part of the licensing procedure and is periodically updated according to experience and changing requirements.

Article 26. (Decommissioning)

As already mentioned the ASTRA Research Reactor in Seibersdorf (a 10 MW pool type) was shut down in July 1999. During the year 2000 the spent fuel elements were removed into a pool within the hot cell facility. Following the transport preparation they were moved to USA in 2001. An Environmental Impact Assessment has been carried out successfully. All relevant legal requirements were obtained for the decommissioning operation.

Currently the intermediate radioactive material (the construction materials surrounding the core) is in the process of being treated and conditioned using the hot cell facility. Special care has been taken to Beryllium elements used as reflector during reactor operation. Because of the toxicity of this material and its activity content, they are welded into stainless steel tubes filled with dry quartz sand. In this form they will be placed within shielded containers for the interim storage. Graphite elements formerly used for in-core experiments and as a reflector were heated before enclosing them into steel tubes, in order to remove the Wigner energy.

It is intended to remove all activated and contaminated parts from the former reactor operation. The biological shield will be cut in blocks and the activity content of these blocks will be determined. Blocks with activity below the clearance level will be removed as inactive waste. The other blocks will be sealed and removed into the interim storage facility for radioactive waste.

Throughout the decommissioning process the ventilation for the underpressure keeping and the filter system remains in operation. After decontamination the building will be used as part of the interim storage facility. The decommissioning is scheduled to be finished in 2005, the transformation into an interim storage facility is planned till 2008.

Decommissioning is financed by the Austrian state.

SECTION G SAFETY OF SPENT FUEL MANAGEMENT

As explained in Section B, Austria has only research reactors. All spent fuel will be returned to the U.S. Department of Energy. Therefore Austria has only to take care for interim storage on site of small amounts of spent fuel.

SECTION H SAFETY OF RADIOACTIVE WASTE MANAGEMENT

Article 11 (General safety requirements)

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

It is part of the licensing process as well as of the periodic inspection by the authority to

- minimize the generation of radioactive waste,
- take into account interdependencies among the different steps in radioactive waste management,
- provide for effective protection of individual, society and the environment,
- to take into account the biological, chemical and other hazards.

It is Austria's policy to collect all radioactive waste, to treat it (mineralise all combustible waste) and to condition it for safe storage in order to minimise the burden for future generations. Although the problem of final storage is not yet solved, adequate financial fundings for final storage have already been established.

Article 12 (Existing facilities and past practices)

According to a contract between NES and the competent Ministry in 1976 all radioactive waste arising in Austria has been collected including the radioactive waste from the IAEA laboratories sited at Seibersdorf. Since then a number of storage halls and other facilities were financed by the state and built at Seibersdorf. Different categories of waste (liquid burnable, liquid non burnable, solid burnable, solid non burnable, etc.) were stored in specifically designed storage halls. For intermediate level waste a trench made of concrete boxes was used. After installation of treatment facilities, especially the incineration plant and the supercompactor, all this "historical waste" was treated, conditioned and is actually stored in the interim storage facility.

Article 13 (Siting of proposed facilities)

For the next future it is planned to adapt the existing ASTRA reactor building in Seibersdorf as an interim storage facility.

Article 14-16 (Design and construction of facilities, Assessment of safety of facilities, Operation of facilities)

The NES radioactive waste management facilities are duly licensed by the Federal Ministry of Agriculture, Forestry, Environment and Water Management.

Procedures are established to effectively minimize and monitor the releases of radioactivity in accordance with applicable environmental regulations, e.g. HEPA filtration of gas effluents from the incinerator.

A comprehensive program of environmental radiation monitoring is in place to ensure that any unexpected releases of radioactivity are detected, and the necessary actions taken, in a timely manner.

The following chapters describe in short the existing facilities:

(a) Segregation

It is to mention that pre-sorting is already required from the waste producers. For specific tasks as dismantling and segregation activities a special room ("sorting box") is equipped with a ventilation system offering underpressure for the safe handling of radioactive material. If required, special tools and equipment can be installed.

(b) Waste water treatment facility

In this facility, waste water from the NES site in Seibersdorf is treated. The four waste water sources include incinerator operations, laboratories working with radioactive material, all other laboratories on site (theoretically inactive waste water), and the IAEA Safeguards Analytical Laboratory (SAL) delivering potentially α-contaminated waste water.

A schematic depiction of the facility is shown in Section L (d), Figure 2. As a first step, waste water is delivered via direct pipeline connections from the point of origin into separate admission basins. Measurements are then performed to determine the activity of the waste water. If below the regulatory limits, the water is transferred directly into the collecting basin and, after repeated measurements, discharged into the environment. In the opposite case, the water is pumped into the storage tanks, some equipped with stirrers, where a precipitation is performed by addition of a suitable reagent, e.g., $[Fe(CN)_6]^{4-}$ for Cs^+ precipitation. The active precipitate is separated from the liquid in a Filtrox® filtration unit. The resulting sludge is dried and conditioned in the high force compactor. The liquid is pumped back into the storage tanks, rechecked for activity, and transferred into the collecting basin. Occasionally, a second precipitation may be called for to comply with the regulatory limits

(c) High force compactor

Non burnable solid radioactive waste can be treated using the high force compactor (see Section L (d) Figure 3). This unit is of horizontal design. 100 litre steel drums containing solid waste are fed into an opening from top into the channel of the ram. When operating the ram, the content in the channel is compressed into the compaction station with a compaction force of 12 MN. Pellets formed in this way are ejected after opening the compaction station and transferred into 200 litre drums for storing.

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

(d) Cementation equipment

For conditioning the method of cementing is applied for immobilizing radioactive waste (see Section L (d) Figure 4).

With one exception only 200 litre steel drums are in use. The exception is a small number of pre-cemented containers used for storing intermediate level waste which needs additional shielding. These containers offer a wall thickness of 20 cm concrete and can take up one 200 litre drum each.

Cementing is carried out by in-drum cementing in 200 litre steel drums or by mixing waste with cement and water in a separate equipment to be filled into 200 litre drums. Waste to be cemented must be mixable.

If waste can not be mixed, 100 litre drums are used taking up the waste, then they are centred in 200 litre drums and surrounded with mortar.

Pellets are conditioned in the analogue way.

(e) Interim storage

All conditioned radioactive waste is stored within two dry engineered construction storage halls (see Section L (d) Figure 5 and 6). The capacity is limited to 15000 drums of 200 litre volume. At present 9500 drums are stored. It can be estimated that the capacity is sufficient till the year 2012.

Radioactive waste resulting from decommissioning of reactors or other sources with large quantities of waste are not considered and solutions for interim storage have to be found. Only waste from Austrian users of radioactive materials is stored at the NES facility.

(f) Incinerator

The shaft incinerator of the "Karlsruhe" type (see Section L (d) Figure 7) is an excess air unit having a capacity of about 40 kg per hour and a combustion volume of 1 m diameter and 5 m height. The off-gas cleaning system consists of a set of ceramic hot gas filters, quench, two stage wet scrubber and HEPA-Filters.

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

In addition, modifications to the shaft have been carried out too, where for example additional openings were introduced in order to facilitate effectively the incineration of powdery material. As already reported in detail a project of incinerating about 1000 tons of ion-exchange resin had been successfully carried out, where the dried material was transferred into the combustion chamber via a screw and a blowing system.

<u>Technical data of the incinerator:</u>

- Excess air incinerator
- Shaft type, single chamber
- Combustion chamber: 1 m diameter, 5 m high
- Combustion temperature: 1000 ° C
- Capacity : ~ 40 kg / h solid burnable waste (calorific value: average $21x10^6$ J/kg = 5000 kcal/kg)
- Underpressure in the combustion chamber: 10^3 Pascal = 10 mbar
- Air flow: 300-600 m^3 variable, depending on underpressure in combustion chamber

- Feeding from top batchwise (2-3 kg) through airlock, liquids through burner
- Feeding of powdery material by blowing system into combustion chamber
- Hot gas filter, in brick-lined filter box, Silicon-carbide candles, mean porosity : 20 µm
- Quench, spray cooler with nozzles, decreases off-gas temperature from 700 °C to 70 °C
- Two stage scrubber (one trickle flow, one spray) using caustic soda solution to pH 8.1
- Heater, raises off-gas temperature to ~ 100 ° C
- HEPA filters
- Off-gas draft fan, radial blower, regulated by underpressure of combustion chamber
- Mixing chamber
- Stack, 35m high

Operational experience

During 20 years of operation the following amount of waste has been treated:

- liquid waste 41430 kg 41,4 m³
- solid waste 695576 kg 4200 m³
- ion exchange resins 534882 kg 1600 m³ (after drying)

By the end of 2002 a total of about 1300 tonnes or 5841 m³ were combusted.

Depending on the amount of radioactive waste to be combusted the incinerator was operated the number of shifts necessary for the planned quantity every year. The plant was operated for some 43000 hours in total. It is operated in two shifts a day, e. i. from 6.00 a. m. till 10.00 p.m. 6 days a week, with two operators in one shift.

The treatment of these wastes resulted in a volume reduction of about 50:1 comparing row material to ashes. But operating such a facility creates secondary waste, changing the picture of volume-reduction significantly.

Apart from operational waste as hot gas- and HEPA-filters, maintenance and repairs a number of replacements as for example the removal of an electrostatic filter originally installed at the off-gas cleaning system, renewal of refractory-brick lining of the lower half of the combustion chamber after 12 years of operation and a part of the refractory-brick lining in the hot gas filter boxes, renewal of HEPA-filter boxes, replacement of parts of piping and other equipment have to be included.

The following secondary waste to be treated as radioactive waste arised during 20 years:

	Pieces	**kg**	**m³**
Ashes		78000	112
Hot gas filter candles	1818	11200	20
HEPA-filter	1161	23000	125
Replacement of refractory bricks		14000	8
Replacement of parts, pieces of equipment			10
Waste water			15000
- after treatment (precipitation) resulting as solid waste		50000	25

Non radioactive material removed from the incinerator plant during this period of time is not included in the table.

For treatment and conditioning of the radioactive secondary waste different techniques were applied and the following numbers of 200 ltre drums, containing the conditioned waste, obtained:

Waste	Treatment	No. of drums
Hot gas filter (ceramic)	crushing and cementing	140
HEPA-filter	super compaction	25
Refractory bricks	crushing and cementing	90
Parts and equipment	super compaction or cementing	80

Activity releases to the atmosphere

Radioactive releases to the atmosphere are checked by analyses of samples collected in a sampling system connected to the stack. Release limits are radio nuclide specific and set by the authority.

In total the following radioactive releases have been determined during 20 years of incinerator operation:

α [MBq]	β [MBq]	^{60}Co [MBq]	^{137}Cs [MBq]
11,4	77,4	< 24,8	< 24,7

Activity throughput

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

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

Radiation exposure to staff

Staff working at the incinerator is not only acting as operators during incineration campaigns but also responsibly for maintenance checks and repairs at the incinerator system.

In addition it is partly engaged in handling and segregation of Radwaste prior to its combustion. This must be taken into account, when considering radiation doses to personal.

All readings are derived from Thermo-Luminescence Dose meters (TLD).

Figure 8 shows in graphical form the average annual dose to the staff.

No single person of the staff involved in handling and incinerating of radioactive waste ever had a radiation dose in excess of the limits set in the relevant regulations.

Article 17 (Institutional measures after closure)

There are currently no plans for closure of the existing NES facilities. No unresolved issues related to closure exist.

SECTION I TRANSBOUNDARY MOVEMENT

Article 27 (Transboundary movement)

The transboundary movement of radioactive waste follows the guidance of the "Ordinance on the Transfer of Radioactive Wastes" [BGBl No. 44/1997: Radioaktive Abfälle-Verbringungsverordnung] (which takes into account the Council Directive 92/3/EURATOM of 3 February 1992 on the supervision and control of shipments of radioactive waste between Member States and into and out of the Community) as well as international transport regulations.

SECTION J DISUSED SEALED SOURCES

Article 28 (Disused sealed sources)

Disused sealed sources are stored either on the site of the former user awaiting reuse, or they are transported to NES for temporary storage pending reuse. In both cases, the storage occurs according to applicable radiation protection regulations. If sealed sources are declared as spent ones, then they are transferred to NES for conditioning and interim storage.

NES is also a producer of sealed sources. Most of them are distributed to domestic users. Some of them are used abroad by Austrian companies. All of these sources are taken back by NES if no longer used or spent.

SECTION K PLANNED ACTIVITIES TO IMPROVE SAFETY

Due to the plan to extend the period of interimly storing the conditioned waste up to 2030 it is intended to store the drums in a way that a visual control of every single drum is possible. At the same time it should also be possible to withdraw single drums from the storage, e.g. in case that defects are detected, so that reconditioning can be carried out.

Improvements at the incineration facility are planned in order to further reduce non-radioactive and radioactive emission to the environment.

SECTION L ANNEXES

(a) Inventory of spent fuel

List of spent fuel elements at the Research Reactor TRIGA Mark II in Vienna

Batch Number	Number of elements	Weight of the element (grams)	Weight of fissionable Isotopes (grams)	Storage place
2071	1	177.45	35.15	Active fuel storage, 2
2077	1	180.33	35.72	Active fuel storage, 2
2085	1	179.07	35.47	Active fuel storage, 2
2147 TC	1	183.87	36.42	Active fuel storage, 2
2156	1	184.81	36.61	Active fuel storage, 2
2177	1	179.16	35.49	Active fuel storage, 2
2196	1	186.44	36.93	Active fuel storage, 2
2117	1	178.79	35.42	Active fuel storage, 2
Total:		**1449.92**	**287.21**	

(b) Inventory of radioactive waste

<300d Activity [MBq]			
I-123	111	12	h
Ga-67	166	78	h
Sb-122	0.52	2.7	d
In-111	122	2.8	d
Ac-225	33.75	10	d
P-32	6	14	d
Cr-51	2.21	28	d
Fe-59	64.88	45	d
Sr-89	1.97	51	d
I-125	1404.92	60	d
Sb-124	1.31	60	d
Sr-85	80.53	65	d
Co-58	314	71	d
Co-56	4.26	79	d
Sc-46	2.63	84	d
S-35	197.89	88	d
Y-88	8.04	107	d
Se-75	2297.67	120	d
Po-210	51208.09	138	d
Ir-192	2095.49	174	d
Gd-153	1.19	242	d
Zn-65	172.09	244	d
Ag-110m	92.6	250	d
Co-57	6776.48	271	d
Mn-54	18.04	312	d
TOTAL	**65183.56**		
	= 6.52E+10	**Bq**	

12.3a Activity [MBq]			
H-3	**181899867.6**	12	a
	= 1.819E+14	**Bq**	

<15a Activity [MBq]			
Cs-134	132690.29	2.1	a
Na-22	964.17	2.6	a
Pm-147	136692.04	2.6	a
Fe-55	55504.55	2.7	a
Sb-125	13.39	2.8	a
Tl-204	4302.48	3.8	a
Eu-155	4.13	5	a
Co-60	3638561.15	5.3	a
Eu-154	305.87	8.8	a
Ba-133	781.37	11	a
Kr-85	580441.26	11	a
Eu-152	276.94	13	a
TOTAL	**4550537.64**		
	= 4.55E+12	**Bq**	

<30.2a Activity [MBq]			
Pb-210	11.71	22.3	a
Sr-90	775293.37	28.5	a
Cs-137	1900427.86	30.17	a
FP	3306076.56	30.17	a
TOTAL	**5981809.5**		
	= 5.98E+12	**Bq**	

<432.6a Activity [MBq]			
Pu-238	1023.74	87.74	a
Ni-63	21032.65	100	a
Ag-108m	688.36	127	a
Am-241	573362.81	432.6	a
TOTAL	**596107.56**		
	= 5.96E+11	**Bq**	

<1600a Activity [MBq]			
Ac-228	2353.01	6.13	h
Pb-212	63550.12	10.64	h
Th-228	11270.61	1.91	a
Ra-226	294915.44	1600	a
TOTAL	**372089.18**		
	= 3.72E+11	**Bq**	

>1600a Activity [MBq]			
Bi-214	5171.34	19.9	m
Pb-214	6825.92	26.8	m
Bi-212	1536.73	60.6	m
C-14	160408,48	5730	a
Cs-135	1	2,00E+06	a
Nb-94	21.93	2.20E+04	a
Pu-239	29150.02	2.41E+04	a
U-235	96.51	7.04E+08	a
K-40	1.89	1.28E+09	a
U-238	54.01	4.47E+09	a
U Nat	414.73	4.47E+09	a
Th-232	2592.34	1.40E+10	a
Th Nat	1720.65	1.40E+10	a
TOTAL	**207995.55**		
	= 2.08E+11	**Bq**	

(c) Figures

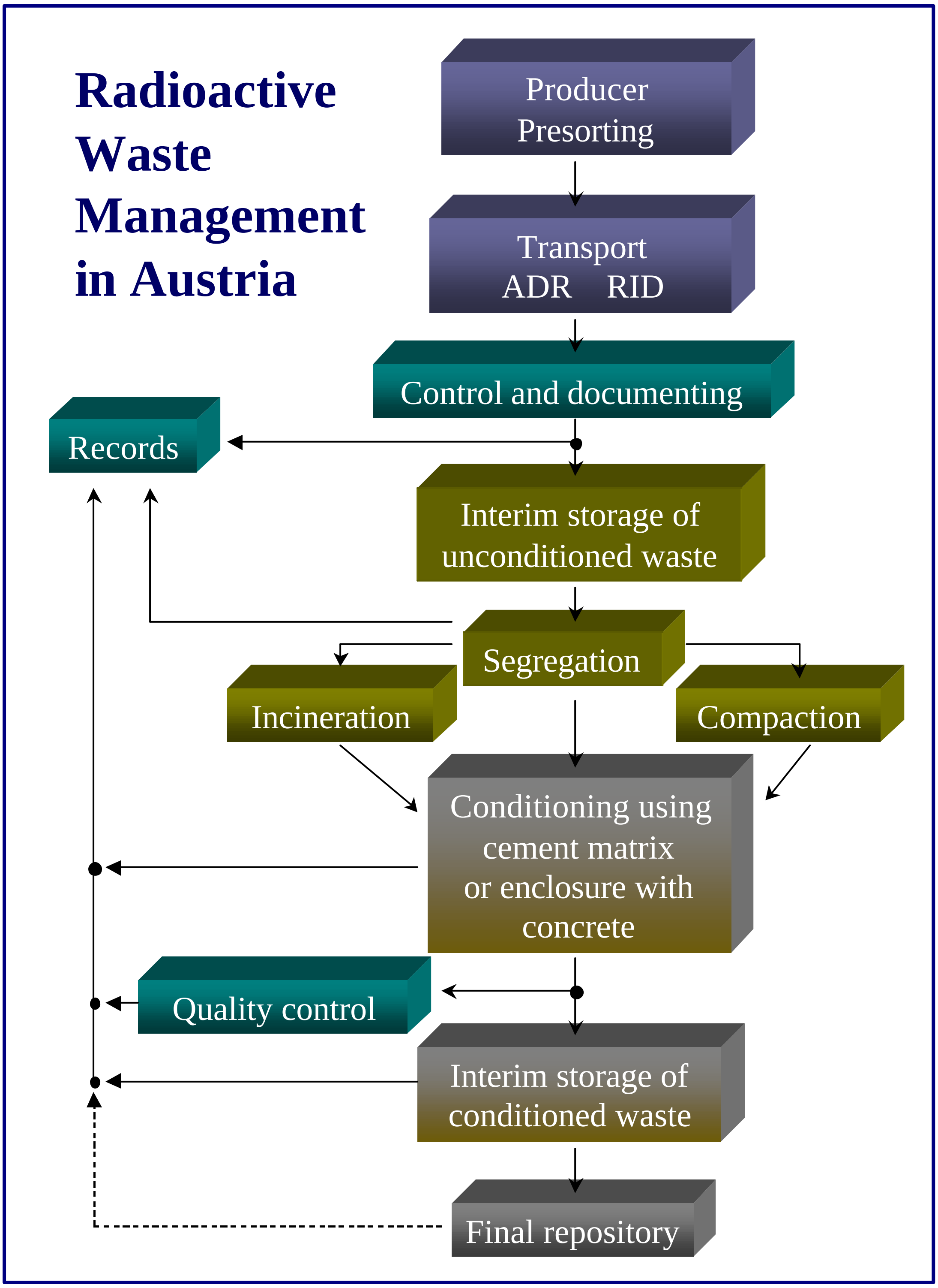

Figure 1: Radioactive waste management in Austria

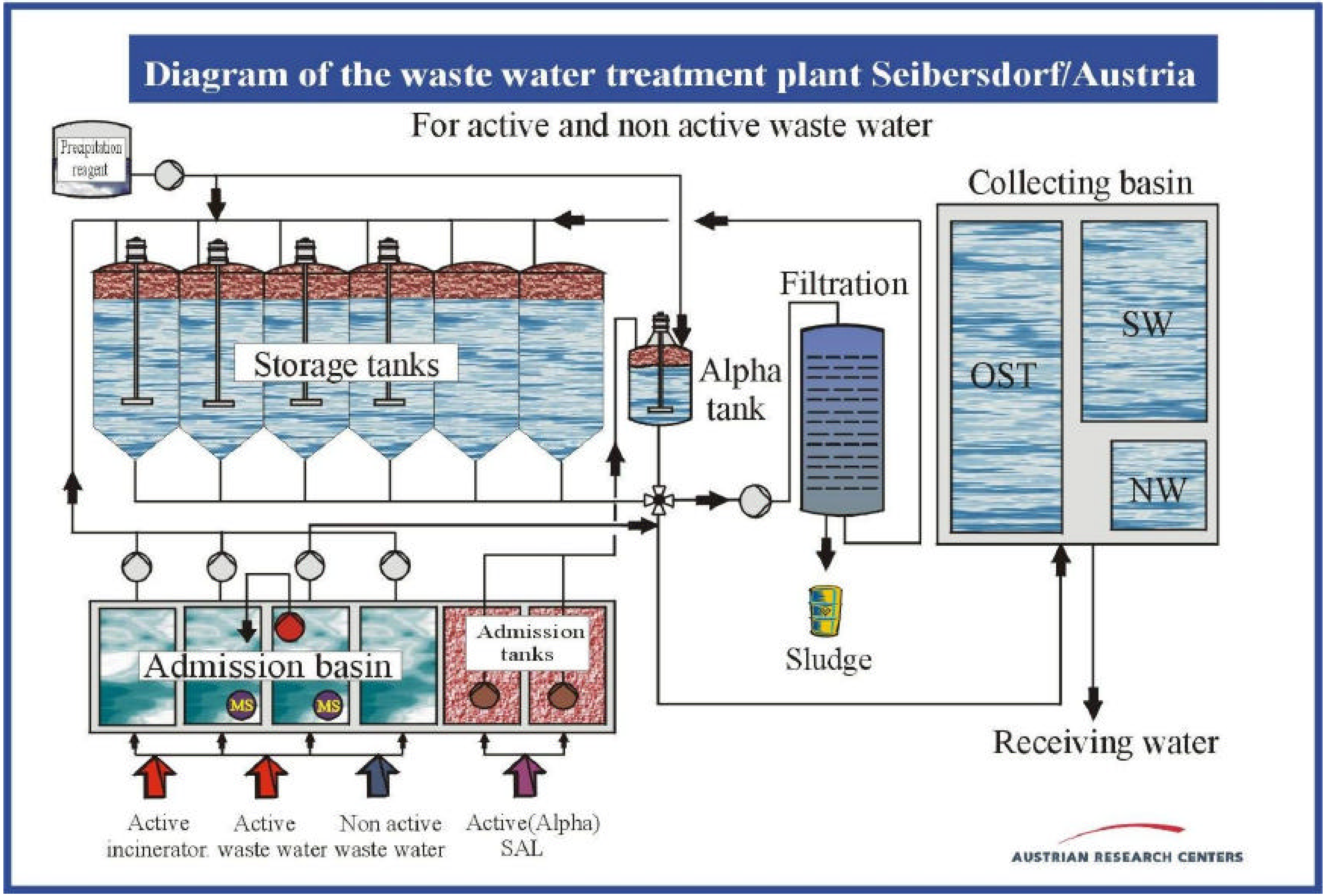

Figure 2: Waste water treatment plant Seibersdorf

Figure 3: Supercompactor

Figure 4: Cementation equipment

Figure 5: Storage halls

Figure 6: Conditioned waste in interim storage hall 12A

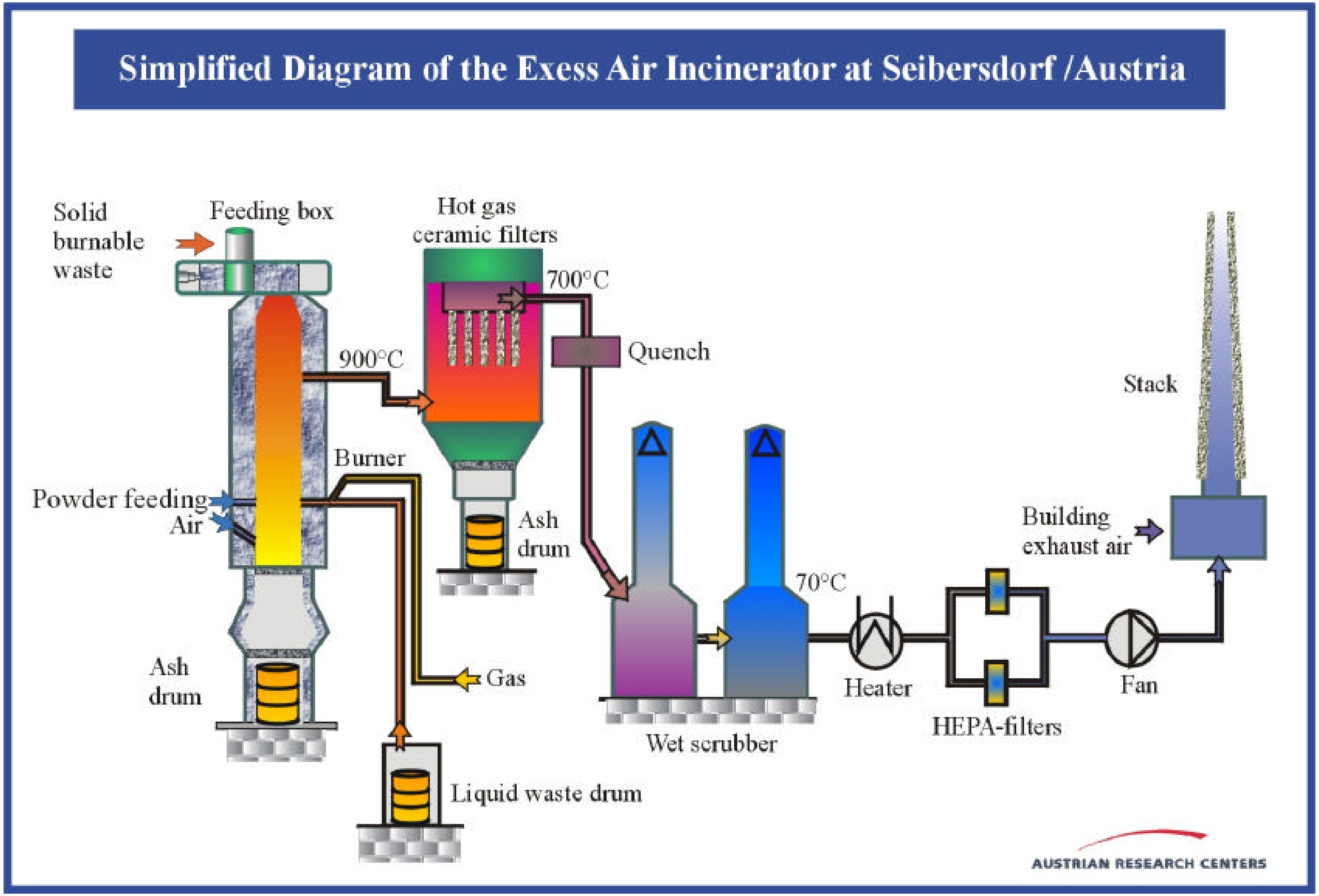

Figure 7: Simplified Diagram of the Excess Air Incinerator

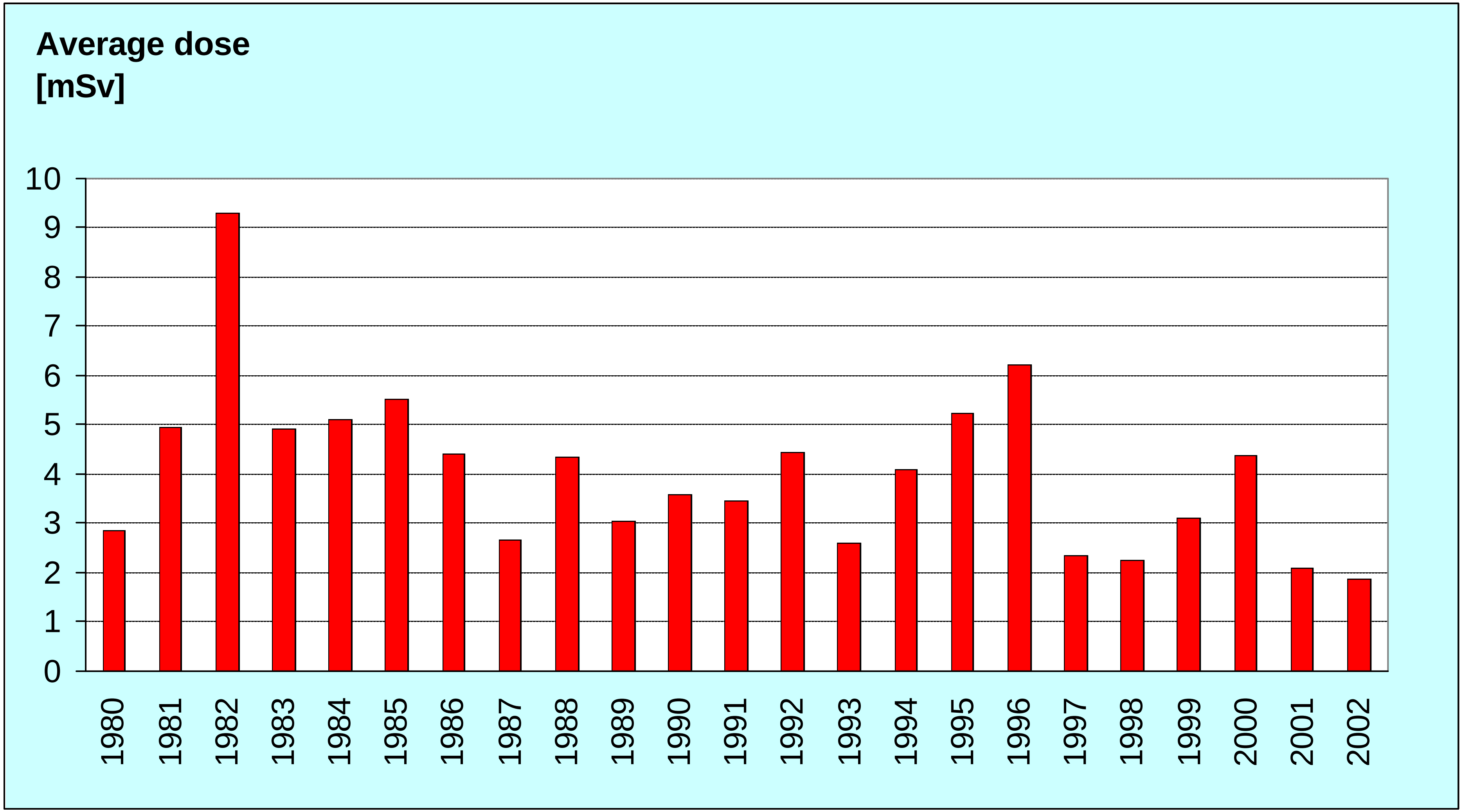

Figure 8: Average dose to the staff of the Seibersdorf waste treatment facilities