Ministerie van Infrastructuur
en Waterstaat

Joint Convention on the safety of spent fuel management and on the safety of radioactive waste management

National report of the Kingdom of the Netherlands
for the 8th review meeting
(17-28 March 2025)

AND

National report for Council Directive 2011/70/Euratom

Establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste

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Symbol/abbreviation	Full term	Translation or explanation
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ALARA	As Low As Reasonably Achievable	
ANVS	Autoriteit Nucleaire Veiligheid en Stralings-bescherming	Authority for Nuclear Safety and Radiation Protection
ARTEMIS	Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decom-missioning and Remediation	
Awb	Algemene wet bestuursrecht	General Administrative Act
AVG	Afval Verwerkings Gebouw	Waste processing building
Bbs	Besluit basisveiligheidsnormen stralings-bescherming	Basic Safety Standards for Radiation Protection Decree
Biudrabs	Besluit in-, uit- en doorvoer van radioactieve afvalstoffen en bestraalde splijtstoffen	Radioactive waste and Fissile materials (Import, Export and Transit) Decree
Bkse	Besluit kerninstallaties, splijtstoffen en ertsen	Nuclear Installations, Fissile Materials and Ores Decree
Bvser	Besluit vervoer splijtstoffen, ertsen en radioactieve stoffen	Fissile materials, Ores and Radioactive materials Transport Decree
Bq	Becquerel	
CET-sn	Crisis Expert Team - straling en nucleair	Crisis Expert Team – radiological and nuclear
COG	Container OpslagGebouw	Container storage building
Conventional waste	Waste substances as intended in the Environmental Protection Act (or non-radioactive waste)	
COVRA	Centrale Organisatie Voor Radioactief Afval	Central Organisation for Radioactive Waste
DGMI	Directorate-general for the Environment and International Affairs	
Directive	Council Directive 2011/70/Euratom of the European Council dated 19 July 2011 on the establishment of a community framework for the responsible and safe management of spent fuel and radioactive waste Directive report: report on the implementation of the Directive	
EIA	Environmental Impact Assessment	
ENSREG	European Nuclear Safety Regulator Group	
EPZ	N.V. Elektriciteits-Produktiemaatschappij Zuid-Nederland	(License holder, owner and operator of Borssele NPP)
EU	European Union	
EURAD	European Joint Programme on Radioactive Waste Management	
EZK	(Ministerie van) Economische Zaken en Klimaat	(Ministry of) Economic Affairs and Climate Policy
€	Euro	
GKN	Gemeenschappelijke Kernenergiecentrale Nederland	(License holder, owner and operator of Dodewaard NPP – in Safe Enclosure)
GRS	Gesellschaft für Anlagen- und Reaktorsicher-heit	(German Technical support Organisation)
HABOG	Hoogradioactief AfvalBehandelings- en OpslagGebouw	High-level waste treatment and storage building

Symbol/abbreviation	Full term	Translation or explanation
HASS	High Activity Sealed Sources	
HERCA	Heads of the European Radiological protection Competent Authorities	
HEU	High Enriched Uranium	
HFR	Hoge Flux Reactor	High Flux Reactor (Research Reactor in Petten, tank-in-pool type, 45 MWth)
HLW	High-Level Waste	In Dutch: hoogradioactief afval (HRA)
HOR	Hoger Onderwijs Reactor	Higher Education Reactor (research reactor of the Delft University of Technology)
IAEA	International Atomic Energy Agency	
IandWM	(Ministry of) Infrastructure and Water Management	
IBC	Isoleren, Beheersen, Controleren	Isolate, Manage, Control
IGJ	Inspectie Gezondheidszorg en Jeugd	Health and Youth Care Inspectorate
ILT	Inspectie Leefomgeving en Transport	Human Environment and Transport Inspectorate of the Ministry of Infrastructure & Water Management
ILW	Intermediate-Level waste	
IMG	Inspectie Militaire Gezondheidszorg	Inspectorate for Military Healthcare
IRRS	Integrated Regulatory Review Service	
ISZW	Inspectie SZW	Inspectorate SZW
Joint Convention (JC)	Joint Convention on the Safety of the Management of Spent Fuel and the Management of Radioactive Waste Joint Convention report: national report for the Joint convention	
JRC	Joint Research Centre of the European Communities	
Kew	Kernenergiewet	Nuclear Energy Act
LCP-S	Landelijk Crisisplan Straling	National Crisis Plan for Radiation Incidents
LEU	Low Enriched Uranium	
LILW	Low- and Intermediate-Level Waste	In Dutch: laag- en middelradioactief afval (LMRA)
LLW	Low-Level Waste	
LNV	(Ministerie van) Landbouw, Natuur en Voedselkwaliteit	Ministry of Agriculture, Nature and Food Quality
LOG	Laag- en middelradioactief afval Opslag-Gebouw	Low- and intermediate-level waste storage building
LTO	Long Term Operation	
MOG	Multifunctioneel OpslagGebouw	Multifunctional storage building
MoU	Memorandum of Understanding	
MOX	Mengoxide	Mixed Oxide
Mwe	Megawatt electrical	
MWth	Megawatt thermal	
National programme	The national programme for the responsible and safe management of spent fuel and radioactive waste	
NCS	Nationaal Crisisplan Stralingsincidenten	National Emergency Plan for Radiation Incidents

Symbol/abbreviation	Full term	Translation or explanation
NDRIS	Nationaal DosisRegistratie en Informatie Systeem	National Dose Registration and Information System
(OECD/)NEA	Nuclear Energy Agency (NEA) within the Organisation for Economic Cooperation and Development (OECD)	
NORM	Naturally Occurring Radioactive Material	
NPP	Nuclear Power Plant	
NRG	Nuclear Research and consultancy Group	License holder and operator of the HFR
NSD	Directive 2009/71/Euratom: Nuclear Safety Directive	
NVR	Nucleaire VeiligheidsRegels	Nuclear safety rules (in the Netherlands)
NVWA	Nederlandse Voedsel- en Warenautoriteit	The Netherlands Food and Consumer Product Safety Authority
OPERA	OnderzoeksProgramma Eindberging Radioactief Afval	National geological disposal research programme (2011-2017)
PALLAS	Research and medical isotope production reactor	
RB	Regulatory body	
Rbs	Regeling Basisveiligheidsnormen Stralings-bescherming	Regulation on Basic Safety Standards for Radiation Protection
RID	Reactor Institute Delft	(Operator of the HOR research reactor in Delft)
RIVM	Rijksinstituut voor Volksgezondheid en Milieu	National Institute of Public Health and the Environment
RR	Research Reactor	
RW	Radioactive waste	
SAR	Safety Analysis Report	
SEA	Strategic environmental impact assessment	
SF	Spent Fuel	Fission material that has been irradiated and permanently removed from a reactor core
SHINE	Nuclear installation for the production of medical isotopes	
Sodm	Staatstoezicht op de Mijnen	State Supervision of Mines
Sv	Sievert	
SZW	(Ministerie van) Sociale Zaken en Werkgelegen-heid	(Ministry of) Social Affairs and Employment
TS	Technical Specifications	
UN	United Nations	
URENCO	Uranium Enrichment Corporation Ltd	
Vbs	ANVS-Verordening Basisveiligheidsnormen Stralingsbescherming	Regulation of the Authority for Nuclear Safety and Radiation Protection (ANVS-Regulation)
VOG and VOG-2	Verarmd uranium OpslagGebouw	Storage building for depleted uranium
WENRA	Western European Safety Regulators Association	
Wm	Wet milieubeheer	Environmental protection act
Woo	Wet open overheid	Act on government information
WSF	Waste Storage Facility	Waste storage building for legacy waste in Petten
Wvr	Wet veiligheidsregio's	Safety Regions Act
zbo	Zelfstandig bestuursorgaan	Independent administrative body

Section A Introduction

A.1 Purpose of the national report

This report serves the purpose of reporting progress both for the implementation of the Joint Convention and the Directive. For information on the relationship between the Joint Convention report and the Directive report, see Section A.3.

On 10 March 1999, the Netherlands signed the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management[1] (hereafter: Joint Convention or JC), which was subsequently formally ratified on 26 April 2000 and entered into force on 18 June 2001. The Joint Convention obliges each Contracting Party to apply widely recognized principles and tools in order to achieve and maintain high standards of safety during management of spent fuel and radioactive waste (hereafter: radioactive waste) and to report on the national implementation of these principles (hereafter: Joint Convention report).

This report is the eight Joint Convention report in its series. It describes how the Netherlands meets the obligations of each of the articles established by the Joint Convention.

Article 14.1 of the Council Directive 2011/70/Euratom (hereafter: the Directive) establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste, also requires Member States to report on how they have fulfilled their obligations as formulated by the articles of the Directive (hereafter: Directive report). The Directive states that for the Directive report, advantage can be taken of the review and reporting under the Joint Convention.

This report is the fourth Directive report in its series. The report describes how the Netherlands meets the obligations of the Directive.

The information provided by the present report applies to the situation of 1 April 2024 unless explicitly specified otherwise.

A.2 Structure of this report

The national report follows closely the structure as suggested in INFCIRC/604/Rev.4, 'Guidelines regarding the form and structure of national reports' which applies to reporting under the joint Convention. When appropriate, more detailed information is provided in the Annexes. This updated report has been designed to be a standalone document to facilitate peer review. Where the content of one section is found to be applicable to both the Joint Convention report and the report to the European Commission, this will be mentioned in the text (see also Section A.3).

[1] https://www.iaea.org/topics/nuclear-safety-conventions/joint-convention-safety-spent-fuel-management-and-safety-radioactive-waste.

In this national report the different articles from the Joint Convention (hereafter: Articles) are addressed as follows:
Section A – Introduction
Section B – Article 32 and 32.1, policies and practices
Section C – Article 3, scope of application
Section D – Article 32.2, inventories and lists
Section E – Articles 18 - 20, legislative and regulatory system
Section F – Articles 21 – 26, other general safety provisions
Section G – Articles 4 – 10, safety of spent fuel management
Section H – Articles 11 – 17, safety of radioactive waste management
Section I – Article 27, transboundary movement
Section J – Article 28, disused sealed sources
Section K – General efforts to improve safety

A.3 Relationship between the Joint Convention report and the Directive report

In the European Union, Council Directive 2011/70/Euratom establishes a community framework for the responsible and safe management of spent fuel and radioactive waste. Article 11 of the Directive obliges EU Member States to implement a national programme for the management of spent fuel and radioactive waste (hereafter: National programme) which describes in detail the policy regarding the management of spent fuel and radioactive waste now and in the future. The Netherlands published its National programme in 2016 and is currently working on an update (foreseen in 2025). Article 14 of the Directive obliges EU Member States to report to the European Commission on the implementation of the Directive, for the first time by 23 August 2015, and every three years thereafter.

Article 14.1 of the Directive states that Member States can take advantage of reporting under the Joint Convention (i.e., regarding optimizing the use of resources and to providing coherent information) to assist them in preparing the Directive report. Although they have different addressees and some differences in scope, the Directive and Joint Convention have the same overall objective of the safe management of spent fuel and radioactive waste. Member States also have obligations under the Directive to fulfil certain requirements that are not covered in the Joint Convention report. Consequently, information is added where needed to fully report on the progress that has been made with the implementation of the Directive. The table below shows where the articles of the Directive are addressed in this report.

Table 1: Correlation table between Joint Convention report and Directive report

Article of Directive 2011/70/Euratom	Where addressed
1 Subject-matter	Not relevant for the Directive report
2 Scope	Section C: Scope
3 Definitions	Not relevant for the Directive report
4 General principles	
4.1	Section B: 32.1(III) Radioactive waste management policy
4.2	Section B: 32.1(III) Radioactive waste management policy
4.3.a	Section G: 4(II) Minimization of radioactive waste
4.3.b	Section G: 4(III) Interdependencies in spent fuel and radioactive waste management
4.3.c	Section B: 32.1(III) Radioactive waste management policy
4.3.d	Section B: 32.1(III) Radioactive waste management policy
4.3.e	Section F: 22(II) Adequate financial resources at COVRA
4.3.f	Section B: 32.1(III) Radioactive waste management policy

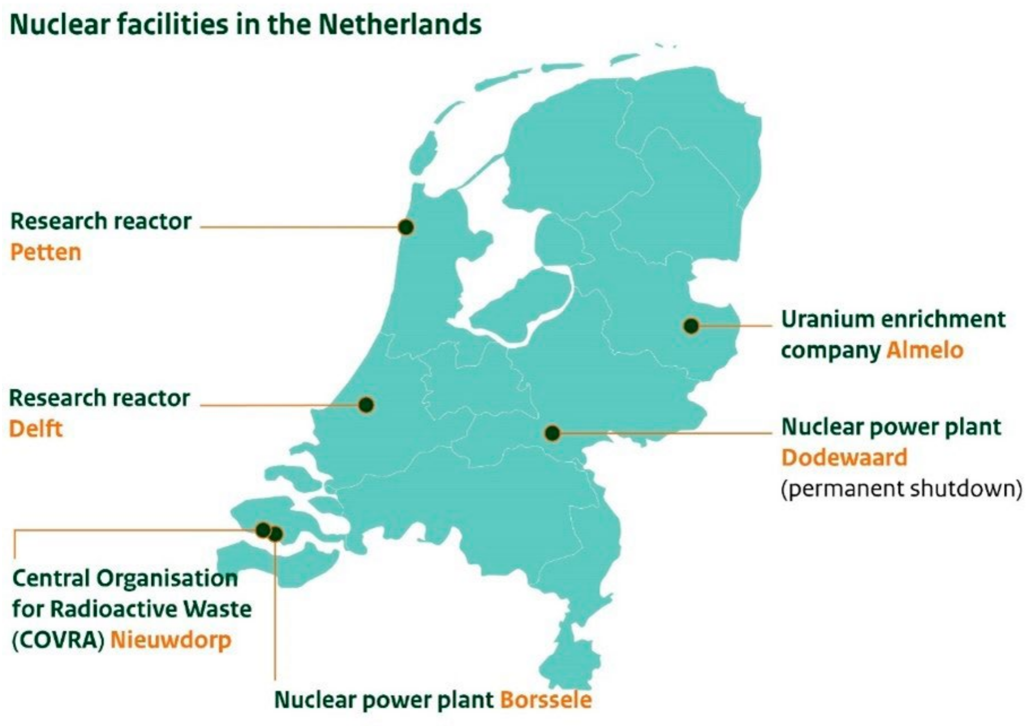
Article of Directive 2011/70/Euratom	Where addressed
4.4.a, b, c	Section I: Transboundary Movement
5 National framework	
5.1.a	Section B: 32.1(III) Radioactive waste management policy
5.1.b	Section E: 19.1 Legislative and regulatory framework Section E: 19.2.a National safety requirements and regulations
5.1.c	Section E: 19.2.b System of licensing
5.1.d	Section E: 19.2.c Regulatory assessment and inspections
5.1.e	Section E: 19.2.d Institutional control, regulatory inspection and documentation and reporting Section E: 19.2.e The enforcement of applicable regulations and of the terms of the licenses
5.1.f	Section E: 19.2.f A clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management
5.1.g	Section E: 19.2.g.1 National requirements for public information and participation
5.1.h	Section E: 19.2.g.2 Financing schemes for the management of spent fuel and radioactive waste – legal framework
5.2	Section E: 19.2.g.3 Improvement of the national framework
6 Competent regulatory authority	
6.1	Section E: 20 Regulatory Body
6.2	Section E: 20 Regulatory Body
6.3	Section E: 20 Regulatory Body
7 License holders	
7.1	Section F: 21 Responsibility of the license holder
7.2	Section G: 8 Assessment of safety of spent fuel and radioactive waste management facilities
7.3	Section G: 8(II) Updated assessments before operation
7.4	Section F: 23 Quality assurance
7.5	Section F: 22(I) Qualified staff at COVRA
8 Expertise and skills	Section E: 20.1 Authority for Nuclear Safety and Radiation Protection Section F: 22(I) Qualified staff at COVRA Section K.2: Maintenance of competence
9 Financial resources	Section F: 22(II) Adequate financial resources at COVRA
10 Transparency	Section E: 19 (especially sections on the Environment and Planning Act, General Administrative Act and 19.2.b System of licensing) and 20.1.j Openness and transparency of regulatory activities
11 National programmes	Section L: Implementation of the National programme
12 Contents of national programmes	Section L: Implementation of the National programme
13 Notification	Not relevant for the Directive report
14 Reporting	
14.1 and 14.2.a	Not relevant for the Directive report
14.2.b	Section D: Inventory
14.3	Section K.4: Results of self-assessments and peer reviews
15 Transposition	Section A.3 and Section L: 15
16 Entry into force	Not relevant for the Directive report
17 Addressees	Not relevant for the Directive report

A.4 National nuclear programme

The Netherlands has a small but divers nuclear programme (see the figure below):

- One nuclear power plant (NPP) in operation: the Borssele Pressurized Water Reactor (Siemens/KWU design, net electrical output approximately 490 MWe), operated by N. V. Elektriciteits-Produktiemaatschappij Zuid-Nederland (EPZ).
- One NPP is in safe enclosure: the Dodewaard Boiling Water Reactor (GE design, 60 MWe), operated by Gemeenschappelijke Kerncentrale Nederland (GKN). This NPP has been permanently shut down in 1997 and is awaiting decommissioning.
- There are two research reactors in operation:
  - the High Flux Reactor (HFR, 45 MWth) of the EU Joint Research Centre, operated by the Nuclear Research & consultancy Group (NRG), and
  - the Hoger Onderwijs Reactor (HOR, 2 MWth) at the Reactor Institute Delft (RID), of the Delft University of Technology.
- One uranium enrichment company: Urenco Netherlands. Urenco has facilities for uranium enrichment in Almelo. Licensed capacity is currently 6200 tSW/a.
- One national Waste Management Organisation: Central Organisation for Radioactive Waste (in Dutch: Centrale Organisatie Voor Radioactief Afval, COVRA). COVRA is located at one site in Nieuwdorp and has facilities for the long-term interim storage of low-, intermediate- and high-level waste. The latter category includes spent fuel of research reactors, waste from molybdenum production and waste from reprocessing of spent fuel of NPP Borssele. COVRA also manages radioactive waste from non-nuclear origin.

Figure 1: Locations of current nuclear installations in the Netherlands



Details on the national nuclear programme of the Netherlands can be found in the national report for the Convention on Nuclear Safety (CNS). That report demonstrates that the Netherlands has developed, and continues to improve, a robust domestic framework for nuclear safety in line with its international obligations.

A.5 Producers of spent fuel and radioactive waste in the Netherlands

Spent fuel and radioactive waste (hereafter: radioactive waste) are generated by various license holders. All companies in the Netherlands that hold a license based on the Nuclear Energy Act are required to transfer their radioactive waste to COVRA unless specific clearance is granted by the ANVS. The waste produced can be divided into ten sectors: nuclear, medical isotopes, medical care, education and research, oil and gas, scrap metals, industry general, naturally occurring radioactive material (NORM), smoke detectors and other.

NORM-waste with an activity concentration of up to ten times higher than the clearance levels (about 95 volume% of the Dutch radioactive waste produced), need not be entrusted to COVRA but is safely managed as very low-level waste at a licensed designated landfill.

For more information on the various types of radioactive waste in the Netherlands, see text on Article 32.1(IV) in Section B.

A.6 Recent developments since the previous national report

This section shows the progress made in the management of spent fuel and radioactive waste by summarising the developments since the previous national report.

A.6.a Recent developments of the regulatory framework

- The basic legislation governing nuclear activities is contained in the Nuclear Energy Act. The Nuclear Energy Act is a framework law, which sets out the basic rules on the application of nuclear technology and materials, makes provision for radiation protection, designates the competent authorities and outlines their responsibilities. More detailed legislation is provided by associated Decrees and Regulations. Some Decrees associated with the Nuclear Energy Act contain additional regulations related to the use of nuclear technology and materials. In recent years here have been no significant changes of the law. The framework has been evaluated in 2024. There are plans for some rearrangement of the legislation and minor adjustments that are not relevant for the management of spent fuel and radioactive waste.
- An evaluation of the system of legislation and regulations in the field of nuclear safety and radiation protection was carried out in 2023. The aim was to determine whether changes are necessary to the system to guarantee safety during the possible construction of new nuclear power plants in the Netherlands in the short and long term. The evaluation shows that the current legal framework ensures nuclear safety and that no major adjustments are required for the current plans for the coming years. There are a few recommendations to consider which will make the system and its implementation more robust and future-proof. These recommendations and suggestions will be taken up in the near future in conjunction with the recommendations of the International Atomic Energy Agency (IAEA) missions carried out in the Netherlands in 2023: IRRS, IPPAS and ARTEMIS.
- Since 15 May 2020, policy development and legislation concerning radioactive waste and spent fuel is transferred from the ANVS to the Ministry of Infrastructure and Water Management (IandWM), i.c. the Directorate-general for Environment and International Affairs. In connection with this, a bill to amend Section 3 of the Nuclear Energy Act is currently before the House of Representatives. This is a proposal for an amendment in connection with the adjustment of the task of the ANVS regarding policy preparation and policy evaluation. See Section E, 20.1.c. for a description of the tasks of the ANVS.
- Although reprocessing does not take place in the Netherlands, reprocessing has been added to the definition of radioactive waste management as defined in the Bkse to fully comply with the Directive. This amendment to the regulatory framework entered into force on 30 October 2021.
- Article 10.7 of the Basic Safety Standards for Radiation Protection Decree (Bbs) determines that radioactive waste shall be disposed of as quickly as reasonably possible, but in any case, within a period set by the ANVS. The ANVS-Regulation on Basic Safety Standards for Radiation Protection now sets a – generally applicable – maximum period of two years for the disposal of radioactive waste. When granted by license, the license holder can deviate from this maximum period of two years.

This general provision does not apply to nuclear facilities. This amendment to the ANVS-Regulation applies from 1 July 2023.
- COVRA charges the costs for the management of radioactive waste to the providers of the waste by means of tariffs. The Bbs and the Nuclear Installations, Fissile Materials and Ores Decree (Bkse) stipulate that COVRA will set these tariffs in a transparent, objective and non-discriminatory manner. A new policy rule provides further elaboration on these criteria. The policy rule provides clarity for COVRA and the public, including waste providers and entered into force on 12 March 2024.

A.6.b Recent developments of the regulatory body (ANVS)
- A new organisational structure came into effect on 1 February 2023. The ANVS now has two substantive departments (the Competent Authority Department and the Assessment & Advice Department) and a Business Operations & Information department. More information can be found in Section E, 20.1.d.
- Besides the ANVS, there are other organisations in the Netherlands with responsibilities and tasks in relation to radiation protection based on the Nuclear Energy Act. Hence, a Cooperation Agreement for Radiation Protection (signed in 2017) was set up to describe the interaction, communication and cooperation between the ANVS and the concerned policy departments and inspectorates of other ministries. Four working arrangements have been made, and another three will be finalized in 2024. More information can be found in Section E, 20.1.b.
- The ANVS Academy was launched in 2022. The ANVS Academy is a comprehensive and easy to use platform on which all education and training activities for ANVS employees are offered. This is an important step in improving our knowledge management. In parallel, several new courses are being developed and a new system of personal education plans has been introduced. More information can be found in Section E, 20.1.g.
- In 2023, the ANVS renewed its Supervision and Intervention Strategy (TIS). The updated TIS was written by and for ANVS employees who work in supervision. The TIS has also been published on the internet. Compared to the 2017 version, the text is shorter, more concise and has been modernised. More information can be found in Section E, text on Article 19.2: 19.2.e.
- The ANVS has started implementing a renewed systematic approach to implement the IAEA Safety Standards and the WENRA Safety Reference Levels within the existing framework, using binding and non-binding instruments that are already in place.

A.6.c Recent policy developments
- In December 2021, the government coalition presented its plans for the coming years. It included the pursuit of a strong reduction in greenhouse gas emissions. As part of this, there are plans to support the construction of two new nuclear power plants and to extend the operating life of the Borssele nuclear power plant. The agreement also reconfirms that safe, permanent storage of nuclear waste will be ensured. This coalition will, among other things, facilitate market parties in their explorations, support innovations, invite tenders, review the (financial) contribution of the government, and prepare legislation and regulations where necessary. There are ongoing negotiations to form a government after the elections of November 2023. At the time of writing, the coalition agreement of 2021 is still valid.
- The possible extension of the nuclear programme and building of new facilities for medical isotopes do not change the fundamentals of the policies for radioactive waste and spent fuel. However, if new facilities are being build, more waste will be produced in the period until 2130 than anticipated before the plans for two new NPPs and the LTO of the Borssele NPP. The Dutch government is improving communication and dialogue with its citizens to assure confidence in existing policies and its possible developments, as increased interest in nuclear energy also means an increased interest in how radioactive waste (mainly high-level waste) is dealt with. A website has been launched to provide information in an accessible way (www.overkernenergie.nl). Plans for communication and participation are being put together.
- On 21 March 2022, a new assessment framework to allow acceptance of alternative packages of reprocessed fuel has been sent to parliament. The assessment framework came into force in January 2023. Driving force behind this new policy was a request of the NPP Borssele to allow more flexibility in the packages of reprocessing waste returning to the Netherlands.

- In the policy paper sent to the House of Representatives on 9 December 2022, designated areas of policy developments on the management of radioactive waste are described, as well as which steps are being taken regarding updating the National programme for 2025.
- In a letter to parliament on 9 December 2022, the government declared to favour reprocessing of spent fuel from NPPs rather than direct storage of spent fuel at COVRA without reprocessing it. Driving force behind this policy accentuation is the intent of the government in the coalition agreement of December 2021 to support the Long-Term Operation (LTO) of the NPP Borssele and support the build of two new NPPs. Main argument to support reprocessing is that in the end there is relatively less waste to be managed while the nuclear programme is growing. More information can be found in Section B, text on Article 32.1(I).
- On 22 December 2022, the House of Representatives was informed about the planning and general outlines of the National programme for 2025. These outlines are based on the conclusions and recommendations of several studies on the effectiveness of the policy.

A.6.d Other recent developments

- The Ministry of IandWM together with the ANVS, published an updated Guide for Readers (in Dutch: Wegwijzer) in 2022. The Guide gives an overview of the policy on nuclear safety and radiation protection and also outlines how the Netherlands handles the organization and implementation of this policy. This overarching document is intended for professionals working in the field.
- To ensure a thorough knowledge of all waste streams and to have an overall review of the management strategies, the Ministry of IandWM requested the Institute for Public Health and the Environment (in Dutch: Rijksinstituut voor Volksgezondheid en Milieu, RIVM) to perform a complete study of all waste streams in the Netherlands. The report of this study has been published in 2022 and includes landfills[2]. More information can be found in Section L, text on Directive Article 12.1.c.
- The national inventory of radioactive waste has been updated in 2022[3]. This inventory includes various alternative scenarios and estimates the amount of high-level waste (HLW), low- and intermediate-level waste (LILW) and NORM-waste up to and including 2130. More information can be found in Section L, text on Directive Article 12.1.c.
- Netherlands and Belgium have declared that they want to explore areas of collaboration in the management of radioactive waste, including technical research into a disposal facility. The Political Declaration on Energy Cooperation between the Netherlands and Belgium of December 18, 2022, includes agreements on this matter.
- The Netherlands hosted three missions of the IAEA in 2023: IRRS (June), IPPAS (October) and ARTEMIS (November). More information on both the waste related IRRS suggestions and recommendations and the ARTEMIS mission can be found in Section K.4.
- The high-level waste treatment and storage building (in Dutch: Hoogradioactief AfvalBehandelings- en OpslagGebouw, HABOG) of COVRA has been extended. COVRA is also building a new multifunctional storage building for the storage of low- and intermediate level waste (in Dutch: Multifunctioneel OpslagGebouw, MOG). Construction of the MOG has started at the end of 2023 and it is planned to receive its first waste in 2025. More information on HABOG can be found in Section G, Annex 1 and Annex 2.
- The HFR in Petten is in operation since 1961 and is nearing the end of its operating lifetime. In order to continue the production of medical isotopes, a new research reactor (named PALLAS) is being build. For the PALLAS reactor to be in operation, both a construction permit and an operating license are needed. In 2023, a construction license has been granted by the ANVS. According to PALLAS organization, the plan is to finish the construction of the new reactor around 2028. The decommissioning of the HFR is planned to start in 2035, pending on the start of operation of the Pallas reactor.
- NRG plans to decommission the 'GBD-building', starting in 2025. The reason for this decommissioning activity is the construction of the new PALLAS reactor. Several radionuclide laboratories are located in the GBD-building. These laboratories are all classified as laboratories in which relatively low amounts

[2] https://www.rivm.nl/publicaties/radioactieve-rest-en-afvalstromen-in-nederland-inventarisatie.
[3] https://www.covra.nl/app/uploads/2022/10/Nationale-Radioactief-Afval-Inventarisatie.pdf.

of radioactivates were allowed. The decommissioning of the GBD-building is estimated to finish before 2026.
- At the time of writing, the Rathenau Institute is completing their advice on the decision-making process for the long-term management of spent fuel and radioactive waste. The advice is expected in July 2024. More information can be found in Section A.7.a.

A.7 Update on the challenges and suggestions from the seventh Joint Convention Review Meeting

During the seventh Joint Convention Review Meeting in 2022, two challenges and one suggestion were identified for the Netherlands.

A.7.a Challenge: Proceeding from storage to disposal including public acceptability

The National programme describes the route the Netherlands is taking towards disposal. After the interim storage period, geological disposal is foreseen around 2130. The decision-making on disposal is expected around 2100. In the meantime, the parliament and the public will be informed about the developments of policies on radioactive waste management. For instance, during the consultation moments for the strategic environmental assessment and the planned updates of the National programme (updated at least every ten years, due in 2025). The national report on the implementation of the National programme as required by the Directive (every three years) as well as policy papers are available to the public.

Participation on participation

The National programme announced the establishment of a consultation group on the management of spent fuel and radioactive waste (Disposal Advisory Platform). To further define the mission of this consultation group, a number of interviews with national stakeholders (researchers, local and national government, waste producers and NGO's) were conducted. Lessons learned by countries with experience on public participation were also collected during interviews. The main conclusion of this research was that there is support for the establishment of such a consultation group in the Netherlands, but stakeholders agreed that this consultation group should have a more active role than solely acting as a sounding board. Therefore, instead of establishing one consultation group, it was decided to start a project in which a variety of stakeholders can participate on different subjects which are relevant for the decision-making process on disposal.

For the period July 2019 till July 2024, the Minister of IandWM has entrusted the Rathenau Institute to design a participative process to deliberate on a supported decision-making process on disposal of radioactive waste and spent fuel (participation on participation). The results will be consolidated in an advice to the Minister of IandWM. The advice is expected in July 2024 and will be considered in the development of the roadmap to disposal (see Section A.8.1).

Research on disposal

COVRA published a detailed research plan for the period of 2020-2025 as part of a long-term research programme for geological disposal of radioactive waste (COPERA) in 2020. This programme uses the research roadmap developed in the OPERA safety case, thereby using a structured process to select research activities to be carried out over the coming years.

The research programme at COVRA is reviewed by an International Advisory Board consisting of international experts in fields crucial for the geological disposal of radioactive waste. The goal of the International Advisory Board is to assure the quality of the research programme and its outputs, assure its international embedment and its linking with adjacent initiatives in the Netherlands and abroad, and to strengthen the research programme based on input from international experts.

Information on management of radioactive waste
Both COVRA as well as ANVS publish information on management of radioactive waste on their websites (www.covra.nl and www.anvs.nl). The information is constantly kept up to date. ANVS has the legal task to inform the public on nuclear safety and radiation protection. For more information on reporting and information to the public by the ANVS, see Section E, 20.1.j. COVRA gives a lot of attention to communication, both to stakeholders as well as to the public. For more information on the communication practice of COVRA, see Annex 2.

A.7.b Challenge: Maintain and develop an infrastructure for knowledge and expertise on nuclear safety and radiation protection

In 2019, the Advisory Board of the ANVS presented an advice on the possible ways to guarantee the adequate education and scientific knowledge in the Netherlands. As a response to this advice, the ANVS appointed an independent committee, the so-called Van der Zande Commission.

From June 2019 to January 2020, the Van der Zande Commission explored the support and conditions within the sector, knowledge institutions and within the government on how to maintain and further develop the required knowledge structure for nuclear safety and radiation applications within the Netherlands.

Following the discussions with stakeholders, the Van der Zande Commission made the following recommendations:

- Draw up a knowledge and innovation agenda for nuclear technology and radiation from the government.
- Establish a national platform for Nuclear Technology and Radiation, and from the platform initiate three impulse programs in the field of awareness, research and education.
- Establish a Human Resources Observatory for Nuclear Technology and Radiation.
- Strengthen horizontal interdepartmental coordination at (high) official level.

These recommendations relate to the Ministry of IandWM and the ANVS, but also to other ministries and the sector.

The recommendations were followed-up by the establishment of an interdepartmental working group at the end of 2020. This working group consisted of the ANVS, the Ministry of Economic Affairs and Climate Policy, the Ministry of IandWM, the Ministry of Social Affairs and Employment, the Ministry of Health, Welfare and Sport and the Ministry of Education, Culture and Science. The working group was to investigate the challenges related to guaranteeing the required knowledge structure within the Netherlands in the long-term, as well as to identify concrete solutions to these challenges. In the analysis, the (future) supply and demand of expertise, the inflow and outflow into training and employment, and the size of the relevant labour force are discussed.

The interdepartmental working group recommended the House of Representatives in June 2023 to:

- Invest in nuclear education at all levels, in order to familiarize a large group of students with nuclear technology.
- Increase scientific expertise by establishing professorships, including a chair in the field of radiation protection.
- Stimulate cooperation between the existing organizations that offer radiation protection courses.
- Investigate solutions to make sure a shortage of labour will not hamper the government's nuclear ambitions.

The interdepartmental working group stresses that the background to the challenges addressed in the advice from the Van der Zande Commission has changed dramatically in just a few years. As a result of the government's ambitions to add more nuclear power to the energy mix, as well as a new production facility for medical isotopes (PALLAS), the nuclear sector is growing. On the one hand, this leads to an even larger challenge concerning the required knowledge base, especially considering the broader workforce required to build new nuclear power plants in a very tight labour market. On the other hand, the new developments also create momentum for all parties involved in the nuclear field to invest in the knowledge base, and an incentive for students and professionals to enter the field.

Another important development was the announcement by the government that nuclear energy will be part of the so-called Top sector Energy, meaning that an integrated knowledge and innovation agenda will be created for the nuclear sector. Incorporation in the Top sector Energy formalizes cooperation of public and private actors in the field and will serve as a vehicle for combined public and private investments in the knowledge base for nuclear technology.

Within the revised interdepartmental governance structure, a separate working group has been set up devoted to the maintenance and development of the knowledge structure within nuclear technology and radiation applications. Through this structure, follow-up will be given to the recommendations of the interdepartmental working group which were presented in June 2023.

Additionally, in 2021, an amendment was adopted within the House of Representatives to allocate five million Euro within the budget of the Ministry of Economic Affairs and Climate Policy to strengthen the knowledge structure and to encourage innovation in the fields of nuclear technology and radiation protection. This one-off five million Euro offers the opportunity to boost the knowledge structure within the Netherlands. Enhancing knowledge for the management of spent fuel and radioactive waste is included in that programme.

As part of the university curriculum, the Ministry of Education, Culture and Science partially finances courses on nuclear technology and radiation protection.

The Government also (partially) finances research and consultancy institutes (NRG, RIVM) to develop and maintain knowledge on relevant nuclear safety and radiation protection subjects.

A.7.c Suggestion: Implement feedback obtained from the national research programme on disposal into waste acceptance criteria

In the current research programme COPERA, safety cases for disposal are being drafted. Once these safety cases are finished, these can provide input for the waste acceptance criteria.

A.8 Overarching issues from the seventh Joint Convention review meeting

During the seventh Review Meeting in 2022, the Contracting Parties agreed that the national reports for the next Review Meeting should address, as appropriate, the actual measures that have been taken in implementing the following overarching issues[4]:

1. Competence and staffing linked to timetable for spent fuel and radioactive waste management programmes

Designing and implementing a roadmap to disposal was put forward during the 2022 evaluation of the Dutch policy for the management of spent fuel and radioactive waste. The roadmap is a mean to make progress towards disposal and take responsibility towards future generations. This roadmap will include the necessary steps for several paths such as research, participation, decision-making processes, developments of legislative framework and knowledge management. The roadmap will include timelines for the development of necessary knowledge, the decisions that must be taken and the parties involved, the necessary developments in legislation and regulations and the organization of participation and consultation. This roadmap will also include the dual track approach and a milestone for the decision on whether to choose for a national or an international solution.

[4] Summary report of the Seventh Review Meeting of the Contracting Parties, July 2022.

The roadmap to disposal will be included in the update of the National programme due in 2025 and the subsequent updates. In this way, the roadmap will be updated periodically with each update of the National programme.

2. Inclusive public engagement on radioactive waste management and on spent fuel management programmes

See Section A.7.a for information on the research on the decision-making process on disposal by the Rathenau Institute.

3. Ageing management of packages and facilities for radioactive waste and spent fuel, considering extended storage periods

COVRA has a comprehensive ageing management programme, giving attention to aspects of ageing important for nuclear safety. This programme includes in-service-inspection, (preventive) maintenance, monitoring of compliance with acceptance criteria and documenting and learning from operating experience.

COVRA stores packaged and immobilized LILW in the low- and intermediate-level waste storage building (in Dutch: Laag- en middelradioactief afval OpslagGebouw, LOG) for a relatively long period of at least 100 years. The storage period is important since it is the basis for the design life of the facility and the packaging requirements.

Operator inspection and monitoring is a critical element of the long-term storage of LILW. An active maintenance and surveillance program is necessary to assure the continued ability of the facility design and materials perform their intended function for the duration of the storage period. The design of the package and configuration of the packages and the facility should allow monitoring and/or inspection of the integrity of the facility and its inventory. The methods employed for the inspection and monitoring will vary depending on the facility and the waste and package type. COVRA inspection of packages is visual inspection by operators and radiation monitoring. COVRA has a dedicated quarantine dock to store damaged or deteriorated waste packages before and after repair. A separate dock makes it easier inspect the quarantine packages and to make sure the repair will be effective in the long-term. Only after storage in the dock, waste can return to the standard storage location.

The spent fuel elements of the research reactors are delivered to COVRA in a cask containing a basket with about 33 elements. Inside COVRA the basket with elements is removed from the cask and placed in a steel canister, which is closed by welding and filled with an inert gas (helium). These sealed canisters are placed in wells, in the same way as the vitrified residues. The wells are filled with another inert gas (argon) to prevent corrosion of canisters containing spent fuel elements or vitrified waste. Argon atmosphere is measured on a regular basis (once a year). When no (or very low levels of) helium is found, the canister integrity is guaranteed. If helium is found, the weld can be redone or the canister can be put into a steel overpack, which is closed by welding and filled with an inert gas (helium). In 2024 the plan is to commission an installation which can open a spent fuel canister, retrieve the basket with fuel and repackage in a new canister. Similar procedures exist for other high-level waste.

4. Long-term management of disused sealed sources, including sustainable options for regional as well as multinational solutions

If reuse is not possible, disused sealed sources are preferably returned to the supplier or manufacturer. Otherwise, the same policy applies for the long-term management of disused sealed sources as for radioactive waste: radioactive waste (including disuses sealed sources that cannot be returned to the supplier or manufacturer) must be transferred as soon as reasonably possible to COVRA for interim storage. After the period of interim storage, geological disposal of all radioactive waste stored at COVRA is foreseen in 2130 in one disposal facility.

A.9 Overview matrix of liabilities and current policies and practices

An overview matrix providing the types of liabilities and the general policies and practices for the Netherlands is given below.

Type of liability	Long-term management (LTM) policy	Funding of liabilities	Current practices / facilities	Planned facilities
Spent fuel (SF) and reprocess-ing waste	It is up to the licensee to decide if SF is to be reprocessed. Research reactor (RR)-SF and HLW resulting from reprocessing of SF of NPP Borssele, are to be stored at COVRA, the national waste management organisation. Licensees pay all-in tariffs that are determined by COVRA and which cover all costs of storage and disposal of SF and radioactive waste. It is foreseen that all radioactive wastes, including HLW from reprocessing and RR-SF, ultimately will be disposed of in one single geological disposal facility.	If applicable, SF producers fund the reprocessing of SF and management of resulting wastes. Via tariffs, license holders fund storage and disposal of their SF and radioactive waste. Upon transferral of the waste to COVRA, all liabilities, including the responsibility for safety, are transferred to COVRA.	SF of NPP Borssele is reprocessed in France; resulting vitrified and metallic HLW are stored in HABOG at COVRA. SF of RRs is stored in HABOG at COVRA. The main producers of nuclear waste generally directly pay for the construction costs of the buildings in which the waste is stored, these construction costs are not included in the waste management tariffs.	A geological disposal facility is foreseen around 2130.
Nuclear Fuel Cycle (NFC) waste	All radioactive wastes from NFC facilities have to be stored at COVRA. Licensees pay all-in tariffs that are determined by COVRA and which cover all expected costs of storage and disposal of radioactive waste. It is foreseen that all radioactive wastes that have not decayed below clearance levels, ultimately will be disposed of in one single geological disposal facility.	Via the tariffs of COVRA, license holders fund storage and disposal of their radioactive wastes. Upon transferral of the waste to COVRA, all liabilities, including the responsibility for safety, are transferred to COVRA.	All NFC waste is transferred from license holders to COVRA followed by storage in aboveground facilities at COVRA. The main producers of nuclear waste generally directly pay for the construction costs of the buildings in which the waste is stored, these construction costs are not included in the waste management tariffs.	A geological disposal facility is foreseen around 2130.
Application wastes	All radioactive wastes have to be stored at COVRA unless specific clearance is granted by the ANVS. Licensees pay all-in tariffs that are determined by COVRA and which cover all expected costs of storage and disposal of radioactive waste. It is foreseen that all radioactive waste that has not decayed below clearance levels, ultimately will be disposed of in one single geological disposal facility.	Via the tariffs of COVRA, license holders fund storage and disposal of their radioactive wastes. Upon transferral of the waste to COVRA, all liabilities, including the responsibility for safety, are transferred to COVRA.	All radioactive waste is transferred from license holders to COVRA followed by storage in aboveground facilities.	A geological disposal facility is foreseen around 2130.

Type of liability	Long-term management (LTM) policy	Funding of liabilities	Current practices / facilities	Planned facilities
NORM- waste	Disposal of NORM-waste between 1 – 10 times the general clearance levels at designated landfills. When specific clearance is applicable: disposal of NORM-waste below the specific clearance levels at designated landfills. For NORM-waste with an activity concentration > 10 times the general clearance levels and when specific clearance is not applicable: see application wastes.	Via tariffs, waste producers fund disposal of their radioactive wastes at designated landfills.	Disposal of NORM-waste between 1 – 10 times the general clearance levels at designated landfills. When specific clearance is applicable: disposal of NORM-waste below the specific clearance levels at designated landfills.	No planned facilities.
Decommis-sioning Liabilities	Since 2011, it is mandatory for license holders of nuclear facilities to choose the immediate decommission-ing strategy in their decommissioning plan. In exceptional circumstances, the Minister can allow different strategies. This exceptional circumstance applies only in one case: the NPP of Dodewaard. Bkse requires the license holder of a nuclear facility to have and periodically (every five years) update a decommissioning plan during the lifetime of the facility or sooner when there is a need to update the decommissioning plan. The ANVS will evaluate the plan and decide on approval. Ultimate responsibility rests with the license holder.	The license holders of nuclear reactors are required to have financial assurance for decommissioning, to cover the costs of decom-missioning (including a contingency add-on) and resulting waste manage-ment costs. The financial assurance will have to be updated and approved by the Ministries of IandWM and Finance at least every 5 years or sooner when there is a need to update the decommissioning plan or the financial assurance. The Ministers of Finance and of IandWM are responsible for the evaluation and approval of the financial assurance for decommis-sioning.	License holders of NFC facilities are required to have an up-to-date decommissioning plan throughout their entire lifecycle. License holders of nuclear reactors are required to have also an updated financial guarantee.	A NPP is in safe enclosure (Dodewaard).
Disused sealed sources	All import, manufacturing, storage, use, export and disposal of radioactive sources needs a license. All radioactive wastes have to be stored at the facilities of COVRA. Licensees pay all-in tariffs that are determined by COVRA and which cover all expected costs of storage and disposal of radioactive waste. It is foreseen that all radioactive wastes ultimately will be disposed of in one single geological disposal facility.	HASS (High Active Sealed Sources) are regulated according to EU regulations[5], implemented in Dutch regulation for licensing, registration & require financial guarantee.	If reuse is not possible, disused sealed sources are preferably returned to the supplier or manufacturer. All radioactive waste is transferred to COVRA, followed by storage in above-ground facilities at COVRA. Most orphan sources are found during routine radiological monitoring of scrap material with portal monitors at scrap yards.	A geological disposal facility is foreseen around 2130.

[5] Directive 2003/122/Euratom on the control of high activity sealed radioactive sources and orphan sources.

Section B Policies and Practices

32 Reporting

This section addresses the following.

JOINT CONVENTION

ARTICLE 32. REPORTING

1. In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:
   (I) spent fuel management policy;
   (II) spent fuel management practices;
   (III) radioactive waste management policy;
   (IV) radioactive waste management practices;
   (V) criteria used to define and categorize radioactive waste.

DIRECTIVE 2011/70/Euratom

ARTICLE 4. GENERAL PRINCIPLES

1. Member States shall establish and maintain national policies on spent fuel and radioactive waste management. Without prejudice to Article 2(3), each Member State shall have ultimate responsibility for management of the spent fuel and radioactive waste generated in it.

2. Where radioactive waste or spent fuel is shipped for processing or reprocessing to a Member State or a third country, the ultimate responsibility for the safe and responsible disposal of those materials, including any waste as a by-product, shall remain with the Member State or third country from which the radioactive material was shipped.

3. National policies shall be based on all of the following principles:
   (c) spent fuel and radioactive waste shall be safely managed, including in the long term with passive safety features;
   (d) implementation of measures shall follow a graded approach;
   (f) an evidence-based and documented decision-making process shall be applied with regard to all stages of the management of spent fuel and radioactive waste.

ARTICLE 5. NATIONAL FRAMEWORK

5.1. Member States shall establish and maintain a national legislative, regulatory and organisational framework (‘national framework’) for spent fuel and radioactive waste management that allocates responsibility and provides for coordination between relevant competent bodies. The national framework shall provide for all of the following:

   a. a national programme for the implementation of spent fuel and radioactive waste management policy;

32.1(I) Spent fuel management policy

The policy on the management of radioactive waste also applies to spent fuel and is described in Section B, text on Article 32.1(III). In this section, only spent fuel specific aspects of the policy are included.

Reprocessing

The policy in the Netherlands on reprocessing of spent fuel is the following: the decision on whether or not to reprocess spent fuel is up to the operator of a nuclear facility. After reprocessing, the operator remains responsible for the safe storage of radioactive waste and has to come to arrangements with COVRA on that point.

In policy papers sent to parliament in 2022/2023, the State Secretary expressed a preference for the reprocessing of spent fuel from nuclear power plants above direct storage of the spent fuel at COVRA. Main argument to support reprocessing is that there is eventually less volume of waste to be managed while the nuclear programme is growing. A study showed that the consequences of reprocessing and direct storage of spent fuel are comparable for non-proliferation, safety and economical aspects while the environmental consequences (specifically when considering the entire fuel cycle) are more favourable for reprocessing. The choice between direct storage or reprocessing of spent fuel (the back-end strategy) is nevertheless left to the operator's judgement.

Note that the spent fuel from the research reactors is not reprocessed but directly stored at COVRA.

Evaluation of back-end strategy

In the case of a new nuclear power plant, the license holder will have to provide a back-end strategy during the license application process and evaluate it every ten years. The government should evaluate policies for back-end strategies every twenty years.

For now, it is assumed that the NPP Borssele will continue reprocessing its spent fuel if its operation time will be extended, and possibly new nuclear power plants will do the same.

32.1(II) Spent fuel management practices

Spent fuel from the NPPs

Borssele NPP

The operator of the Borssele NPP decided in favour of reprocessing spent fuel for both economic reasons, reuse of plutonium and reduction of the volume of waste. The Borssele NPP has a license that allows the on-site temporary storage of spent fuel in the spent fuel pool to reduce residual heat before shipping to France for reprocessing. The actual length of the cooling period is according to the safety requirements of the transport packages and the specifications of the reprocessing company (namely Orano in La Hague, France). The fuel pool inventory is kept to a practical minimum, as required by the plant's operating license.

Intergovernmental agreement with France

In 1979, the Dutch and French governments signed a first agreement in which the possible return to the Netherlands of spent fuel originating from the Borssele nuclear power plant following reprocessing is organised. The Netherlands agreed to implement no statutory measures or draw up regulations which prevent COGEMA (now Orano) from returning the radioactive waste produced during reprocessing to the Netherlands. Orano is the French organisation responsible for reprocessing the spent fuel.

In July 2006 a new French legislation entered into force, prescribing a formal agreement beforehand of the return scheme for the radioactive waste after the reprocessing of the spent fuel.

In 2009 a second bilateral agreement[6] between France and the Netherlands was signed for Dutch spent fuel produced until 2015.

A third agreement[7] entered into force on 1 January 2014, regulating matters related to reprocessing of the spent fuel produced by the Borssele NPP until 2033. This agreement includes the acceptance of its spent fuel by Orano at the latest 31 December 2049, its reprocessing, and the return of radioactive wastes to the Netherlands before 31 December 2052. After reprocessing, the vitrified waste and the residual waste components are sent back to the Netherlands for interim storage in the HABOG at COVRA.

Under previous contracts all the plutonium extracted from the Borssele NPP reprocessed spent fuel was sold for reuse in MOX fuel for NPPs. Reprocessed uranium is also reused in fresh fuel. The plutonium made available under the current contract will also be reused in MOX fuel. A license for NPP Borssele to use MOX elements was issued in June 2011, and the first MOX elements were loaded in 2014.

Dodewaard NPP

Since the boiling water reactor in Dodewaard has been shut down in 1997, it has been in a stage of safe enclosure[8]. All spent fuel from the Dodewaard NPP was removed from the site in 2003. The spent fuel from the reactor was transferred to Sellafield (UK) for reprocessing:

- The separated uranium from the Dodewaard NPP has been sold to a European NPP.
- The separated plutonium has been sold to AREVA and the British Nuclear Decommissioning Authority (NDA).
- The vitrified waste was returned from Sellafield to the Netherlands in March 2010, and shipped to COVRA for interim storage.

Spent fuel from the research reactors

Spent fuel from research reactors is not being reprocessed. After storage in the on-site spent fuel pools, the spent fuel elements are directly transported to COVRA for interim storage. A cooling period of at least three years is applied before the spent fuel is transferred to COVRA. Periodic transports are arranged to ensure that the pool always has sufficient storage capacity available to accommodate all elements present in the reactor core.

HFR

Following the international non-proliferation effort initiated by the USA[9] in 1978 to substitute Low Enriched Uranium (LEU) to High Enriched Uranium (HEU), the HFR in Petten completed its conversion to LEU targets in May 2006. The last HEU fuel elements from the HFR were transported to COVRA in March 2011.

HOR

At the HOR in Delft the conversion from HEU fuel to LEU fuel started in 1998. With the last HEU fuel element removed from the core on 10 January 2005, the conversion was completed. The last HEU fuel elements from the HOR were shipped to COVRA in May 2011.

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[6] Agreement between the Government of the Kingdom of the Netherlands and the Government of the French Republic concerning amendment to the Agreement of 29 May 1979 concerning the reprocessing in France of irradiated fuel elements, Paris, 2 September 2009.

[7] Agreement between the Government of the Kingdom of the Netherlands and the Government of the French Republic concerning the reprocessing in France of Dutch irradiated fuel elements, The Hague, 20 April 2012.

[8] According to legislation in force since April 2011, decommissioning of a nuclear facility shall commence directly after final shut down and carried out without undue delay (no safe enclosure). NPP Dodewaard is excluded from this requirement.

[9] IAEA: Management of high enriched uranium for peaceful purposes: status and trends: https://www-pub.iaea.org/MTCD/Publications/PDF/te_1452_web.pdf, 2005.

32.1(III) Radioactive waste management policy

National programme for the management of radioactive waste and spent fuel

The policy on the safe management of spent fuel and radioactive waste has been detailed in the National programme for the management of radioactive waste and spent fuel[10] [11], that was published in 2016 in compliance with Directive 2011/70/Euratom. It is the most recent and complete official publication detailing this policy and it also includes other related issues like an inventory and a description of the route to disposal.

The National programme has been drafted according to Articles 11 and 12 of the Directive.

Summary of the policy on the safe management of spent fuel and radioactive waste

The various elements of the policy apply to both the management of radioactive waste as well as spent fuel.

An important aspect of the policy on management of radioactive waste is that radioactive waste should be transferred as soon as reasonably possible to COVRA for long-term centralized interim storage in dedicated buildings followed by geological disposal in 2130. After the period of interim storage, geological disposal of all radioactive waste stored at COVRA is foreseen in 2130 in one disposal facility. The definitive decision on the disposal method will be taken around 2100.

Since 1984, the management of radioactive waste in the Netherlands has been based on the following principles:

- Minimising the occurrence of radioactive waste, both in volume and activity.
  Prevention of waste production, reuse and using radioactive decay are successful policy instruments.
- Safe management of radioactive waste now and in the future.
  Radioactive waste should be transferred as soon as reasonably possible to COVRA. During interim storage at COVRA, the waste is safely managed in dedicated buildings. Around 2130 geological disposal is foreseen. The definitive decision on the disposal method will be taken around 2100. The design of the geological disposal facility shall allow the retrieval of the waste (via the existing shaft) during the use of the geological disposal facility.
- No unreasonable burdens on the shoulders of future generations.
  Generations that have profited from a specific application of radioactivity, such as nuclear power or medical isotopes, must bear the burdens for managing the waste produced in those activities. To minimize the burden for the management of waste in the future, a passive management method is required: geological disposal. Future generations should have sufficient knowledge and financial resources to establish, operate and close a disposal facility. The period of retrievability offers the possibility of retrieving waste from the disposal facility if new techniques for waste processing or management become available. A reversible process for decision-making on disposal also allows future generations flexibility on decisions taken in the past.
- Those who produce radioactive waste bear the costs for the management of the waste.
- For all costs involved in the management of the radioactive waste 'the polluter pays' principle applies.

Relation to other policies

The policy on protection against radiation from radioactive waste is the same as the policy on radiation protection, which protects individuals, society and the environment against the risks of exposure to ionising radiation. Exposure to radiation must be justified, as low as reasonably achievable (ALARA) and must remain within specified thresholds. Anyone using ionising radiation bears prime responsibility for its use. The same principles are applied to the management of radioactive waste.

[10] National programme in Dutch: https://www.rijksoverheid.nl/onderwerpen/straling/documenten/rapporten/2016/06/30/rapport-het-nationale-programma-voor-het-beheer-van-radioactief-afval-en-verbruikte-splijtstoffen

[11] National programme in English (non-binding translation) https://english.autoriteitnvs.nl/documents/report/2016/08/09/the-national-programme-for-the-management-of-radioactive-waste-and-spent-fuel

The policy on minimizing radioactive waste is in line with the policy for conventional waste. For example, the policy strives to close raw material cycles as far as possible, with priority to be given to the most environmentally friendly possible processing methods. In the policy on radioactive waste, the same preferred order is assumed: prevention, reuse and finally, safe management of remaining waste substances. In addition to that, as with management of hazardous conventional waste, the IBC-principle is applied to the management of radioactive waste: isolate, manage and control.

Graded approach

This subsection also addresses Article 4.3.d of Directive 2011/70/Euratom.

The policy, regulations and supervision follow a graded approach: the greater the risk, the stricter the regime. For example, the requirements imposed on activities involving spent fuel are stricter than for activities involving other less radioactive substances.

COVRA has a graded approach in their storage buildings. There are dedicated buildings for high-level waste, low and intermediate level waste and NORM-waste.

The application of specific clearance follows this line as well. The level of containment in the management of the waste is according to the risks presented by the materials that need to be disposed of.

Safe management now: centralized long-term interim storage

This subsection also addresses Article 4.3.c of Directive 2011/70/Euratom.

Since 1984, the policy assumes centralized interim storage of the radioactive waste and spent fuel in dedicated buildings at COVRA for a period of at least 100 years. The central collection, processing and storage of radioactive waste also ensures implementation of key aspects such as environmental hygiene, cost effectiveness and industrial hygiene. Also benefits of economies of scale are optimized by centralizing most of the radioactive waste management activities.

Some advantages of a long-term interim storage period are:

- The volume of radioactive waste that has to be disposed of can grow and as a result, the operating costs per unit of waste can be restricted. In addition, technical advances into the most efficient and cheapest method possible of disposing the waste may take place.
- The period of at least 100 years interim storage can also be used for allowing money placed in a fund to accumulate.
- A substantial volume of radioactive waste will decay to below the clearance level and consequently will not need to be disposed of in a deep geological disposal facility or in a surface disposal facility.
- Heat generating waste will cool to a temperature at which it is easier to handle and to dispose of.
- Since no choice has yet been made for a location for the disposal facility, this period can be used to select a suitable location in consultation with society;
- There is time to learn from the experiences in building and operating geological disposal in other countries.
- There is time for research into the best long-term solution and new techniques; other management options may become available.
- During the long-term interim storage period, international or regional solutions may become available. Disposal, certainly for a country with a small nuclear sector, is the most expensive step in the management of radioactive waste. Cooperation between countries on radioactive waste management can result in cost savings.

Long-term interim storage poses challenges such as maintaining knowledge and keeping the public involved (see Section K). It also forces to construct safe and robust storage buildings. The various waste processing facilities and storage facilities at COVRA have been designed to last at least for one hundred years, however if needed they can be maintained, refurbished or replaced to accommodate a longer interim storage period. During the sixth Review Meeting, the upfront design of packages and facilities for long-term safe interim storage (100 –300 years) was identified as an Area of Good Performance for the Netherlands. Disposal should be kept on the agenda in order to keep moving forward.

Radioactive waste must be transported to COVRA[12] as soon as reasonably achievable. There are some exceptions:
- Radioactive wastes with a half-life of less than 100 days, are allowed to decay for a maximum period of two years on the production site.
- Large amounts of NORM-waste are reused or disposed of at designated landfills.
- Some legacy waste is still present at the research location in Petten (for more information, see Section H, text on Article 12(II)).

COVRA has been authorised for the collection and reception of radioactive waste. At the delivery of the radioactive waste to COVRA, the operator transfers the legal ownership and the related (financial) liabilities for the waste to COVRA. The fact that COVRA takes full responsibilities for the waste is laid down in the General Conditions of COVRA. The waste producer receives a proof of the transfer of its radioactive waste to COVRA. As a result, COVRA becomes owner of the radioactive waste and is responsible for all further stages of radioactive waste management. This ensures there is clarity on the responsibility for those stages.

COVRA includes all estimated costs for processing, storage and disposal in its charges, based on the state of the art at that time. Moreover, with the implementation of the Directive, the obligation has been introduced to set off COVRA's research costs for disposal in the charges imposed by COVRA. The tariffs should be set to acquire the financial resources and knowledge needed to achieve disposal around 2130. The accumulated funds are projected to grow during the period of interim storage in order to cover the cost for both long-term interim storage and for the implementation and operation of the (geological) disposal facility for the waste as well as associated research. See Section F, text on Article 22(II) for more information.

Since 2002, 100% of the shares in COVRA are held by the State and this guarantees a system of long-term institutional control.

For information on the facilities of COVRA, see Annex 1. For information on the various types of radioactive waste in the Netherlands, their origin and management, see text on Article 32.1(IV) in Section B.

Decay storage

There are forms of radioactive waste that require several tens of (thousands of) years to decay below the threshold values. According to regulations, such wastes shall be stored at COVRA followed by disposal. However, the Government aims at a circular economy and wishes to stimulate the market for renewable raw materials and the reuse of scarce materials.

Therefore, it is possible to store such radioactive materials unprocessed at COVRA for a maximum period of 50 years. After decay below clearance levels, the material can be reused.

Safe management in the future: one geological disposal facility

This subsection also addresses Article 4.3.c of Directive 2011/70/Euratom.

Responsibility for radioactive waste does not end following the period of aboveground storage. High-level waste and long-lived low- and intermediate-level must be managed for many thousands of years

[12] Disposal at a designated landfill is possible for NORM-waste between 1 – 10 times clearance levels, NORM-waste below the specific clearance levels or when specific clearance is applicable.

before the radiation levels have decreased to such an extent that they no longer represent radiation risks. Passive safety by geological disposal is one mean of guaranteeing safety over a very long period. For that reason, also by international consensus, geological disposal is viewed as the only safe means of managing long-lived radioactive waste for the long term.

The Netherlands foresees geological disposal in 2130. All types of radioactive waste at COVRA will be disposed in one geological disposal facility. The cumulative waste volume that is currently in interim storage at COVRA in the Netherlands, is several tens of thousands cubic meters. In volume most of it is low- and intermediate-level waste (see Section D, text on Article 32.2(IV)). Note that there are designated landfills for specific cases of NORM waste (see Section D, text on Article 32.1(IV)). In the meantime, for the long-term safe storage of high-level waste, the HABOG is as far as possible equipped with passive safety features (see Annex 2).

During the storage period, the deep geological disposal is prepared financially, technically and socially in such a way that it can be implemented after the interim storage period.

Retrievability and reversibility
For several decades, retrievability has been included as a precondition in the policy for the management of radioactive waste in a disposal facility. This means that the possibility for retrieving waste (packages) must be included in the design of a facility, such that the retrievability of the waste (via the existing shaft) must be possible during the use of the disposal facility. Research in the past (see Annex 4) has shown that it is possible for a period of one hundred through to several hundreds of years to create a retrievable geological disposal facility in clay and salt. Following this period, the radioactive waste can still be retrieved via a new shaft. See Section H, text on Article 14(III) for more information on retrievability.

Evidence-based and documented decision-making processes
This subsection also addresses Article 4.3.f of Directive 2011/70/Euratom.

Opening the possibility to reverse decisions taken in the past must relieve future generations from the burden of these decisions. This means that during the entire process of preparation for disposal, the building of the disposal facility and actual disposal of the waste, consideration will have to be given to whether the next step should definitively be taken, or whether a step back should be taken in the process.

Policy supporting research in the Netherlands is performed by an ongoing policy supporting programme at RIVM, a five-year programme the Rathenau Institute, and independent publications of the RLI (Council for the Environment and Infrastructure).

Dual track strategy
To achieve disposal, both a national and an international line are being followed: a dual track strategy. Within this strategy, a national route towards disposal will be elaborated. At the same time, the possibility of international collaboration will not be excluded. The dual track strategy makes it possible to respond appropriately to possible international initiatives regarding management of radioactive waste.

The costs of a national disposal facility will be relatively high for a country with a small inventory. Cooperation with other countries may reduce these costs due to the economy of scale.

ERDO Association
The ERDO Association was established on 7 January 2021 in Vlissingen, the Netherlands and continues the work of the European Repository Development Organization Working Group (ERDO-wg). As a relatively small, self-financed body, the ERDO Association can concentrate resources and manage projects effectively on modest budgets with efficient timescales. The ERDO Association is an association of radioactive waste management organizations from Denmark, Slovenia, Croatia, Italy, Norway and Belgium (the Ministry of Climate and Environment of Poland is an observer) with a mission to work

together to address the common challenges in managing their radioactive wastes. The Netherlands is one of the cofounders and COVRA is chair and secretary of the ERDO Association.

For European countries with only small amounts of waste to manage, constructing their own disposal solutions is a major challenge. The Joint Convention states that under certain circumstances, countries can fulfil this responsibility by sharing a disposal facility and the Directive also acknowledges this option. The founding feasibility studies for sharing disposal solutions in Europe were carried out in the European Commission SAPIERR projects that involved organizations from numerous European countries.
This led to the establishment of the ERDO-wg in 2009. Shared solutions have been researched over the last 20 years and much of the corresponding knowledge base lies within the ERDO Association. Both the fundamental concepts and the practical aspects of multinational waste management solutions have been researched and discussed by the IAEA, often with central involvement of ERDO Association members.

Public Participation
Transparency of nuclear activities and close communication to the public aid to enable a dialogue among stakeholders and the public debate on disposal, at the same time yielding confidence in the regulator and in the safety of radioactive waste management. There are several regulations that describe public participation in various procedures (see Section E, text on Article 19 for more information).

Decision-making process on disposal
See A.7.a for information on the research on the decision-making process on disposal by the Rathenau Institute.

Research programme
The Netherlands has been involved in research on the long-term management of spent fuel and radioactive waste for decades already. For information about the past and current research programmes, see Section K.6 and Annex 4.

32.1(IV) Radioactive waste management practices

Overview
The table below shows the various categories of radioactive waste and their management methods, now and in the future. The practices are explained further in the next sections.

Table 2: Categories of radioactive wastes and their management options

Category radioactive waste	Interim management	Long-term management
HLW	Storage at COVRA	
LILW	Storage at COVRA	Geological disposal[13]
NORM, subject to licensing	Storage at COVRA	
NORM, subject to notification (i.e., up to 10x the general clearance level)	-	Designated landfill
Radioactive waste with T1/2 < 100 days decaying below clearance levels in 2 years	-	
Radioactive waste decaying below clearance levels in 50 years	Storage at COVRA	Reuse or reprocessing as conventional waste
Radioactive waste below clearance levels	-	
When applicable: radioactive waste between general and specific clearance levels	As specified in the requirements for the specific clearance	As specified in the requirements for the specific clearance

[13] Radioactive waste that has decayed till below exemption levels at the time of disposal will be treated as conventional waste.

Storage facilities

One national central interim storage facility: COVRA

For information on radioactive waste management at COVRA, see Section B, text on Article 32.1(III) 'Safe management now'.

Waste Storage Facility (WSF) in Petten

For information on the WSF, see Section H, text on Article 12(II).

Disposal facilities

Landfills

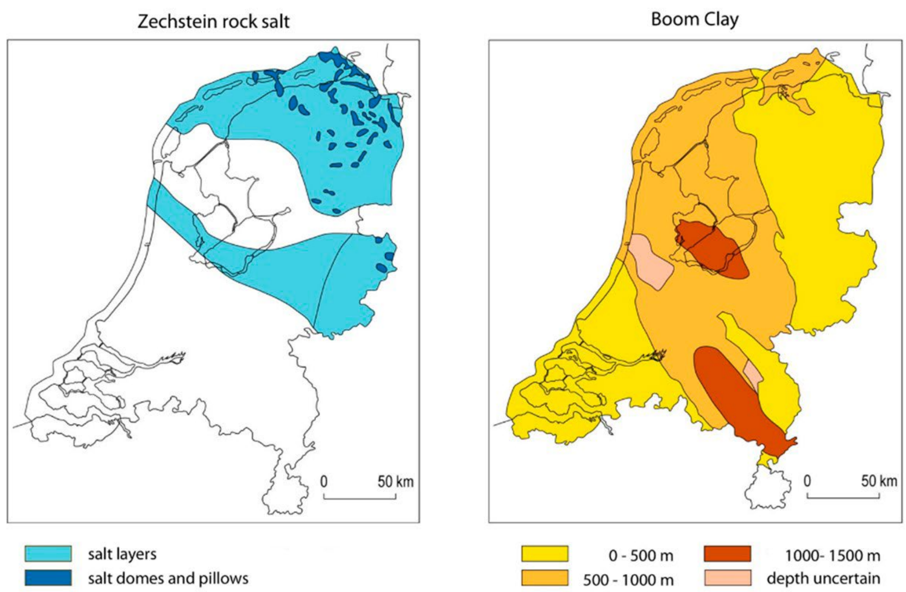
There are designated landfills for specific types of NORM-waste or when specific clearance is applicable in the Netherlands. These landfills are constructed in such a way that they can safely store these waste streams and they have a license to do so.

Geological disposal facilities

Currently, there are no geological disposal facilities in the Netherlands, nor are there underground research laboratories. For research purposes, knowledge gathered at foreign underground research laboratories is used when necessary.

The geological conditions in the Netherlands are at first glance favourable for the geological disposal of radioactive waste. In the northern part of the country there are large deep lying salt formations. Clay formations are ubiquitous at varying depth in the whole country. Extensions of the Boom clay, which qualifies as potentially suitable host rock for a repository in Belgium, also abounds in the southwest of the Netherlands (see figure below).

Figure 2: Distribution of Zechstein salt formation (left) and distribution and depth of the Boom Clay formation (right)



The various types of radioactive wastes, their origin and their management

The spent fuel and radioactive waste are generated by various license holders which can be divided into ten sectors: nuclear, medical isotopes, medical care, education and research, oil and gas, scrap metals, industry general, NORM, smoke detectors and other.

NORM-waste: waste containing Naturally Occurring Radioactive Materials

Waste containing NORM can result from processing ores and other raw materials or from dismantling installations used by the gas and oil industries. NORM will be considered as radioactive waste, if no further commercial use is foreseen.

Sometimes NORM has natural radioactivity concentrations exceeding the clearance levels. These levels have been specified in the Basic Safety Standards Radiation Protection Decree. Below the clearance levels, no notification to the authorities is required for handling of NORM. As far as possible this material is reused, for instance as additives for the preparation of building materials or for road construction.

Above the clearance level but below ten times this level, a notification to the competent authority is sufficient for handling NORM. The legislation for NORM allows the industry generating it, to mix it up with other materials for recycling purposes as long as this activity does not result in an increased risk to individuals, society or environment. Mixing up NORM with the sole purpose of dilution is not allowed.

In case no commercial use is foreseen and NORM is declared as waste, and the activity concentration levels are less than ten times the general clearance levels, it can be disposed of at designated landfills. Disposal at designated landfills is also allowed for NORM-waste when specific clearance is applicable and the activity concentration is below the specific clearance levels. These designated landfills are constructed such that they can safely store these waste streams if they have a license to do so.

NORM-waste shall be transferred to COVRA when no commercial use is foreseen and the general clearance levels are exceeded by a factor of ten. When specific clearance is applicable, but the specific clearance levels are exceeded, the NORM-waste shall also be transferred to COVRA. It is the case for instance for waste issued from the phosphor production with an activity between 500 and 4000 Bq/gram dominated by polonium-, bismuth- and lead- isotopes. Depending on the initial activity the material can decay to the general clearance levels within 100 to 150 years. So, after such a foreseen interim storage period at COVRA as radioactive waste, the material can be disposed of as conventional waste or reused if any suitable purpose can be found. The waste is stored at COVRA in large freight containers in a modular building specifically built for this material.

Depleted uranium

The tails that remain after the uranium enrichment process at Urenco are not considered waste as long as they are available for re-enrichment. If Urenco decides that re-enrichment is not economically feasible, the tails are converted to solid uranium oxide (U3O8) in France or the United Kingdom and stored at COVRA.

The uranium oxide is stored in standardized 3.5 m3 containers (DV-70, each containing around 12 metric tons of U3O8) in a custom-built modular storage building. One storage module with a storage capacity of 650 containers became operational in 2004, two more in 2008 and with the construction of modules 4, 5 and 6 in 2011, the depleted uranium storage building was completed. In 2017 a second depleted uranium storage building (in Dutch: verarmd uranium opslaggebouw VOG-2) became operational. VOG-2 has three storage modules, each module has the capacity to store 2,193 containers.

LILW: Low- and intermediate-level waste

LILW arises from activities with radioisotopes - in among others - industry, research institutes and hospitals. It includes lightly contaminated materials, such as tissues or cloth, plastic, metal- or glass objects. In addition, drums with LILW-waste in cement, originating from nuclear power plants, are delivered in a conditioned form to COVRA. The radioactivity is dominated by the radionuclides Ni-63, Cs-137, H-3 and Fe-55.

A substantial volume of LILW waste will decay to a non-radioactive level during the interim storage period. To keep track of the actual level of radioactivity, the radioactive content of each package is recorded in a database. Thus, the expected date at which the radioactivity has decayed below the clearance levels can be calculated. In the Netherlands, the clearance levels are numerically equivalent to the exemption levels.

COVRA has dedicated storage buildings for the storage of LILW.

HLW: High-level Waste

The HLW at COVRA consists of:

- Heat-generating waste such as vitrified waste from reprocessed spent fuel from the NPPs in Borssele and Dodewaard, spent fuel from the research reactors and spent uranium targets from molybdenum production.
- Non-heat-generating waste such as hulls and ends from fuel assemblies and waste from nuclear research and radio-isotope production.

Because of the long-term interim storage period, the design of the high-level waste treatment and storage building (HABOG) includes as many passive safety features as possible. In addition, precautions are taken to prevent degradation of the waste packages. In the design of the building all accidents with a frequency of occurrence larger than once per million years were considered. The design of the waste packages, as well as the building, is such that these accidents do not cause radiological damage to the environment.

Heat-generating HLW and non-heat-generating HLW, are stored in separate compartments of the HABOG. The non-heat-generating waste is, remotely controlled, stacked in well-shielded storage areas. The heat-generating waste is stored in an inert noble gas atmosphere and the well is cooled by natural convection. The HABOG is in full operation since 2003.

The storage capacity of the HABOG has recently been expanded with two additional vaults for the storage of heat-producing high-level waste.

The spent fuel elements of the research reactors are delivered to COVRA in a cask containing a basket with about 33 elements. At COVRA the basket with elements is removed from the cask and placed in a steel canister, which is welded tight and filled with an inert gas (helium). These sealed canisters are placed in wells, in the same way as the vitrified residues. The wells are filled with another inert gas (argon) to prevent corrosion of canisters with spent fuel elements or vitrified waste. For more information on the storage buildings at COVRA, see Annex 1.

32.1(V) Criteria used to define and categorize radioactive waste

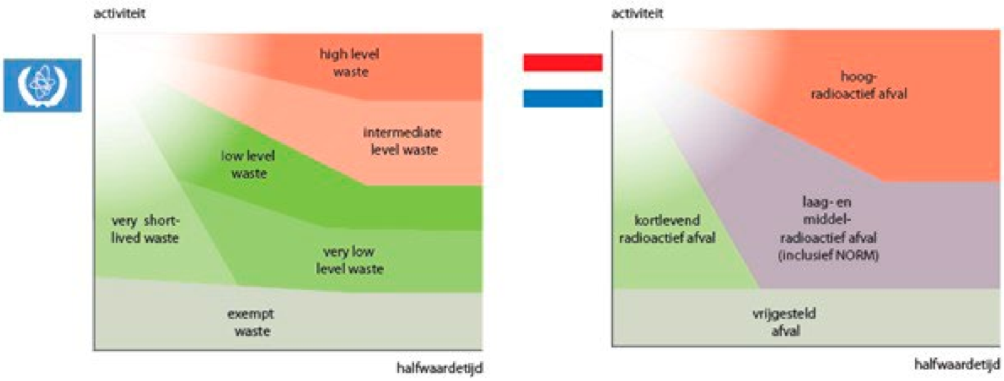
The definition of radioactive waste is given in the Bbs: *A radioactive substance can be designated as radioactive waste by the Authority*[14]*, or the commercial operator, if no product or material reuse is planned for the material either by the Authority or by the commercial operator, and there is no question of dumping the material.*

At COVRA, radioactive waste is divided into four categories: HLW (non-heat generating and heat generating), LILW (including NORM-waste), short-lived waste and exempt waste. These categories are based on based on practical criteria both derived from the need to limit exposures during the long-term interim storage period and from requirements set by the disposal route. Roughly speaking, the IAEA categories HLW and ILW equate broadly with the Dutch category HLW and the IAEA categories LLW and very low-level waste (VLLW) with the Dutch category LILW (see figure below).

Note that there is no specific waste category for sources, these are classified as radioactive waste (unless they contain fissile material or ore).

[14] ANVS.

Figure 3: The correlation between the IAEA and Dutch classifications of radioactive waste



The waste in the storage buildings for LILW is segregated according to the scheme in the table below.

Table 3: Categories of LILW classified by type of radioactivity

Category	Type of radioactivity
A	Alpha emitters
B	Beta/gamma contaminated waste from nuclear power plants
C	Beta/gamma contaminated waste from producers other than nuclear power plants with radioisotopes with a half-life longer than 15 years
D	Beta/gamma contaminated waste from producers other than nuclear power plants with radioisotopes with a half-life shorter than 15 years

Section C Scope of Application

Section C addresses the following.

JOINT CONVENTION

ARTICLE 3. SCOPE OF APPLICATION
h

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

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

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

4. This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

DIRECTIVE 2011/70/Euratom

ARTICLE 2. SCOPE

1. This Directive shall apply to all stages of:
   (a) spent fuel management when the spent fuel results from civilian activities;
   (b) radioactive waste management, from generation to disposal, when the radioactive waste results from civilian activities.

2. This Directive shall not apply to:
   (a) waste from extractive industries which may be radioactive and which falls within the scope of Directive 2006/21/EC;
   (b) authorised releases.

3. Article 4(4) of this Directive shall not apply to:
   (a) repatriation of disused sealed sources to a supplier or manufacturer;
   (b) shipment of spent fuel of research reactors to a country where research reactor fuels are supplied or manufactured, taking into account applicable international agreements;
   (c) the waste and spent fuel of the existing Krško nuclear power plant, when it concerns shipments between Slovenia and Croatia.

4. This Directive shall not affect the right of a Member State or an undertaking in that Member

State to return radioactive waste after processing to its country of origin where:

(a) the radioactive waste is to be shipped to that Member State or undertaking for processing; or

(b) other material is to be shipped to that Member State or undertaking with the purpose of recovering the radioactive waste.

This Directive shall not affect the right of a Member State or an undertaking in that Member State to which spent fuel is to be shipped for treatment or reprocessing to return to its country of origin radioactive waste recovered from the treatment or reprocessing operation, or an agreed equivalent.

3.1 Spent fuel

This national report applies to all stages of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors.

Spent fuel from the Borssele NPP which has been transferred to France for reprocessing, will not be accounted for in the spent fuel inventory as long as it is at the reprocessing plant or in the cooling down phase before being transported back to the Netherlands.

3.2 Radioactive waste

This national report applies to all stages of radioactive waste management, from generation to disposal, when the radioactive waste results from civilian activities.

The Netherlands has decided that waste that contains only naturally occurring radioactive materials (NORM) for which no further commercial use is foreseen (NORM-waste), in concentrations exceeding the clearance levels specified in the regulation on Radiation Protection, shall be declared as radioactive waste under the scope of this report.

Authorized releases are out of scope of this report.

3.3 Military or defence programmes

The Netherlands has decided that waste originating from military or defence programmes will not be addressed in this report, unless this waste has been transferred permanently to COVRA and therefore further managed within civilian programmes.

Section D Inventories and Lists

This section addresses the following.

JOINT CONVENTION

ARTICLE 32, PARAGRAPH 2. REPORTING
This report shall also include:

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

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

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

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

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

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

DIRECTIVE 2011/70/Euratom

ARTICLE 12. CONTENTS OF NATIONAL PROGRAMMES

1. The national programmes shall set out how the Member States intend to implement their national policies referred to in Article 4 for the responsible and safe management of spent fuel and radioactive waste to secure the aims of this Directive, and shall include all of the following:
   (c) an inventory of all spent fuel and radioactive waste and estimates for future quantities, including those from decommissioning, clearly indicating the location and amount of the radioactive waste and spent fuel in accordance with appropriate classification of the radioactive waste;

ARTICLE 14. REPORTING

2. On the basis of the Member States’ reports, the Commission shall submit to the European Parliament and the Council the following:
   (b) an inventory of radioactive waste and spent fuel present in the Community’s territory and the future prospects.

32.2(I) Spent fuel management facilities

The table below contains a list of the spent fuel management facilities in which spent fuel is stored, their location and essential features.

Table 4: Spent Fuel management facilities

Location	Spent fuel management facility	Features
Nieuwdorp	Dry storage in vaults at COVRA.	COVRA facility for treatment and storage of HLW and SF (HABOG).
Borssele	Fuel storage pool at Borssele NPP.	Pool belongs to NPP where SF is stored temporarily before shipment to France for reprocessing.
Petten	Fuel storage pool of RR HFR.	Pool belongs to RR where SF is stored temporarily before shipment to COVRA
Petten	Dry storage in vaults at WSF.	Legacy SF samples from HFR irradiation experiments; stored in drums in concrete-lined vaults. To be transferred to COVRA[15].
Delft	Fuel storage pool of RR HOR.	Pool belongs to RR where SF is stored temporarily awaiting shipment to COVRA.

32.2(II) Inventory of spent fuel

The inventory of spent fuel on 31 December 2023, stored at the COVRA facilities, is summarized below:

SF of NPPs[16]	0 m^3	0 Bq
SF of RRs	9.2 m^3	170.0 PBq
Uranium targets	2.2 m^3	5.2 PBq

32.2(III) Radioactive waste management facilities

The table below contains a list of the radioactive waste management facilities in which radioactive waste is stored, their location and essential features. Small-scale waste management departments of hospitals, research institutes or industries storing radioactive waste for decay or performing simple operations (such as compacting waste awaiting collection by COVRA) are not included in the list. Waste storage departments of the Borssele NPP and of the research reactors are not specifically mentioned either, because Bbs Article 10.7 as well as a general license condition obliges license holders to limit their inventories by transferring their radioactive waste periodically to COVRA. NRG is not allowed to store new waste in the WSF.

Table 5: Radioactive waste management facilities

Location	Radioactive waste management facility	Features
Nieuwdorp	Dry storage of HLW in canisters.	COVRA facility for treatment and storage of HLW and SF (HABOG).
Nieuwdorp	Dry storage of LILW in conditioned form in drums and containers.	COVRA facilities for treatment and storage of LILW (AVG and LOG).
Nieuwdorp	Dry storage of NORM- waste (calcinate) in containers.	COVRA container storage facility (COG) for material in unconditioned form to allow for potential future reuse.

[15] More details can be found in Section H, text on Article 12(II).
[16] All NPP SF is reprocessed.

Location	Radioactive waste management facility	Features
Nieuwdorp	Dry storage of depleted uranium oxide in small containers.	COVRA facility (VOG and VOG-2) for storage of depleted uranium oxide as U3O8 in unconditioned form to allow for potential future reuse.
Petten	Dry storage of unconditioned waste in drums at the WSF.	Partly HLW from irradiation experiments. To be transferred to COVRA[17].
Lelystad, Middenmeer (Afvalzorg B.V.) and Rotterdam (Mineralz B.V.)	Disposal of NORM-waste between 1 – 10 times clearance levels, NORM-waste below the specific clearance levels or when specific clearance is applicable.	Designated landfills.

32.2(IV) Inventory of radioactive waste at COVRA

The inventory of radioactive waste on 31 December 2023, stored at the COVRA facilities, is summarized below:

HLW (excluding SF)	100.2 m^3	2.895 PBq
LILW	12,876 m^3	10,240 TBq
NORM-wastes	25,475 m^3	791 TBq

32.2(V) Nuclear facilities in the process of being decommissioned

The table below contains a list of nuclear facilities in the process of being decommissioned.

Table 6: Nuclear facilities being decommissioned

Facility	Date of final shut down	State of decommissioning
Dodewaard NPP	1997	Safe enclosure as of 01/07/2005, decommissioning planned for 2045.

[17] More details can be found in Section H, text on Article 12(II).

Section E Legislative and Regulatory System

18 Implementing measures

This section addresses the following.

JOINT CONVENTION

ARTICLE 18. IMPLEMENTING MEASURES
Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention

On 10 March 1999, the Netherlands signed the Joint Convention, which was subsequently ratified on 26 April 2000 and entered into force on 18 June 2001.

A legislative and regulatory system necessary to implement the obligations under the Joint Convention is in place. Details of this system are given in the text on Article 19.

19 Legislative and regulatory framework

This section addresses the following.

JOINT CONVENTION

ARTICLE 19. LEGISLATIVE AND REGULATORY FRAMEWORK

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

2. This legislative and regulatory framework shall provide for:
   - (I) the establishment of applicable national safety requirements and regulations for radiation safety;
   - (II) a system of licensing of spent fuel and radioactive waste management activities;
   - (III) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a license;
   - (IV) a system of appropriate institutional control, regulatory inspection and documentation and reporting;
   - (V) the enforcement of applicable regulations and of the terms of the licenses;
   - (VI) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.

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

DIRECTIVE 2011/70/Euratom

ARTICLE 5. NATIONAL FRAMEWORK

5.1. Member States shall establish and maintain a national legislative, regulatory and organisational framework ('national framework') for spent fuel and radioactive waste management that allocates responsibility and provides for coordination between relevant competent bodies. The national framework shall provide for all of the following:

- b. national arrangements for the safety of spent fuel and radioactive waste management. The determination of how those arrangements are to be adopted and through which instrument they are to be applied rests within the competence of the Member States;
- c. a system of licensing of spent fuel and radioactive waste management activities, facilities or both, including the prohibition of spent fuel or radioactive waste management activities, of the operation of a spent fuel or radioactive waste management facility without a license or both and, if appropriate, prescribing conditions for further management of the activity, facility or both;
- d. a system of appropriate control, a management system, regulatory inspections, documentation and reporting obligations for radioactive waste and spent fuel management activities, facilities or both, including appropriate measures for the post-closure periods of disposal facilities;
- e. enforcement actions, including the suspension of activities and the modification, expiration or revocation of a license together with requirements, if appropriate, for alternative solutions that lead to improved safety;
- f. the allocation of responsibility to the bodies involved in the different steps of spent fuel and radioactive waste management; in particular, the national framework shall give primary responsibility for the spent fuel and radioactive waste to their generators or, under specific circumstances, to a license holder to whom this responsibility has been entrusted by competent bodies;
- g. national requirements for public information and participation;
- h. the financing scheme(s) for spent fuel and radioactive waste management in accordance with Article 9.

5.2. Member States shall ensure that the national framework is improved where appropriate, taking into account operating experience, insights gained from the decision-making process referred to in Article 4(3)(f), and the development of relevant technology and research.

ARTICLE 10. TRANSPARENCY

1. Member States shall ensure that necessary information on the management of spent fuel and radioactive waste be made available to workers and the general public. This obligation includes ensuring that the competent regulatory authority inform the public in the fields of its competence. Information shall be made available to the public in accordance with national legislation and international obligations, provided that this does not jeopardise other interests such as, inter alia, security, recognized in national legislation or international obligations.

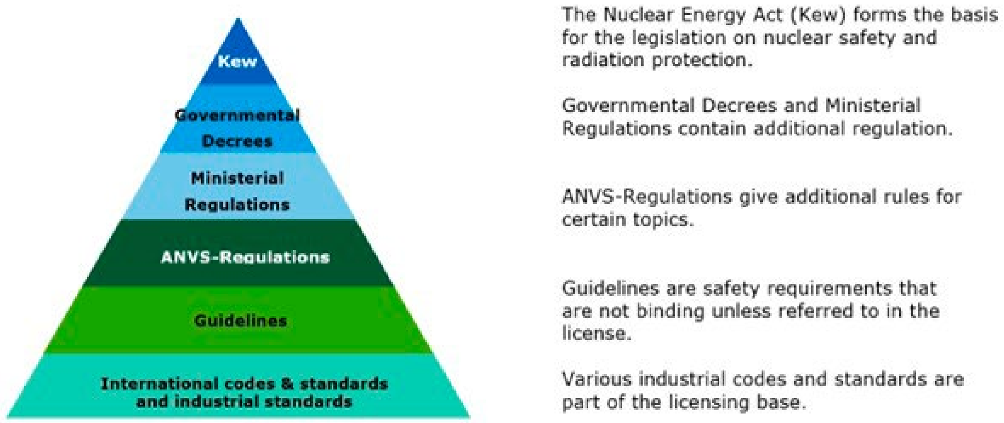
2. Member States shall ensure that the public be given the necessary opportunities to participate effectively in the decision making process regarding spent fuel and radioactive waste management in accordance with national legislation and international obligations.

19.1 Legislative and regulatory framework governing the safety of spent fuel and radio-active waste management

19.1.a. Overview of national legislative framework

Structure
The legal framework in the Netherlands with respect to nuclear installations can be presented as a hierarchical structure (see figure below).

Figure 4: Simplified representation of the hierarchy of the Dutch legal framework



The Nuclear Energy Act is the most prominent law.

Figure 5: Schematic overview of national legislation for activities with ionizing radiation

Governmental framework
The Netherlands is a parliamentary democracy. On behalf of the Dutch people, parliament assesses government proposals, establishes legislation and is permitted to present proposals for new legislation to the government. The parliament of the Netherlands consists of two chambers: the House of Representatives and the Senate. General elections for the House of Representatives are held at least once every four years. The government comprises the King, the Prime Minister, and the other ministers. The Cabinet is the government, excluding the King, but including the State Secretaries. The Cabinet formulates and is accountable for the government's policies.

Process of establishing arrangements such as laws and other requirements
This subsection also addresses Article 5.1.b of Directive 2011/70/Euratom.

The Constitution of the Netherlands describes how laws are established, and how the Constitution itself can be amended. The national legal framework consists of laws, Governmental Decrees and Ministerial Decrees. The majority of laws are introduced to the parliament by the Government. The members of parliament can adopt, reject or amend a Bill. Certain laws, such as the Nuclear Energy Act, are a so-called framework act whereby the establishment of the underlying detailed requirements is delegated to the Government, ministers or specific administrative bodies.

The Advisory Division of the Council of State[18] provides the Government with independent advice on proposals for new laws and Governmental Decrees. During the procedure of legislation and regulation, the competent regulatory authority involves the relevant actors such as license holders, non-governmental organisations (NGOs) and public in this process.

There is also a procedure employed for draft Governmental Decrees whereby parliament is offered an opportunity to examine these closely and suggest improvements. It is up to the responsible Minister to decide how to use this input. Governmental Decrees do not require a vote in parliament. Ministerial regulations are issued by a Minister. These regulations also are not submitted to parliament for input or vote.

Allocation of responsibilities for safety and implementation of activities

Ministry of IandWM – Directorate-general for the Environment and International Affairs
The State Secretary of IandWM is accountable for nuclear safety, security and radiation protection, including policies concerning management of waste and their implementation. This responsibility is delegated to the Director-general for Environment and International Affairs (DGMI). The director general for the Environment and International Affairs is therefore responsible for policy development regarding nuclear safety, security and radiation protection and for the relevant national legislation, i.e., Nuclear Energy Act and Ministerial Decrees and regulations.

The State Secretary of IandWM bears political responsibility for the ANVS.

Regulatory body
The regulatory body (RB) ANVS is the authority designated by the government as having legal authority for conducting the regulatory processes, including issuing authorizations, supervision and enforcement, and thereby regulating nuclear safety, security and safeguards, radiation protection, radioactive waste management and transport safety. The regulatory tasks related to the management of spent fuel and radioactive waste are in the scope of the ANVS. As stated before, since 15 May 2020 policy development and legislation concerning radioactive waste and spent fuel is transferred to the Ministry of IandWM, i.c.

[18] The Council of State (in Dutch: Raad van State) has two primary tasks, carried out by two separate divisions. The Advisory Division, as its name implies, advises the government and parliament on legislation and governance, while the Administrative Jurisdiction Division is the country's highest general administrative court. The basis for these responsibilities can be found in Articles 73 and 75 of the Dutch Constitution.

the dgMI. In connection with this, a bill to amend Section 3 of the Nuclear Energy Act is currently before the House of Representatives. This is a proposal for an amendment in connection with the adjustment of the task of the ANVS regarding policy preparation and policy evaluation.

Several other ministers also have responsibilities in specific areas related to the use of radioactivity and radiation. Therefore, some departments of ministries or inspectorates thereof can be considered to be part of the RB under the Nuclear Energy Act.

For more information on the RB, see Section E, text on Article 20.

COVRA

COVRA is the national waste management organisation which has the task to manage the Dutch radioactive waste, now and in the future. Since 2002, 100% of the shares in COVRA are held by the State and this guarantees a system of long-term institutional control.

Licensee

The licensee bears prime responsibility for safe management of spent fuel and radioactive waste.

19.1.b Primary legislative framework: laws

The following are the main laws to which nuclear facilities in the Netherlands, including COVRA[19], are subject:

- The Nuclear Energy Act (in Dutch: Kernenergiewet, Kew).
- The Environment and Planning Act (in Dutch: Omgevingswet, Ow).
- The Environmental Protection Act (in Dutch: Wet milieubeheer, Wm).
- The General Administrative Act (in Dutch: Algemene wet bestuursrecht, Awb).

Other important Acts with relevance for the licensing and operation of nuclear installations are the Open Government Act (in Dutch: Wet open overheid, Woo) and the Safety Regions Act (in Dutch: Wet veiligheidsregio's). In this section, the main elements of several acts are elaborated. For more information on secondary legislation, like the aforementioned Decrees and NVRs[20], see Section E, 19.2.

Nuclear Energy Act

The basis of the legislation in the Netherlands governing nuclear activities and radiation protection, including radioactive waste management, is contained in the Nuclear Energy Act. The Nuclear Energy Act is a framework law, which sets out the basic rules on the application of nuclear technology and materials, makes provision for radiation protection, designates the competent authorities and outlines their responsibilities. More detailed legislation is provided by associated Government Decrees, Ministerial and ANVS-Regulations.

Operation of a nuclear facility can only be conducted in accordance with a license issued under the Nuclear Energy Act. The licenses for nuclear installations also include general aspects of the environment and the possible impact on the environment.

Regarding nuclear facilities, the purpose of the Nuclear Energy Act, according to its Section 15b, is to serve the following interests:

- The protection of people, animals, plants and property.
- The security of the State.
- The security and safeguarding of nuclear material.
- The liability for damage or injury caused to third parties.
- The compliance with international obligations.

[19] Disposal facilities would also fall in this category. However, there are currently no such facilities in the Netherlands.
[20] In Dutch: Nucleaire Veiligheidsregels, NVRs. NVRs are amended IAEA Requirements or Guides.

Within the framework of the Nuclear Energy Act, fissile materials are defined as materials containing up to a certain percentage of uranium, plutonium or thorium (i.e., 0.1% uranium or plutonium and 3% thorium by weight). All other materials containing radionuclides and exceeding the exemption levels, are defined as radioactive materials.

Three areas of application of the Nuclear Energy Act

As far as nuclear facilities are concerned, the Nuclear Energy Act covers three distinct areas relating to the use of fissile materials, including spent fuel, and ores: (1) registration, (2) transport and management of such materials, and (3) the operation of facilities and sites at which these materials are stored, used or processed:

1. The registration of fissile materials and ores is regulated in Sections 13 and 14 of the Nuclear Energy Act; further details are given in a special Decree issued on 8 October 1969 (Bulletin of Acts and Decrees 471). The statutory rules include a reporting requirement under which notice must be given of the presence of stocks of fissile materials and ores. The ANVS is responsible for maintaining the register.
2. A license is required to transport, import, export, be in possession of or dispose of fissile materials and ores. This is specified in Section 15, sub a of the Act. The licensing requirements apply to each specific activity mentioned here.
3. Licenses are also required for building, commissioning, operating and decommissioning nuclear installations (Section 15, sub b).

In theory, a license to build a nuclear installation may be issued separately from a license to actually commission it. However, the licensing of the construction of a radioactive waste or spent fuel management facility addresses more than the construction work. Account will have to be taken of all activities to be conducted in the installation, during and after its construction. The authorities need to decide whether the location, design and construction of the installation are suitable, offering sufficient protection of the public and the environment from any danger, damage or nuisance associated with the activities to be conducted in the installation.

Amendments to a license will be needed where planned modifications of an installation invalidate the earlier description of it. The license for the decommissioning of nuclear facilities is regarded as a special form of modification and is treated as such. Refer to Section E, 19.2.a for the Bkse decree, that provides more guidance on decommissioning issues.

The Nuclear Energy Act includes a separate chapter (Chapter VI) on intervention and emergency planning and response.

Amendments to the Act

Since the last national report, the Nuclear Energy Act and subordinate regulation were updated with the legal establishment of the ANVS as an independent administrative body (in Dutch: zelfstandig bestuursorgaan, zbo). The ANVS as a zbo is independent in its functioning and organising its activities, but the Minister of IandWM remains politically responsible for its functioning and is accountable to the parliament. As mentioned, a bill to amend Section 3 of the Nuclear Energy Act is currently before the House of Representatives. This is a proposal for an amendment in connection with the adjustment of the task of the ANVS regarding policy preparation and policy evaluation.

Environment and Planning Act

The Environment and Planning Act (in Dutch: Omgevingswet, Ow) combines and modernises laws for spatial planning, housing, infrastructure, the environment, nature and water protection. It focuses on a healthy physical environment that meets the needs of society. The Environment and Planning Act has come into force on January 1, 2024. The Nuclear Energy Act is exempted from the Environment and Planning Act. The conventional environmental aspects of nuclear facilities, such as noise, hazardous substances and vibration, are regulated in the Nuclear Energy Act license for nuclear installations. However, planning and updating of the National programme for the management of radioactive waste and spent fuel is found to be subject to the general requirements of strategic environmental impact assessment.

The main purpose of the Environment and Planning Act is to establish a single, straightforward procedure with one set of rules for persons or businesses seeking permission for activities which affect the physical environment. This includes one application form to fill in, one single competent authority, one supervision and enforcement authority and one procedure for objections and appeals. The purpose is to simplify licensing systems and reduction of expenses for the applicants.

The civil engineering part of the construction of a nuclear installation and local spatial planning aspects will be licensed under the Environment and Planning Act by local authorities on the level of towns or rural municipalities.

The nuclear safety and radiation protection aspects will be licensed under the Nuclear

Energy Act by the regulatory body.

The purpose of the Environment and Planning Act related to the aspect of water is to prevent and where necessary, limit flooding, swamping and water shortage. Furthermore, it is meant to protect and improve the chemical and ecological status of water systems and to allow water systems to fulfil societal and ecological functions.

Nuclear installations need an environmental permit for water activities under the Environment and Planning Act to license their direct (nonradioactive) discharges to the surface water.

According to this Act and the associated Environmental Decree, the licensing procedure for the construction of a nuclear facility includes a requirement to draft an Environmental Impact Assessment (EIA) report. An assessment on the significance of the environmental impact is required, for instance, in situations involving:
- A change in the type, quantity or enrichment of the fuel used.
- An increase in the release of radioactive effluents.
- An increase in the on-site storage of spent fuel.
- Decommissioning.

An independent Commission for Environmental Assessment can be asked to give advice on the requirements of all EIAs conducted in the Netherlands, including those related to nuclear facilities.

The general public and interest groups often use EIAs as a basis for commenting on and

raising objections to decisions on nuclear activities.

General Administrative Act
This subsection also addresses Article 5.1.g of Directive 2011/70/Euratom.

The General Administrative Act (in Dutch: Algemene wet bestuursrecht, Awb) is the law that governs the activities of administrative bodies of (local) government and the interaction of the public in the procedures (i.e., objections and appeals). The Awb applies to virtually all procedures in administrative law, including the Nuclear Energy Act. It thus also details the general procedures for the oversight and the enforcement and related to the latter the possible sanctions.

The Awb also provides for procedures regarding publication of information of draft decisions, like those needed to grant a license. These need to be published in the Government Gazette (in Dutch: Staatscourant), and some cases in in the national and/or local press.

The Awb has both a short and an extensive preparation procedure. The Nuclear Energy Act specifies which procedure applies to which decision-making process.

- In the case of a short procedure, there is only a final decision. Any stakeholder is free to appeal to object to the ANVS and afterwards to the Council of State. This applies to simple authorization processes.
- In the case of an extensive procedure, the ANVS draws a draft decision. This applies to complex licensing processes. Under the Awb, documents provided with an application for a license are to be made available for participation by the public. Everyone is free to lodge written or oral opinions on a draft decision. All views made to the draft version of the decision are taken into account in the final version. Everyone who has expressed views on the draft decision or any stakeholder is free to appeal to the Council of State (the highest administrative court in the Netherlands) against the decision by which the license is eventually granted, amended or withdrawn. Licenses are published on the internet and can be found via the website of the ANVS.

In drawing up regulations, public participation is effectively indirectly achieved via parliament.

With regards to the management of spent fuel and radioactive waste, via the already described procedures, the public can participate in the decision-making processes involving licensing for installations in which spent fuel and/or radioactive waste are managed.

Current policy envisages a decision on disposal around the year 2100. Therefore, at present there is no specific licensing procedure for a disposal facility yet.

Open Government Act
The Open Government Act (in Dutch: Wet open overheid, Woo) regulates the right of citizens to obtain governmental documents and public information from the government.

Safety Regions Act
The Safety Regions Act (in Dutch: Wet veiligheidsregio's, Wvr) and the Decree Safety Regions based on it, determines especially the tasks of the management of Safety Regions and sets a number of basic requirements for the organization of the emergency services and the quality of the personnel and equipment.

The Netherlands is divided in a total of 25 Safety Regions (in Dutch: Veiligheidsregio's, VR). These are public bodies whose task is to facilitate regional cooperation in dealing with crisis, disasters and disruptions of public order. Each municipality works together with one of these safety regions. Together, they are responsible for drawing up joint regulations for crisis management and for administering the emergency services (Fire Brigades and Regional Medical Assistance Organization) in their respective region.

19.1.c Ratification of international conventions and legal instruments related to the management of spent fuel and radioactive waste

The Netherlands is, in addition to the Joint Convention, party to several other Treaties and Conventions related to the management of spent fuel and radioactive waste and has implemented the obligations and requirements under these legal instruments in the Nuclear Energy Act and in associated Decrees and regulations.

Non-proliferation: the Netherlands is party to the Treaty on the Non-Proliferation of Nuclear Weapons, the non-proliferation treaty of the UN. Related to this are the guidelines from the Nuclear Suppliers Group that lay down restrictions on the transfer of sensitive nuclear techniques such as enrichment and reprocessing. Furthermore, the Netherlands is a party to the safeguards agreement between the IAEA, Euratom and Euratom's non-nuclear weapon Member States and has in force the Additional Protocol and the Comprehensive Safeguards Agreement. In addition, the Netherlands is affiliated to the

Proliferation Security Initiative, based on Resolution 1540 of the UN Security Council for the Non-proliferation of Weapons of Mass Destruction[21].

Nuclear safety: the Netherlands is party to the UN Convention on Nuclear Safety, the CNS.

Physical protection: the Netherlands is party to the Convention on Physical Protection of Nuclear Material and Nuclear Facilities[22]. In addition, the Netherlands has also expressed its support for the following Codes of Conduct:
- Code of Conduct on the Safety and Security of Radioactive Sources (published 2004, IAEA).
- Code of Conduct on the Safety of Research Reactors (published 2004, IAEA).

EU-legislation: for all EU countries, EU legislation has a large impact on the national legislation. Examples are given below.

The Netherlands, as a member state of the European Union, has implemented Directive 2006/117/Euratom in the Radioactive waste and Fissile materials (Import, Export and Transit) Decree. This Directive sets out similar requirements as the ones specified in paragraphs 1(I)-(V) of Article 27 of the Joint Convention. For more information, see Section I.

The Netherlands has transposed Council Directive 2009/71/Euratom of 25 June 2009 on nuclear safety in its national legislation force[23] in 2011. The safety objectives of the Directive cover those of the Nuclear Safety Convention and are in some regards more specific and have a larger scope.

The Directive 2009/71/Euratom (Nuclear Safety Directive, NSD) prescribes the systematic evaluation and investigation of the nuclear safety of nuclear installations during their operating life possibly leading to improvements in the installation (continuous improvement). Also, the regulation prescribes inter alia that:
- License holders should give sufficient priority to nuclear safety systems.
- License holders must provide adequate human and financial resources to meet the obligations on the nuclear safety of a nuclear installation.
- All parties, including the license holder, are required to provide a mechanism for educating and training their staff responsible for the safety of nuclear installations to meet the expertise and competence in the field of nuclear safety to be maintained and developed.

Post-Fukushima, the EU amended its Nuclear Safety Directive in 2014[24]. The amended Directive was developed considering various reviews, and reinforces several provisions of the 2009 NSD, such as[25]:
1. Strengthens the role of national regulatory authorities by ensuring their independence from national governments. EU countries must provide the regulators with sufficient legal powers, staff, and financial resources.
2. Creates a system of topical peer reviews. EU countries choose a common nuclear safety topic every six years and organise a national safety assessment on it. They then submit their assessment to other countries for review. The findings of these peer reviews are made public.
3. Requires a safety re-evaluation for all nuclear installations to be conducted at least once every 10 years.

[21] UN Security Council Resolution 1540 (UNSCR 1540) for the non-proliferation of Weapons of Mass Destruction (WMD).
[22] Convention on Physical Protection of Nuclear Material and Nuclear Facilities. This is the amended version of the Convention on Physical Protection of Nuclear Material (CPPNM), the amendment having entered into force on 8 May 2016.
[23] Regulation of the Minister of Economic Affairs, Agriculture (EL&I) and Innovation and the Minister of Social Affairs and Labour of 18 July 2011, No WJZ/11014550, concerning the implementation of Directive 2009/71/Euratom of the Council of the European Union 25 June 2009 establishing a Community framework for nuclear safety of nuclear installations (PB EU L 172/18). In 2011, implementation was done via a temporary ordinance (Staatscourant. 2011, nr. 12517), which was made permanent in 2013 (Staatscourant, 2013, nr. 14320).
[24] The Safety Directive was amended by 'Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations'.
[25] 2015, Report of ENSREG, HLG_p(2015-31)_145.

4. Increases transparency by requiring operators of nuclear installations to release information to the public, both in times of normal operation and in case of incidents.

The transposition of the amended Nuclear Safety Directive in Dutch legislation was prepared in 2016 and was completed in 2017[26] and resulted in a new Ministerial Decree on Nuclear Safety (MR-NV).

The Netherlands has transposed Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste. Directive 2011/70/Euratom has been implemented in the Bbs and in the Bkse in 2013. The Netherlands has drafted the required National Programme on radioactive waste and spent fuel according to the definition provided by this Directive.

The Netherlands has implemented Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom in the Bbs. For information on the Bbs, see 19.2.a.

The Netherlands has implemented Council Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment.

19.1.d Special agreements

For information on the special agreements on reprocessing of spent fuel from the Borssele NPP, see Section D text on Article 32.1(II).

19.2 Provisions in the legislative and regulatory framework

19.2.a National safety requirements and regulation

This subsection also addresses Article 5.1.b of Directive 2011/70/Euratom.

This section describes the regulatory framework, focussing on all levels below the top-level (Law) as portrayed in aforementioned legal hierarchy (see paragraph 19.1.a).

In short, the following categories will be discussed in this section:
- (Governmental) Decrees (in Dutch: Besluiten).
- Ministerial Decrees (in Dutch: Ministeriële regelingen).
- ANVS-Regulations (in Dutch: ANVS-verordeningen).
- Dutch Safety Requirements (in Dutch: Nucleaire Veiligheidsregels (NVRs)).
- Guidelines on various issues, non-binding documents published by the ANVS to aid license holders to meet the RB's expectations. When needed, like NVRs these can be referred to in the license conditions and as such become a legally binding part of these. Guidelines can also be applied to existing nuclear installations as a reference (e.g., in PSRs).
- Codes and Standards of industry.

Governmental Decrees

A number of Governmental Decrees have been issued containing additional regulations and these continue to be updated in the light of ongoing developments. Important examples of these in relation to radioactive waste and spent fuel and the safety aspects of nuclear installations are:
- Transport of Fissionable Materials, Ores and Radioactive Substances Decree (Bvser);
- Decree on the import, export and transit of radioactive waste and spent fuel (Biudrabs);
- Environmental Decree;
- Reimbursement Decree;

[26] https://eur-lex.europa.eu/legal-content/NL/NIM/?uri=CELEX:32014L0087.

- Basic Safety Standards Radiation Protection Decree (Bbs);
- Nuclear Installations, Fissionable Materials and Ores Decree (Bkse);
- Radioactive Scrap Detection Decree.

The Nuclear Energy Act and the aforementioned Decrees are fully in compliance with the relevant Euratom Directive laying down the basic safety standards for the protection of workers and the public against the health risks associated with ionising radiation.

Transport of Fissionable Materials, Ores and Radioactive Substances Decree (Bvser)
The Bvser deals with the import, export and domestic transport of fissionable materials, ores and radioactive substances, including radioactive waste and spent fuel, by means of a reporting and licensing system.

Decree on the import, export and transit of radioactive waste and spent fuel (Biudrabs)
The import, export and transit of radioactive waste and spent fuel is regulated by the Decree on the import, export and transit of radioactive waste and spent fuel. This Decree is the implementation of Directive 2006/117/Euratom and is aimed to control shipments of waste between EU Member States and between EU Member States and countries outside the EU.

Environmental Decree
The Environmental Decree, in combination with the Environment and Planning Act, stipulates that in certain circumstances a license application for a nuclear installation shall be accompanied by an EIA. This complies with EU Council Directive 97/11/EC.

Reimbursement Decree
Current regulation already provides for partial reimbursement of the RB for the costs of oversight and licensing. The license holders pay an annual fee and on top of this, and extra fees are paid for individual licensing activities.

Basic Safety Standards for Radiation Protection Decree (Bbs)
The Bbs regulates the protection of the public, patients and workers against the hazards of all ionising radiation. It also establishes a licensing system for non-nuclear installations for handling radioactive materials, including radioactive waste, and radiation-emitting devices, and prescribes general rules for their application.

The Netherlands has transposed Directive 2013/59/Euratom[27], laying down basic safety standards for protection against the dangers arising from exposure to radiation, in its national legislation. On 6 February 2018, the Bbs and the following underlying regulations have come into force:
- Regulation on Basic Safety Standards for Radiation Protection (in Dutch: Regeling basisveiligheidsnormen stralingsbescherming);
- Regulation on Radiation Protection for Occupational Exposure (in Dutch: Regeling stralingsbescherming beroepsmatige blootstelling);
- Regulation on Radiation Protection for Medical Exposure (in Dutch: Regeling
- stralingsbescherming medische blootstelling);
- ANVS-Regulation on Basic Safety Standards for Radiation Protection (In Dutch: ANVS-Verordening basisveiligheidsnormen stralingsbescherming).

The implementation led to the introduction of a situation-based approach (planned, emergency and existing situations), as prescribed in the Basic Safety Standards Directive. Another change was the

[27] Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom.

introduction of registration as one of the two instruments to authorise practices using ionising radiation. Licensing is the other instrument to authorise practices.

This Decree also regulates the requirements for the recycling or disposal of unsealed or sealed sources that are no longer used. Additional requirements for High-Activity Sealed Sources and orphan sources are also laid down in this Decree.

The Bbs and dose criteria for normal operation

Main elements of the Bbs are: (1) justification of the activity, (2) optimization – ALARA and (3) dose limits. Practices involving ionizing radiation should be justified. Dutch regulation features a list of justified and not justified practices.

The exposure to ionising radiation should be kept As Low As Reasonably Achievable (ALARA). The ALARA principle is also recorded in the Nuclear Energy Act (Articles 15c sub 3 and 31), the Bbs and in the Bkse.

The dose limit for members of the public is a maximum total individual dose of 1 mSv for members of the public and 20 mSv for workers in any given year as a consequence of normal operation from all anthropogenic sources emitting ionising radiation (i.e., NPPs, isotope laboratories, sealed sources, X-ray machines, industries), thus excluding natural background and medical exposures.

For a single source (for instance a single NPP), the maximum individual dose is set at 0.1 mSv per annum. An application for authorisation will always be refused if the practice results in an effective public dose higher than 0.1 mSv per year.

The Nuclear Installations, Fissionable Materials and Ores Decree stipulates that the relevant sections of the Bbs and the underlying regulations about the protection against ionizing radiation also apply to fissionable materials, including spent fuel.

The Bbs and radioactive waste

The Bbs also lays down the general radioactive waste requirements and prescribes that radioactive material for which no further use is foreseen is declared as radioactive waste. Besides this, it stipulates that an authorized user of radioactive material is allowed to remove the radioactive material from the site without a license in only a limited number of ways:

1. If the material is not declared as waste:
   - if the (activity) concentration is below the general clearance levels, as applicable;
   - in the case of sealed sources, if return of the source to the manufacturer or supplier of the source is possible;
   - in case of NORM, there are some possibilities to enable reuse of these materials; by transfer to another individual or legal person for use, reuse or recycling of this radioactive material or for collection and pre-treatment of radioactive waste, provided that this person holds a valid license for this material.

2. If the material is declared as waste:
   - by transfer to a recognised waste management organisation. COVRA is the only recognized organisation for the collection, treatment and storage of radioactive waste;
   - by transfer to another designated organisation (landfills) for the collection of radioactive waste;
   - In the case of specific clearance, other options than a transfer to COVRA are possible when the material is below the specific clearance level.

Nuclear Installations, Fissionable Materials and Ores Decree (Bkse)

The Bkse and licensing construction, commissioning & operation

The Bkse regulates all practices involving fissionable materials, including spent fuel, and nuclear facilities (including licensing).

The Bkse sets out additional conditions in relation to a number of areas, including the license application for the construction, commissioning and operation of a facility for the storage of fissionable materials, including spent fuel, and associated requirements. According to Article 8 of Bkse, for such an application, applicants are required to submit (among others) the following information:
- A description of the site where the installation is to be located, including a statement of all relevant geographical, geological, climatological and other conditions;
- A statement of the chemical and physical condition, the shape, the content and the degree of enrichment of the fissionable materials which are to be used in the installation, specifying the maximum quantities of the various fissionable materials that will be present at any one time;
- A description of the measures to be taken either by or on behalf of the applicant so as to prevent harm or detriment or to reduce the risk of harm or detriment, including measures to prevent any harm or detriment caused outside the installation during normal operation, and to prevent any harm or detriment arising from the Postulated Initiating Events (PIEs) referred to in the description, as well as a radiological accident analysis concerning the harm or detriment likely to be caused outside the installation as a result of those events (safety analysis report);
- A risk analysis concerning the harm or detriment likely to be caused outside the installation as a result of severe accidents (Probabilistic Safety Analyses).

The Bkse and decommissioning

The Bkse includes conditions on decommissioning and financial provisions for the costs of Decommissioning of nuclear installations. An important part of this legislation is based on the WENRA Safety Reference Levels on decommissioning.

The Bkse requires the license holder to have and periodically (every five years) update a decommissioning plan during the lifetime of the facility and submit it to the authorities for its evaluation and decision of approval of the ANVS. The Bkse specifies the minimum requirements on the content of the decommissioning plan. The decommissioning plan sets out safety conditions for all the activities carried out during the decommissioning phase, and it provides the basis for the financial provisions for the decommissioning costs.

For the application for a decommissioning license, according to Bkse, the license holder shall submit the following information to the authorities:
- A copy of the operating license;
- A decommissioning plan;
- A description of the measures to be taken either by or on behalf of the applicant so as to prevent harm or detriment or to reduce the risk of harm or detriment, including measures to prevent any harm or detriment caused outside the facility during normal operation, and to prevent any harm or detriment arising from the Postulated Initiating Events (PIEs) referred to in the description, as well as a radiological accident analysis concerning the harm or detriment likely to be caused outside the installation as a result of those events (Safety Analysis Report);
- A risk analysis concerning the harm or detriment likely to be caused outside the installation as a result of severe accidents.

The Bkse and the risk criteria for incidents and accidents

As far as the radiological hazard is concerned, the regulations can be seen as implementing the IAEA Fundamental Safety Standards (IAEA SF-1), in particular implementing the fundamental safety objective to protect people and the environment.

The application according to Bkse of this objective requires the license holder to:
- Verify that pre-set criteria and objectives for individual and societal risk have been met. This includes identifying, quantifying and assessing the risk;
- Reduce the risk, if required, until an optimum level is reached (based on the ALARA principle);
- Exercise control, i.e., maintain the level of risk at this optimum level.

Ministerial Decrees
Ministerial Decrees (in Dutch: Ministeriële Regelingen, MR) are issued by the Minister of IandWM and are mandatory for all (nuclear) installations and activities. In this section, only a selection of Ministerial Decrees relevant in the context of the Joint Convention and as far as not mentioned previously is discussed.

Notable is the transposition of the Directive 2014/87/Euratom of 8 July 2014, amending Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations and covering more or less the safety objectives of the CNS. The transposition of the amended Nuclear Safety Directive resulted in a new Ministerial Decree on Nuclear Safety 14 June 2017.

Regulations and standards issued by regulatory body

Regulations by the regulatory body: ANVS-Regulations
The ANVS is authorized to issue regulations: ANVS-Regulations. These are issued if:
- Rules are needed on technical or organisational issues relevant to nuclear safety, radiation protection and security.
- Governmental Decrees or Ministerial Decrees refer to guidance to be provided in ANVS-Regulations.

Standards by the regulatory body: NVRs
Nuclear Safety Rules are legally binding for an installation or nuclear facility when they are referred to in licenses through a license condition. This mechanism allows the ANVS to enforce the NVRs. The practice of including requirements in the license instead of general rules is suitable for a country like the Netherlands with a very small number of nuclear facilities and only one operating NPP. NVRs are part of the license of the NPP for already more than 30 years.

The NVRs are based on the Safety Standards and Guides issued by the IAEA. These IAEA documents have been assessed to determine how they can be applied in the Netherlands. This has resulted in a series of national adaptations (amendments) to the IAEA documents, which then have become the NVRs. The amendments have been formulated for various reasons: to allow a more precise choice out of different options, to give further guidance, to be more precise, to be more stringent, or to adapt the wordings to specific Dutch circumstances like risk of flooding, population density, seismic activity and local industrial practices.

At the Safety Requirements level, the NVRs are strict requirements which must be followed thoroughly. At the Safety Guides level, the NVRs are less stringent: alternative methods may be used to achieve the same safety levels.

See Section A, 6.b for the ongoing project which will implement the legally non-binding international requirements.

Adopted international nuclear codes and standards
In addition to NVRs, nuclear codes and standards of other countries are often used. Examples are the US Code of Federal Regulations, the US NRC Regulatory Guides, the US NRC Standard Review Plan, and the German RSK recommendations. However, careful consideration needs to be given to application of these foreign standards, since using them out of their original context may lead to difficulties.

The WENRA has introduced WENRA Safety Reference Levels (SRLs), aiming to harmonise reference levels for nuclear safety, the safe management of spent fuel and radioactive waste and for decommissioning. In the framework of the Joint Convention, especially the WENRA Safety Reference Levels for storage of radioactive waste and spent fuel and for decommissioning are relevant; these have to be implemented in the regulatory framework where needed. An example is the regulation on decommissioning and financial provisions for the costs of decommissioning in the Governmental Decree Bkse, an important part of which was based on the WENRA SRLs.

Adopted industrial standards
The Safety Guides in the NVR series give guidance on many specific subjects. However, they do not replace industrial codes and standards. Applicants are therefore required to propose applicable codes and standards, to be reviewed by the RB as part of their applications. Codes and standards in common use in major nuclear countries are generally acceptable (e.g., ASME, IEEE and KTA). The RB has the power to formulate additional requirements if necessary.

19.2.b System of licensing
This subsection also addresses Article 5.1.c of Directive 2011/70/Euratom.

As discussed in the paragraph on Article 19.1, the Nuclear Energy Act stipulates (in Article 15, sub b) that a license must be obtained to construct, commission, operate, modify or decommission a nuclear facility.

Similarly, the Act states (in Article 15, sub a) that a license is required to import, export, possess or dispose of fissionable material. Under Article 29 of the same Act, a license is required in a number of cases (identified in the Decree on Basic Safety Standards Radiation Protection) for the preparation, transport, possession, import or disposal of radioactive material, including radioactive waste.

The procedures to obtain a license under the Nuclear Energy Act (and other acts), follow the procedures specified in the General Administrative Act. These procedures allow for public involvement in the licensing process.

In line with its policy on transparency, the ANVS has published a document on its website, that describes its licensing policy. It also has published a document on its supervision and enforcement policies. There are more guidance documents, that aid license holders and applicants in submitting license applications. All these supports the improvement of the interaction between the ANVS and the license holders and make it more efficient. Refer to Section E, 20.1.j for more information on such policy documents.

The national legislative framework provides the generic nuclear safety and radiation protection objectives that apply to all (nuclear) installations.

The Netherlands has a small nuclear programme. Nevertheless, there are many different nuclear facilities and activities. Because of the diversity present, detailed requirements are listed in the license requirements which are tailored to the characteristics of the facilities and activities. In the licenses, the Nuclear Safety Rules (NVRs) can be referred to as well as other nuclear codes and standards. If necessary, a tailor-made approach can be employed.

Principal responsible authority
The authorities relevant with respect to the regulatory process under the Nuclear Energy

Act have been described in Section E, text on Article 19.1. In addition to the Nuclear Energy

Act, several types of regulation may apply to a nuclear facility and the activities conducted in it and/or supporting it. Therefore, often there are several authorities, sometimes at several levels in the governmental organisation, involved in the licensing procedures.

Advisory bodies
The Health Council of the Netherlands (Gezondheidsraad) is an independent scientific advisory body established under the terms of the Public Health Act and advises the government and parliament on the current level of knowledge with respect to public health issues and health (services) research, including radiation protection. To date there is no standing advisory committee on nuclear safety for the licensing or regulatory processes; an advisory committee can be formed on an ad hoc basis as required. There is an Advisory Board which has the task of providing the ANVS with solicited and unsolicited advice on matters related to the tasks of the ANVS. Refer to the text on Article 20 in the present report, Section E, 20.1.a.

Specific licensing issues in the Nuclear Energy Act
Article 15b of the Nuclear Energy Act enumerates the interests for the protection of which a license may be refused. These interests are listed in Section E, 19.1.a. The license itself lists the restrictions and conditions imposed to take account of these interests. The license conditions may include an obligation to satisfy further requirements that may be set later by the ANVS.

In the case of very minor modifications, the license holders may use a special provision in the Act (Article 17) that allows such modifications to be made with a minor license change. With its license application, the license holder needs to submit a report describing the intended modification and its environmental impact. This instrument can only be used if the consequences of the modification for man and the environment are within the limits of the license in force. There is no obligation to provide an opportunity for views before the definitive licensing decision is issued. The license is published in the Government Gazette and on the website of the ANVS. Interested parties disagreeing with the decision may submit a complaint to the ANVS. If an interested party is not satisfied with the response by the ANVS, he may appeal to the Council of State against the licensing decision.

The ANVS conducts regular reviews to establish whether the restrictions and conditions under which a license that has already been granted are still sufficient to protect workers, the public and the environment, taking account of any developments in nuclear safety that have occurred in the meantime. It should be noted that the regular reviews are not the same as the Periodic Safety Reviews (PSRs), which the license holder is required to perform periodically (according to its license). Article 19.1 of the Nuclear Energy Act empowers the ANVS to modify, add or revoke restrictions and conditions in the license to protect the interests as laid down in Article 15b of the Act. Article 20a of the Act stipulates that the ANVS is empowered to withdraw the license, if this is required to protect those interests. Article 18a of the Nuclear Energy Act empowers the ANVS to compel the license holder to cooperate in a process of total revision and updating of the license. This will be necessary if, for instance, the license has become outdated in the light of numerous technical advances or if improved possibilities to protect the population have become available since the license was issued.

19.2.c Regulatory assessment and inspections
This subsection also addresses Article 5.1.d of Directive 2011/70/Euratom.

Entities performing assessments and inspection
Article 58 of the Nuclear Energy Act provides the basis for entrusting designated officials with the task of performing nuclear safety supervision: safety assessment, inspection and enforcement. This is mainly the task of the inspectors of the ANVS in the Netherlands. Refer to the text on Article 20 in Section E for a detailed description of the ANVS, its functioning, as well as recent developments.

Regulatory assessment process
With each license application, the ANVS reviews and assesses the documentation submitted by the applicant. This might be the EIA report and the Safety Analysis Report (SAR) with underlying safety analyses submitted in the context of a license renewal application or modification request, proposals for design changes, procedural changes such as the introduction of Severe Accident Management Guidelines (SAMGs).

During the licensing phase the ANVS assesses among others, whether the applicable NVRs (i.e., requirements and guidelines for nuclear safety and environment), the requirements and guidelines for security and the regulation for non-nuclear environmental protection have been met and whether the assessments (methods and input data) have been prepared according to the state-of-the-art. The ANVS assesses the radiological consequences associated with postulated transients[28] and accidents in the various installation plant categories. The ANVS will verify in particular that the results are permissible in

[28] Anticipated Operational Occurrences.

view of the regulations. Its expertise enables the ANVS to determine the validity of the (system) analyses and the calculations. The ANVS receives support from a foreign TSO in these activities.

The ANVS lays down the guidelines for the required calculations (e.g., data for food consumption, dispersion). In the final stage of the licensing procedure, the inspectors of ANVS are asked to verify the draft license including its license conditions and requirements regarding its appropriateness for among others enforcement.

19.2.d Institutional control, regulatory inspection and documentation and reporting

This subsection also addresses Article 5.1.e of Directive 2011/70/Euratom.

Article 58 of the Nuclear Energy Act gives the basis for entrusting designated officials with the task of performing assessment, inspection and enforcement. The Decree on Supervision[29] identifies the bodies that have responsibilities in this regard. More about the organisation of the RB can be found in the text on Article 20.

Inspections are planned and results of inspections are reported on by the RB. The function of regulatory inspections is:

- To check that the license holder is acting in compliance with the regulations and conditions set out in the law, the license, the safety analysis report, the Technical Specifications and any self-imposed requirements.
- To report any violation of the license conditions and, if necessary, to initiate enforcement action; to check that the license holder is conducting its activities in accordance with its quality assurance system.
- To check that the license holder is conducting its activities in accordance with the best technical means and/or accepted industry standards.

In addition to inspection activities, international safety review missions take place. An important piece of information for inspection is the safety evaluation report, which is to be periodically updated. In this report the license holder presents its self-assessment of all the relevant technical, organisational, personnel and administrative matters.

The management of inspection is supported by a yearly planning, the reporting of the inspections and the follow-up actions. Depending on the type of facility and with a certain periodicity, meetings between facility management and RB are held. These meetings are devoted to inspections and inspection findings during which any necessary remedial actions are established and the progress made with their execution is discussed.

The ministerial decree on nuclear safety of nuclear installations[30] requires continuous improvement of (nuclear) safety and the execution of periodic safety reviews. In line with this, a license holder carries out periodic safety reviews as required by their license:

- Every 5 years an assessment of the activities and accomplishments in the area of safety, waste management and radiation protection is performed against the license requirements to conclude about eventual shortcomings and possibilities to improve.
- Every 10 years a comprehensive assessment is performed, where the design, operation, procedures and organisation is compared with current/modern (inter)national standards in order to find reasonably achievable improvements.

[29] In Dutch: Besluit aanwijzing en taakvervulling toezichthouders Kernenergiewet.
[30] In Dutch: Regeling Nucleaire veiligheid kerninstallaties.

19.2.e The enforcement of applicable regulations and of the terms of the licenses
This subsection also addresses Article 5.1.e of Directive 2011/70/Euratom.

If the ANVS judges there are serious shortcomings in the actual safety of the operation of a nuclear installation, the ANVS is empowered under Article 37b of the Nuclear Energy Act to take all measures deemed necessary.

Article 19 sub 1 of the Nuclear Energy Act empowers the ANVS to modify, add or revoke restrictions and conditions in the license to protect the interests as laid down in Article 15b of the Act. Article 20a of the Act stipulates that the ANVS is empowered to withdraw the license, if this is required to protect those interests. Articles 22.3, 33.3, 66 and 83a (the latter with a reference to the Environment and Planning Act) offer the possibility of using administrative enforcement.

Articles 5:21 through to 5:31c of the General Administrative Law Act provide a further description of 'Order subject to administrative enforcement'. Article 5:32 grants the authority the power to impose an order subject to a penalty. Article 18a of the Nuclear Energy Act empowers the ANVS to compel the license holder to cooperate in a process of total revision and updating of the license. This will be necessary if, for instance, the license has become outdated in the light of numerous technical advances or if new possibilities to protect the population even better have become available since the license was issued.

The ANVS has published its Supervision and Intervention Strategy (TIS) on the website in 2023 to inform all license holders. This is a modernization of the 2017 strategy. The updated TIS was written by and for ANVS employees who work in supervision. Compared to the 2017 version, the text is shorter, more concise and has been modernised. The principle of the TIS has remained unchanged: safety first. The new strategy describes more clearly how this will be achieved: by conducting risk-oriented supervision, regularly evaluating results and by making adjustments if necessary. In addition to enforcement, ANVS uses incentives. Even when a situation is compliant with the rules, ANVS will address points for attention or improvement. ANVS strives to continuously encourage safety improvements and can identify good practices when situations are better than expected according to the rules. The TIS also describes how ANVS deals with tolerance. For instance, the TIS describes when and how ANVS can temporarily allow a situation which does not fully comply with the rules.

19.2.f A clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management
This subsection also addresses Article 5.1.f of Directive 2011/70/Euratom.

The responsibilities of the State Secretary of IandWM are described in Section E, text on Article 19.1.a.

The Minister of Finance is sole shareholder of COVRA and is responsible for the investment mandate on the funding for waste management.

The RB is described in detail in Section E, text on Article 20.

The license holders hold prime responsibility for the safe management of spent fuel and radioactive waste generated by them, as explained in the text on Article 32.1 in Section B.

As soon as radioactive waste and spent fuel is transferred to COVRA, responsibility for safe management lies with this organisation. See Section B, Article 32.1(III), Safe management now for information on COVRA.

19.2.g Additional requirements on national framework by Directive 2011/70/Euratom
Section 19.2.g addresses additional requirements on the national framework by Directive 2011/70/Euratom and is not applicable for the Joint Convention.

19.2.g.1 National requirements for public information and participation
This subsection also addresses Article 5.1.g of Directive 2011/70/Euratom.

See Section E, 19.1.b for information on the General Administrative Act and other national requirements for public information and participation.

19.2.g.2 Financing schemes for the management of spent fuel and radioactive waste – legal framework
This subsection also addresses Article 5.1.h of Directive 2011/70/Euratom.

See Section F, text on Article 22(II) for information on the financing of the management of radioactive waste.

For the legislation on decommissioning and financial provisions for the costs of decommissioning of nuclear installations, see Section E, 19.2.a (The Bkse and decommissioning).

For information on financial and human resources at the license holder, see Section G of this report.

For information on the financial provisions of disused sealed sources, see Section J.

19.2.g.3 Improvement of the national framework
This subsection also addresses Article 5.2 of Directive 2011/70/Euratom.

Operational experience, national and international
The ANVS continuously monitors its own activities. The ANVS monitors and evaluates the operations of the license holders. Wherever conclusions can be drawn, lessons learned can be used for developing new policy, new regulations or amending licensing conditions.

See Section G, text on Article 9(VI) for information on operational experience feedback.

There are regular bilateral contacts with authorities in European countries and the United States, whereby operational experience is exchanged. Within the EU, the Netherlands is represented in the working groups of WENRA, ENSREG and HERCA. The Netherlands also participates in the activities of other international working groups under the auspices of the IAEA and/or NEA.

Documented decision-making processes
See Section E, 20.2 for information on the independence of the ANVS in the decision-making processes.

Technological developments and results of relevant research
The Nuclear Energy Act offers the competent regulatory body the possibility to take the initiative to adapt the scope of a license and the accompanying licensing conditions if new technological insights make this necessary in the judgement of the authority. For other aspects of knowledge management see Section K.

Results of self-assessments and peer reviews
See Section K.4 for information on the peer review missions. The IRRS-missions and ARTEMIS-mission started with a self-assessment.

19.3 Regulation of radioactive materials as radioactive waste
A definition of radioactive waste is given in the Basic Safety Standards Radiation Protection Decree, the Bbs, and has been provided in Section B, in the text on Article 32.1(V). The policy on the management of spent fuel and radioactive waste has been described in Section B, in the text on Article 32.1.

By implementing these policies, and thus minimising the amount of waste while ensuring that the waste is managed in an environmentally sound way, the Netherlands aim to meet the objectives of the Joint Convention.

19.4 Regulation on decommissioning

In principle the operator is responsible for all aspects of decommissioning. According to legislation, in force since April 2011, a nuclear facility shall be decommissioned directly after final shut down. Decommissioning implies the implementation of all administrative and technical measures that are necessary to remove the facility in a safe manner, and to create an end state of green field. According to legislation this also implies removal of the buildings. Therefore, during the operational phase, the license holder is required to develop a (preliminary) decommissioning plan, describing all the necessary measures to safely reach the end state of decommissioning, including the management of radioactive waste, record keeping, et cetera. This decommissioning plan shall be updated every five years and shall be approved by the ANVS. The final decommissioning plan eventually becomes part of the decommissioning license.

At the end of decommissioning, the license holder can apply for withdrawal of the license, after presenting an end report to the authorities proving that the decommissioning was completed. This report contains at the very least: results of activity measurements on the site and in the groundwater below the site, a description of the decommissioning process and a description of the radioactive waste management process (including fissile and radioactive waste).

The legislation also requires the license holder of NPPs and RRs (as well as Urenco) to make adequate financial resources available for decommissioning at the moment that these are required. Therefore, the license holder will have to calculate the total costs of decommissioning (including the costs of all the activities described in the decommissioning plan) and provide for a financial provision offering sufficient covering at the envisaged start of decommissioning or in the event of unexpected closure of business[31]. The license holder is free to choose the form of the financial provision: however, it has to be approved by the Minister of Finance and the Minister of IandWM.

20 Regulatory body

This section addresses the following.

JOINT CONVENTION

ARTICLE 20. REGULATORY BODY

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

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

DIRECTIVE 2011/70/Euratom

ARTICLE 6. COMPETENT REGULATORY AUTHORITY

1. Each Member State shall establish and maintain a competent regulatory authority in the field of safety of spent fuel and radioactive waste management.

[31] In case of accidents, the Dutch Act on the liability for nuclear accidents applies.

2. Member States shall ensure that the competent regulatory authority is functionally separate from any other body or organisation concerned with the promotion or utilisation of nuclear energy or radioactive material, including electricity production and radioisotope applications, or with the management of spent fuel and radioactive waste, in order to ensure effective independence from undue influence on its regulatory function.

3. Member States shall ensure that the competent regulatory authority is given the legal powers and human and financial resources necessary to fulfil its obligations in connection with the national framework as described in Article 5(1)(b), (c), (d) and (e).

ARTICLE 8. EXPERTISE AND SKILLS

Member States shall ensure that the national framework require all parties to make arrangements for education and training for their staff, as well as research and development activities to cover the needs of the national programme for spent fuel and radioactive waste management in order to obtain, maintain and to further develop necessary expertise and skills.

ARTICLE 10. TRANSPARENCY

1. Member States shall ensure that necessary information on the management of spent fuel and radioactive waste be made available to workers and the general public. This obligation includes ensuring that the competent regulatory authority inform the public in the fields of its competence. Information shall be made available to the public in accordance with national legislation and international obligations, provided that this does not jeopardise other interests such as, inter alia, security, recognized in national legislation or international obligations.

2. Member States shall ensure that the public be given the necessary opportunities to participate effectively in the decision making process regarding spent fuel and radioactive waste management in accordance with national legislation and international obligations.

20.1 Authority for Nuclear Safety and Radiation Protection

20.1.a Introduction

The RB is the competent regulatory authority designated by the Government as having legal authority for conducting the regulatory process, including issuing licenses, and thereby regulating nuclear safety, radiation protection, radioactive waste and transport safety, nuclear security and safeguards.

There is one large entity, the Authority for Nuclear Safety and Radiation Protection (ANVS) and some smaller entities at various ministries that together constitute the RB. However, the regulatory tasks related to radioactive waste management which is the subject of this report are within the scope of the ANVS only. Therefore, this report often will refer to the ANVS as the RB.

The ANVS brings together expertise in the fields of nuclear safety and radiation protection, emergency preparedness and response as well as security and safeguards. For each of these subjects, the ANVS focusses on the granting of licenses, supervision and enforcement and (public) information and has the authorization to prepare its own regulations (ANVS-Regulations) in the situations mentioned by the Nuclear Energy Act. The ANVS ensures that the Netherlands is well prepared for possible radiation incidents. The ANVS can also be requested by responsible ministries to give advice over policy and legislation issues (concerning nuclear safety and radiation protection). All nuclear facilities in the Netherlands, including COVRA, operate under license, awarded after a safety assessment has been carried out successfully. Licenses are granted by the ANVS under the Nuclear Energy Act.

The tasks and mandates of the ANVS are described in Chapter II of the Nuclear Energy Act. In 2017, the ANVS obtained the formal status of an independent administrative body. See also Section E, text on Article 19.1.a.

The ANVS appointed an Advisory Board on 17 April 2018. The board has the task of providing the ANVS with solicited and unsolicited advice on matters related to the tasks of the ANVS. It has six members, with expertise relevant to the tasks of the ANVS. Responsibilities and challenges regarding radioactive waste and its management have been part of exchanges in the context of general topics such as recent developments, the ANVS, and knowledge. Furthermore, the Advisory Board has presented the following advice relevant to radioactive waste:

- Advice on role ANVS around disposal
  On 23 December 2019 the Board issued an advice on what the role of the ANVS around disposal of radioactive waste should be and how the distribution of responsibilities and tasks for the various sub-aspects of policy development, its implementation and realization of the disposal facility should be organised. In dialogue with the ANVS, the Board has identified three aspects that require special attention:
  1. The role of the ANVS in policy preparation for a national disposal facility.
  2. The role of the ANVS in securing and supervising financial resources.
  3. The role of the ANVS in policy preparation for a possible multinational disposal.

  The Board has carried out a reflection on each aspect, providing recommendations and advise for next steps. The transfer of the responsibility for policy preparation (including the participation process) of disposal from ANVS to the Ministry of IandWM since 15 May 2020, ensures that the ANVS can focus on the regulation of safety aspects.

20.1.b Entities of the RB

Below the status and tasks of the entities of the RB are summarized:

- Since 2017, the ANVS is an independent administrative body. The ANVS is involved in regulatory requirements, licensing and independent supervision (safety assessment, inspection and enforcement) of compliance by the license holder(s) and other actors with the requirements on the safety, security and non-proliferation.[32] The ANVS can also be requested to give advice about legislation and policies on nuclear safety and radiation protection. Furthermore, it has responsibilities regarding advising in the area of emergency preparedness and response, and public information and communication.
- The Inspectorate SZW (Ministry of Social Affairs and Employment) has tasks in the protection of the safety of workers against exposure to radiation.
- The Health and Youth Care Inspectorate (Ministry of Health, Welfare and Sport) has tasks in the protection of patients against undesirable effects of exposure to radiation.
- The Dutch State Supervision of Mines (Ministry of Economic Affairs and Climate) oversees the safe and environmentally sound exploration and exploitation of natural resources in the underground like natural gas and oil.
- The Netherlands Food and Consumer Product Safety Authority (NVWA) monitors the quality of food and consumer products to safeguard human health and animal health and welfare. The NVWA supervises the whole production chain, from raw materials and processing aids to end products and consumption. The NVWA is an independent agency, part of the Ministry of Agriculture, Nature and Food Quality, and a delivery agency for the Ministry of Health, Welfare and Sport.
- The Human Environment and Transport Inspectorate of the Ministry of IandWM has general supervision responsibilities for the compliance with the requirements of modal transport regulations.
- The Inspectorate Military Healthcare (IMG) of the Ministry of Defence oversees a healthy and safe work environment for its civilian and military staff. Its scope includes applications of ionizing radiation and accounting for the use of radioactive sources within the military.

[32] These requirements apply to activities and facilities (including nuclear facilities).

Apart from the ANVS, most entities of the RB employ only a limited number of staff for the Nuclear Energy Act-related tasks. In addition to day-to-day contacts between the entities of the RB, there are periodic meetings at manager and director levels.

Cooperation agreements
A Cooperation Agreement for Radiation Protection (signed in 2017) was set up to describe the interaction, communication and cooperation between the ANVS and the concerned policy departments and inspectorates of other ministries. The purpose of the Cooperation Agreement is to promote the cooperation between the various parties who have statutory duties in the area of radiation protection, in the light of providing adequate protection of the environment, members of the public, employees and patients in the Netherlands. This purpose is achieved by making working arrangements and by setting out the framework, with which these arrangements (made between two or more parties on the basis of the Cooperation Agreement) have to comply with. The working arrangements relate to interdepartmental (execution) policy development and –implementation, licensing, supervision and enforcement, communication, research and education, and participating and representation in international fora.

The following parties signed the agreement: the ANVS, the Ministers of IandWM, Social Affairs and Employment (SZW), Health, Welfare and Sport (VWS), Defence, the Human Environment and Transport Inspectorate, the Netherlands Labour Authority (NLA), the Health and Youth Care Inspectorate (IGJ), the Inspectorate for Military Healthcare, the State Supervision of Mines and the Netherlands Food and Consumer Product Safety Authority.

Additional working arrangements under the cooperation agreement have been concluded between the Ministries of Health, Welfare and Sport, Social Affairs and Employment and ANVS, between ANVS and the ministry of Defence, ANVS and the State Supervision of Mines, and ANVS and the Netherlands Labour Authority. Working arrangements between the ANVS and the inspectorates the Health and Youth Care Inspectorate, Inspectorate Military Healthcare and the Netherlands Food and Consumer Product Safety Authority are scheduled for 2024-2025.

Convenant
Also, a Covenant is concluded in 2018 between the ANVS, the Minister of IandWM, and the Minister of Finance, regarding the legal tasks of the ANVS that are conducted by the Customs. With this Covenant, legal requirements[33] will be met regarding the non-fiscal tasks that customs undertake to control European cross border transport of goods under the scope of the Nuclear Energy Act. Furthermore, a covenant between the Police and the ANVS was concluded in the 1990's on secured nuclear transport.

Agreements with other RBs
The ANVS has agreements with several foreign RBs. Examples are a Memorandum of Understanding (MoU) with Belgian counterpart FANC (2017), a cooperation agreement with the Australian counterpart ARPANSA (2018) and an extension Arrangement with the US NRC. The latter is an extension of an agreement signed in 2013. In more recent times, MoUs have been signed with CNSC (Canada), NNR (South Africa), and ASN (France).

20.1.c Tasks of the ANVS
The ANVS has the following statutory duties regarding nuclear safety and radiation protection and associated emergency preparedness and response, and security and safeguards as meant in conventions of the IAEA:
- Granting licenses; all nuclear facilities in the Netherlands, operate under license, awarded after a safety assessment has been carried out successfully. Licenses are granted by the ANVS under the Nuclear Energy Act.
- Regulating all other radiation practices by licensing or notification and registration.

[33] Legal requirements of Article 1:3, paragraph 5 of the General Customs Law.

- Supervising and enforcing compliance with requirements by or under the Nuclear Energy Act.
- Advising the Ministry of IandWM and other Ministries on policies and Acts and regulations.
- Together with various partners maintaining an Emergency Preparedness and Response organisation.
- Providing information to interested parties and the public on nuclear safety and radiation protection.
- Participating in relevant activities of international organisations, as far as related to tasks related to the Nuclear Energy Act.
- Maintaining relationships with comparable foreign authorities and relevant national and international organisations.
- Supporting national organisations with the provision of expertise and knowledge.
- Undertaking research in support of the implementation of its tasks.

These tasks match the tasks a regulatory body is required to have according to the Euratom Directives for radioactive waste, nuclear safety and basic safety standards.

Further integration of safety and security inspections is being stimulated and practiced.

20.1.d. Organisation of the ANVS

The ANVS is led by a Board with two Members: a chair and a vice-chair. The Board Members have been officially appointed as the independent RB. The staff of the ANVS are registered as staff of the Ministry of IandWM and are made available to the board to perform ANVS-tasks. In performing their tasks, they account to the board of the ANVS and not to the Ministry. Staff members only report to the Board of ANVS.

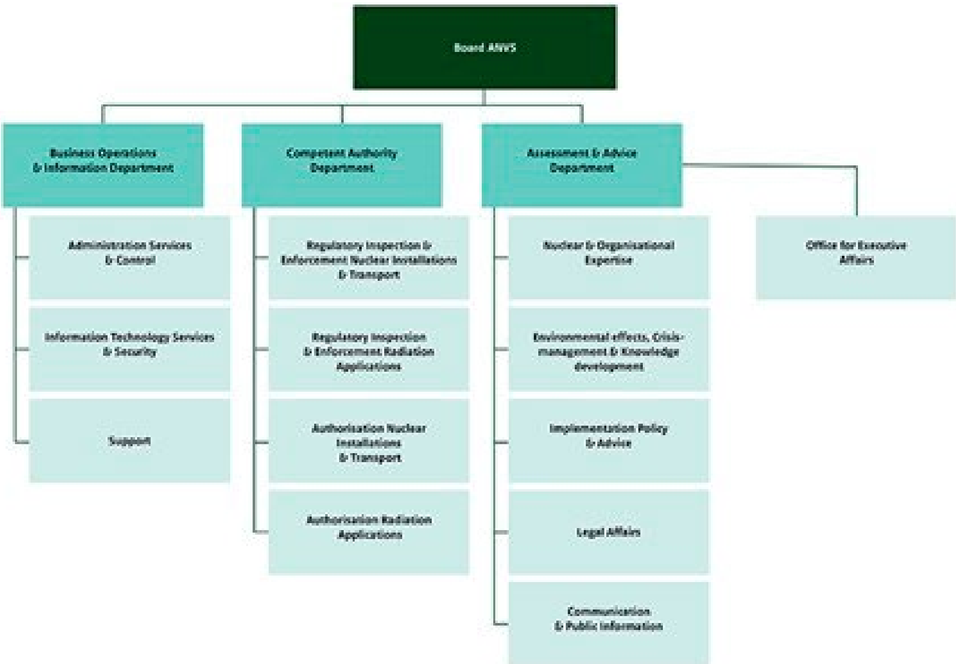
As stated in Section A.6.B, a new organisational structure came into effect on 1 February 2023, with two content-related departments (the Competent Authority Department and the Assessment & Advice Department) and a Business Operations & Information department.

The Competent Authority Department is responsible for issuing permits and for supervision and enforcement of nuclear installations, the transport sector and radiation applications. At team level, licensing and supervision and enforcement are separated.

The teams within the Assessment & Advice Department provide advice on policy, legislation, regulations and authorizations. They also keep track of relevant developments. Furthermore, specialist inspections, assessments, drawing up implementation policy, crisis preparation, crisis response and public information are part of the tasks of this department. In addition, the Administrative Affairs office is accommodated within this department.

The third department is Business Operations & Information. The teams within this department advise and support the management team and ensure that the two content-related departments can do their work. They have a testing and advisory role in internal business operations and provide information.

Figure 6: Organisation chart of the ANVS



20.1.e ANVS licensing, supervision and enforcement policies

The ANVS has documented its policies on licensing, supervision and enforcement. The top-level documents have been published on the ANVS website, to fulfil the principle of openness and transparency of regulatory activities (see Section E, 20.1.j). In this way license holders and the public are informed about the approach taken by the ANVS and its guiding principles. For ANVS staff, there is more detailed information on working procedures available as well (see Section E, 20.1.i).

Some of the guiding principles of the ANVS regarding licensing, as well as supervision and enforcement are:

- Priority to safety, all the efforts of the ANVS serve the protection of people, animals, plants and property. This is more than just verifying compliance with regulatory requirements. Also, security and proliferation of knowledge and radioactive materials (for unauthorized purposes) are an essential element of safety.
- Responsibility at the license holder and justified confidence. The license holder is responsible for (nuclear) safety. This responsibility cannot be transferred to the regulatory body, but the ANVS supervises the license holders and assesses if the confidence given to the license holders is deserved.
- Emphasis on continuous improvement. The safety must remain state-of-the-art. A changing environment, technological advances, lessons learnt from incidents and accidents, all may lead to improvements. The ANVS also requires the license holders to keep risks as low as reasonably achievable (ALARA).
- Risk-oriented approach or graded approach in the execution of the tasks to aid efficient management of available resources at the ANVS.
- Coordination and cooperation with partners and stakeholders are essential for the proper execution of the tasks of the ANVS.

Regarding licensing, the ANVS applies in many license conditions the comply-or-explain principle, meaning the applicant must demonstrate compliance with published regulation. If the applicant cannot meet these requirements exactly as prescribed, he will need to demonstrate how he will meet the objectives of the requirements in an equivalent way.

20.1.f Coordination of activities for managing nuclear accidents and incidents

Refer to the text on Article 25 in Section F on emergency preparedness and response for the relevant details.

20.1.g Development and maintenance of Human Resources and competence

Current manpower situation of the ANVS

ANVS started 2024 with 163 employees (2023: 156) representing 159 FTE (2023: 152).

Qualified staff at the ANVS

By the end of 2024, the ANVS will have a strategic personnel plan, which will be the basis of their work force planning. One of its focal points is how to assure that sufficiently qualified employees remain available. It also considers the long-term requirements and the expected changes in available knowledge that will be needed due to future developments (e.g., new NPPs, decommissioning projects and work regarding the geological storage facility). More structured personnel development plans are also being developed, along with the required training opportunities. The regular updates of the plan serve as input for the draft budgets the ANVS makes and submits to the Minister of IandWM.

See Section K.2 for more information about maintenance of competence at the ANVS.

Disciplines and training

The expertise of the ANVS spans disciplines in areas such as radiation protection, nuclear safety, waste safety, transport safety, conventional safety, risk assessment, security and safeguards, emergency preparedness and response, legal and licensing aspects. When needed, knowledgeable consultants are contracted for support (see also the section on 'Contracted support and cooperations' below).

Currently, efforts are made to integrate the education plans and the relevant trainings into a single platform: the ANVS Academy. This learning & development platform offers training in technical aspects as well as personal development. This platform was launched in June 2022 and will continue to grow. Part of the training policy is that experts have to keep up with developments in their discipline. Apart from the general courses, training dedicated to the technical disciplines is provided in the areas of nuclear safety, radiation protection and emergency preparedness and response. New training courses are developed in close contact with external knowledge partners. The goal is to provide education and training courses on all subjects relevant for the ANVS, including radioactive waste safety and decommissioning. These are (or will be) offered to the staff via the ANVS Academy. This includes international workshops, but also conferences and visits to other regulatory bodies. In addition, information exchange takes place through the international networks of OECD/NEA, IAEA and EU, e.g., the Article 31 and Article 37 Group of Experts. Also to be mentioned are the contributions to HERCA, WENRA, ENSREG, TRANSSC, RASSC, WASSC, NUSSC, EPRSC, NEA/CNRA, NEA/CSNI and several of its Working Groups. Furthermore, there is a policy to participate in several IAEA missions annually, like in IRRS, ARTEMIS, IPPAS, EPREV, INSARR. It is considered to be worthwhile to have staff positioned at IAEA, NEA or EU; however, this has not yet materialised.

All ANVS staff follow regular trainings for their work and maintain training plans that are assessed at least annually with their team leader. In addition to formal education courses, the ANVS utilizes informal, voluntary learning opportunities, including presentations and workshops. The ANVS is also conducting a competence gap analysis, through an employee knowledge survey, to assess the organization's education and development capabilities. The ANVS is working on an improved system of personal education plans for all employees, new and existing, to stimulate and monitor continuous learning.

Staff requiring specific expertise, such as inspectors, receive the specific training required and participate in a mentoring program with more experienced staff before completing work on their own. In addition, they are provided with the training and information required to safely complete their tasks in the various work environments that they may encounter. The inspector qualification process includes instruction for all the procedures necessary to complete inspections and practical experience in the field, combined with the evaluation by a senior inspector. Inspectors also receive training on a comprehensive range of potential workplace hazards that they may encounter, both general (such as chemicals and physical hazards) as well as specific hazards related to the physical locations where they may conduct their inspections. Through this training program, the ANVS fulfils its duty of care to these workers and ensures their ongoing safety through education.

Contracted support
For areas in which its competence is not sufficient, where a specific in-depth analysis is needed or where specialistic models or tools are needed, the ANVS has a budget at its disposal for contracting external specialists. This is considered one of the basic policies of the ANVS: the core disciplines should be available in-house, while the remaining work is subcontracted to third parties like governmental research organisations and/or commercial Technical Support Organisations (TSOs). When more resources are needed to meet peak demands, contracting third parties is an option. In 2023, the coordination of all knowledge activities, including the contracted external specialist support programmes, was bundled in one team at the ANVS. ANVS cooperates with foreign TSOs to evaluate safety cases of license holders.

The ANVS can rely on various national and foreign organisations that regularly provide support. Below, the most important of these organisations are introduced.

Governmental supporting organisation RIVM
The ANVS and the Ministry of IandWM finance ongoing research programmes of the National Institute for Public Health and the Environment (RIVM). RIVM provides scientific support to other Ministries as well.

The mission of RIVM is to keep knowledge up to date, by gathering, generating and integrating knowledge and make it available in the public domain. By performing these tasks RIVM contributes to promoting the health of the population and the environment.

Specifically in the field of radiation protection, RIVM works together with other (governmental) expert organisations as the Royal National Meteorological Institute (KNMI) with models for the prediction of the effects of discharges of radioactive material in the air. RIVM also operates the national radiological monitoring network and coordinates the collaborating expert organisations for radiological and public health advise in nuclear crisis situations. Furthermore, RIVM is contracted by the ANVS to perform environmental monitoring, provide contra-expertise measurements at nuclear installations and assist inspectors with an array of measurement techniques, laboratory capacity and knowledge.

In the field of radioactive waste safety and decommission, RIVM offers expertise to both the Ministry of IandWM and the ANVS for new policy development and implementation.

Education and training organisations
The Technical University in Delft and the Nuclear Research & consultancy Group (NRG) in Petten and Arnhem provide education and training in nuclear technology and radiation protection to clients from nuclear and non-nuclear businesses and various governmental organisations. Dedicated trainings on various topics are also contracted by the ANVS with other national and foreign supporting organisations. For specific needs, the ANVS develops new education and training activities in cooperation with these organisations.

For the education and training in radiation protection a national system exists with several levels of education, in line with the system of Radiation Protection Experts (RPEs) and Radiation Protection Officers (RPOs) in the Euratom Basic Safety Standards. The government recognizes training institutes for a specific training of radiation protection. An education in radiation protection is concluded by an examination that, when passed successfully, leads to a nationally acknowledged degree. Registration of radiation protection experts, on two levels of expertise named General Coordinating Expert in radiation protection and Coordinating Expert in radiation protection, has been implemented.

There are formal requirements to obtain a registration certificate based on the initial education. To maintain the registration, there are requirements for continued education and for work experience.

Technical Support Organisations (TSO)
Consortium of Bel-V, IRSN and Bureau Veritas: In 2021, the major framework contract for nuclear advisory services of the ANVS was set out in a European tender. A consortium of three parties won the tender and is now acting as TSO. The framework contract is divided in three lots: review and assessment, inspection support and research and development assignments. The third lot also comprises the development of education and training courses.

The TSO consists of the following three parties:
- *Bel-V*, a subsidiary of the Federal Agency of Nuclear Control in Belgium,
- *IRSN*, a French governmental institution, and
- *Bureau Veritas*, a global company offering testing, inspection and certification services (only involved in inspection support).

GRS, Germany: The ANVS also collaborates with a TSO from Germany, GRS. This is a TSO for the German national regulator and one of the large German TSOs. GRS provides the maintenance, development and use of an analysis simulator of the Borssele Nuclear Power Plant. Furthermore, in 2023 a specific contract for support on the subject of nuclear security was signed.

NRG, Netherlands: The Nuclear Research & consultancy Group (NRG) in Petten and Arnhem provides consultancy & educational services to government and industry. NRG is also the operator of the HFR research reactor. The company has implemented 'Chinese Wall' procedures to protect the interests of its various clients and avoid conflicts of interest. NRG is regularly contracted by the ANVS for specific assignments in the field of nuclear safety and for support in licensing of applications of ionising radiation. In the contracts there are strong requirements dealing with the potential conflict of interest, which have been audited.

For consultancy and research in the area of radiation protection, the ANVS has a mini-tendering framework contract with both NRG and SCK CEN, a Belgian nuclear research institute with close ties to the academic world. SCK CEN is also the operator of the BR1 and BR2 research reactors at its site in Mol, Belgium.

SCK CEN, Belgium: ANVS has a framework contract with Belgium research institute SCK CEN for consultancy in the area radiation protection. SCK CEN operates two research reactors at its site in Mol, Belgium.

Applus RTD, Netherlands: ANVS has a framework contract for support in licensing of applications of ionising radiation and sampling and measurement support for inspection with the Dutch firm RTD. RTD is a subsidiary of multinational company Applus+, operating in the testing, inspection and certification sector.

20.1.h Financial resources of the ANVS
The State Budget allocates funds for implementing the duties, responsibilities and powers associated with nuclear safety and radiation protection. These resources are also intended to facilitate permanent compliance with quality and expertise requirements in the area of nuclear safety and radiation protection.

Specifically for the ANVS, the Nuclear Energy Act stipulates that the Ministry of IandWM will allocate sufficient financial resources for the ANVS to carry out its duties. The total annual ANVS budget in 2024 is €39.5 million (2023: €36.1 million). The budget of the ANVS for contracted support in 2024 is about €14.1 million (2023: €14.6 million), mostly spent on contracted support provided by organisations like RIVM, BEL-V, GRS and NRG.

Under current regulations the costs of the regulatory body for oversight and licensing are partially reimbursed. Applicants and licensees pay for indicated licensing activities and the license holders of nuclear installations pay an annual fee for oversight.

20.1.i Quality management system of the ANVS

In 2023, the ANVS spent time further developing, describing and implementing its internal processes. Improving the existing processes contributed to the optimization of the internal working methods. The processes are recorded in the ANVS Integral Management System, the AIM[34]. At the end of 2022, a start had already been made on redesigning the ANVS management system to better align it with the IAEA guidelines. This improvement has been confirmed by the IRRS mission 2023. The adjustment work will continue to be carried out in 2024.

20.1.j Openness and transparency at the ANVS

This subsection also addresses Article 10 of Directive 2011/70/Euratom.

The Joint Convention reports as well as national reports on the implementation of the Directive are made available for the public.

To fulfil its legal task to provide public information, the ANVS has created a dedicated ANVS communication unit, which is currently a group of 8 FTE. It supports the ANVS in meeting its objectives for openness and transparency, as well as actively seeking the dialogue with stakeholders.

Legal requirements

Legal requirements on transparency by the ANVS come from several national and international sources. See Section E for more information on the various legal requirements on information to the public and employees.

Council Directives emphasize provision of information to the public and employees. For instance, Directive 2011/70/Euratom, Directive 2013/59/Euratom and of Directive 2014/87/Euratom amending Directive 2009/71/Euratom. All have been transposed in the regulatory framework.

The Nuclear Energy Act (Article 43) provides for the issuing of information to members of the public who could be affected by a nuclear accident.

Stakeholder and public involvement

Stakeholder involvement is embedded by public consultation during the licensing process and if applicable in the process of the EIA under the Environmental Protection Act. This process also involves meetings of ANVS, license holders and the public. These meetings involve possible new licenses as well.

Public participation is also possible using tools such as internet consultation for new legislation and the Internet Platform Participation in case of plans and decisions. The ANVS actively tries to reach as many stakeholders as well through communication on its social media channels about internet consultations.

For information about decision-making on disposal and public involvement in that process, see Section A.7.a.

Stakeholder communication

The ANVS started an internal program in 2022 to inform its employees about when and how to publish information ('Programma Openbaar Maken'). The program coordinates and monitors the coherence of activities, advises, supports and guides the ANVS to improve information management and work as an open government body.

[34] AIM, Dutch acronym for: ANVS Integraal Managementsysteem. The resources at the RB currently are adequate, in terms of Human Resources (number of staff and expertise) and financing.

See also the next section on the website of the ANVS.

Website
The ANVS-website is mainly available in Dutch, but some information is available in English. The ANVS is actively working in 2024 on providing most of the information in English. Documents intended to be used in peer reviews, information intended for more informed groups (experts) and colleagues in other countries are often published in English.

In 2023 and 2024, the ANVS is working on redesigning its website, to make it more accessible for the public. Part of that means rewriting information to make it more understandable for the broader population. Another aspect is clearly directing licensee holders to a part of the website catered especially for them. The ANVS also did research with focus groups and questionnaires to make the website as accessible as possible.

The website is instrumental in positioning the ANVS as an independent authority. Currently, a lot of regulatory information and products are published on a regular basis, mostly on the website of the ANVS. Examples are:
- Licenses granted by ANVS.
- ANVS-Regulations.
- General information about tasks and activities of the ANVS.
- ANVS Annual Report.
- Main vision document of the ANVS, the 'Koersdocument' describing the 'course' of the ANVS, its mission, values, guiding principles, vision on developments, and its choices.
- ANVS policy document on its licensing strategy.
- ANVS policy document on its supervision and enforcement strategy.
- Guidance for applicants on how to apply for a license, including guidance on what kind of information to include.
- Several review and assessment reports.
- Information about cross inspections with FANC (not the reports).
- Incident reports and follow-up.
- IAEA mission reports. In addition to the English version of reports, a Dutch translation (or a Dutch summary) is sometimes provided.

Regular reports
The ANVS reports to the Ministry of IandWM about the execution of its annual plan and the status of planned actions. The ANVS also submits an annual report to parliament containing an overview of registered incidents at nuclear installations.

International collaboration
The ANVS also actively participates in the international public communication and transparency groups, e.g., ENSREG WGTA and OECD/NEA/WGPC.

20.1.k Advisory Committees of the ANVS
The ANVS has an Advisory Board which has the task of providing the ANVS with solicited and unsolicited advice on matters related to the tasks of the ANVS. Refer to Section E, 20.1.a for more information. It has no role in assessing safety, like standing committees in some other countries.

If needed an advisory committee is formed on an ad hoc basis as required, as happened several times in the past. A committee can be formed for any required issue.

20.2 Status of the regulatory body

The ANVS as a zbo is independent in its functioning and organising its activities, but the Minister of IandWM remains politically responsible for its functioning and is accountable to the parliament. The Minister of IandWM is empowered to:

- Appoint, suspend or dismiss the members (of the board) of the ANVS.
- Decide on the remuneration policy for the members of the ANVS.
- Decide on the budget of the ANVS.
- Ask for any information needed for executing his tasks.
- Approve the management regulations of the ANVS.
- Abrogate decisions of the ANVS if they are in violation with the law.
- Take the necessary measures if the ANVS is severely neglecting its tasks.

The main guarantee that the ANVS performs its functions in a manner that does not compromise its independence is in the fact that the ANVS has the statute of an independent administrative body. The Minister of IandWM is politically responsible for its functioning. This minister is not responsible for energy policy.

Section F Other General Safety Provisions

21. Responsibility of the license holder

This section addresses the following.

JOINT CONVENTION

ARTICLE 21. RESPONSIBILITY OF THE LICENSE HOLDER

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

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

DIRECTIVE 2011/70/Euratom

ARTICLE 7. LICENSE HOLDERS

1. Member States shall ensure that the prime responsibility for the safety of spent fuel and radioactive waste management facilities and/or activities rest with the license holder. That responsibility can not be delegated.

21.1 Prime responsibility for safety

Several legal provisions ensure that the license holder is primarily responsible for the safety of the management of spent fuel and radioactive waste.

The primary responsibility of the license holder for safety emerges from the principles of the legal system, including the Nuclear Energy Act and underlying regulations, and the obligations referred to therein for the license holder. The basis for this is laid down in Euratom Directives (for instance 2009/71/Euratom and 2014/87/Euratom). This responsibility is explicitly written down in Article 3 of the Nuclear Safety Regulation for nuclear installations, including the responsibility for contractors, subcontractors and suppliers and the inability to transfer this responsibility.

The Nuclear Energy Act, the Bbs and specific license conditions contain additional requirements for license holders. The Nuclear Energy Act contains a number of articles relating to criteria, interests and circumstances that must be complied with to be able to grant a license. An elaboration can also be found in the Bbs, as there are many regulations that specify 'The operator ensures that...'.

From the moment radioactive material is classified as waste, a number of additional requirements apply. The most important requirement is that the waste shall be transferred to COVRA as soon as reasonably possible. Upon transferral of the waste to COVRA, all liabilities, including the responsibility for safety, are transferred to COVRA. For more information, see Section B and the Overview matrix of liabilities and current policies and practices in Section A.

21.2 Responsibility of contracting party if there is no license holder or other responsible party

Articles 22 and 23 of the Nuclear Energy Act stipulate that in case nuclear or radioactive material is found, the ANVS must be notified and the ANVS is granted power to take appropriate action to prevent or reduce undue radiation risks. For the temporary management of (orphan) fissile materials two institutes have been designated by a special decree[35]: NRG in Petten and COVRA in Nieuwdorp. The same institutes as well as the RIVM in Bilthoven have been designated for the management of (orphan) radioactive materials.

The HASS Directive (aimed at preventing unregulated sources) has been implemented in the Bbs. This Decree allows the Minister of IandWM to intervene in case of unforeseen contamination of sites from past activities or events and grants the ANVS oversight in such situation.

Specific regulations (the Radioactive Scrap Detection Decree and the Radioactive Scrap Detection Regulation) are in place for detection and management of radioactive contaminated scrap metal.

22. Human and financial resources of COVRA

This section addresses the following.

JOINT CONVENTION

ARTICLE 22. HUMAN AND FINANCIAL RESOURCES

Each Contracting Party shall take the appropriate steps to ensure that:

(I) qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;

(II) adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning;

(III) financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

DIRECTIVE 2011/70/Euratom

ARTICLE 4. GENERAL PRINCIPLES

3. National policies shall be based on all of the following principles:
   (e) the costs for the management of spent fuel and radioactive waste shall be borne by those who generated those materials;

ARTICLE 7. LICENSE HOLDERS

5. Member States shall ensure that the national framework require license holders to provide for and maintain adequate financial and human resources to fulfil their obligations with respect to the safety of spent fuel and radioactive waste management as laid down in paragraphs 1 to 4.

[35] Decree on the designation of institutes as meant under Articles 22 sub 4 and 33 sub 4 of the Nuclear Energy Act, Bulletin of Acts and Decrees 1996, 528.

ARTICLE 8. EXPERTISE AND SKILLS
Member States shall ensure that the national framework require all parties to make arrangements for education and training for their staff, as well as research and development activities to cover the needs of the national programme for spent fuel and radioactive waste management in order to obtain, maintain and to further develop necessary expertise and skills.

ARTICLE 9. FINANCIAL RESOURCES
Member States shall ensure that the national framework require that adequate financial resources be available when needed for the implementation of national programmes referred to in Article 11, especially for the management of spent fuel and radioactive waste, taking due account of the responsibility of spent fuel and radioactive waste generators.

22(I) Qualified staff at COVRA
This subsection also addresses Articles 7.5 and 8 of Directive 2011/70/Euratom.

The Nuclear Energy Act requires that an application for a license for a nuclear facility shall contain an estimate of the total number of employees plus details of their tasks and responsibilities and, where applicable, their qualifications. This includes supervisory staff. The license holder has to submit its education and training plan for the RB's information and approval. These requirements apply also to the COVRA waste and spent fuel management facilities.

The Ministerial Regulation on nuclear safety in implementation of European Directive 2009/71 specifies in Article 4 that the license holder must have sufficient financial and human resources to comply with the obligations in respect of nuclear safety of the nuclear installation under its authority.

Nuclear Safety Rule NVR-GS-R-3 on the management system for facilities and activities requires the management of the organisation to make available those resources needed for correctly implementing the activities of the organisation. These resources also include the financial resources.

COVRA has implemented a Personnel Qualification Plan (as part of a more generic quality management system) in which clear guidelines have been formulated on attracting and supporting (new) employees in their development. In addition to the Personnel Qualification Plan, COVRA has an education plan and education matrix which contains the requisite level of expertise, and in which the requirements for training and education are laid down. A training plan ensures that an adequate number of staff, with relevant expertise and appropriate training is always available. Any major organisational changes, at the management level for example, must be reported to the RB. Together with the job descriptions, which detail the responsibilities and authority interfaces, the Personnel Qualification Plan and the education plan constitute the building blocks to ensure qualified staff.

See Section K.2 for more information about maintenance of competence at COVRA.

22(II) Adequate financial resources at COVRA
This subsection also addresses Articles 4.3.e and 9 of Directive 2011/70/Euratom.

The adequacy of financial resources for decommissioning is addressed in Section F, text on Article 26.

Polluter pays principle
One of the principles in the policy on the management radioactive waste is 'the polluter pays': waste producers pay for all costs of the management of the radioactive waste (Bbs, Article 10.10).

The polluter pays principle is implemented as follows:
1. Some of the buildings at COVRA are dedicated to the management of the waste of large clients and commissioned on their behalf. These buildings are invoiced, and not activated on COVRA's balance sheet. An example is the (expansion of) the HABOG, which is paid for by EPZ and the buildings for

depleted uranium (VOG and VOG-2), which are paid for by Urenco. The financial construction risk is therefore not COVRA's.

2. Upon delivery of the waste, the producer pays COVRA the stipulated price (contractual) tariff, which is meant to cover the costs arising from the services over the entire management cycle (from transport, processing, storage to final disposal) based on the current insights. With the implementation of the Directive, the obligation has been introduced to set off the research costs into waste management in the charges imposed by COVRA. After payment, COVRA takes over the legal ownership and thereby the responsibility for the radioactive waste. This policy prevents waste suppliers from being unable to meet their obligations in the future in the event of financial problems or termination of the business operations. COVRA thus mitigates the risks that could arise from (for example) a possible future bankruptcy of waste producers.

Current arrangements at COVRA

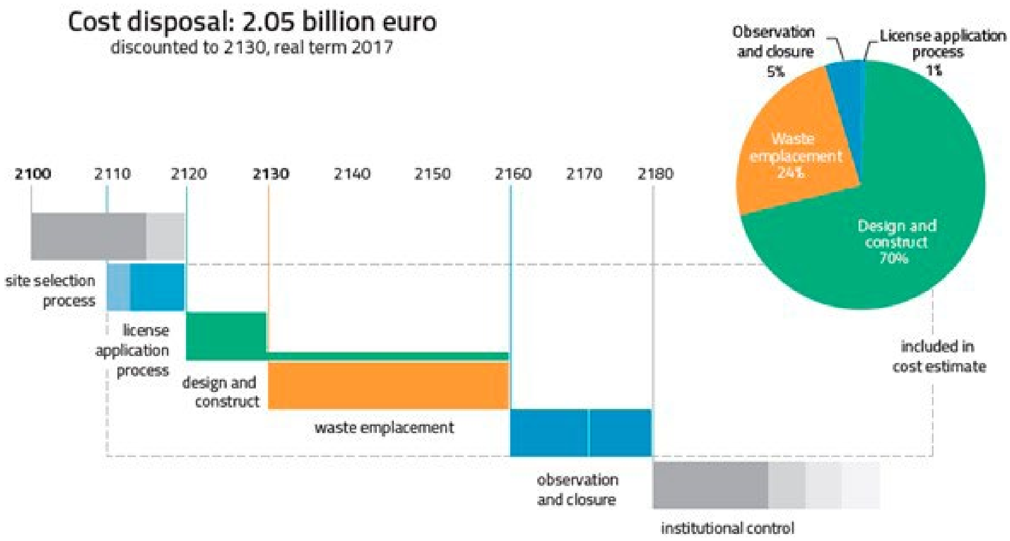
Based on the polluter pays principle, COVRA passes on the estimated costs for interim storage and geological disposal to the tariffs it charges the waste suppliers. After payment of the tariffs, the financial liability for the waste is transferred to COVRA. Part of the tariffs is transferred to a fund. Accumulated funds are projected to grow during the period of interim storage, to cover the costs of both above ground storage and geological disposal. Attention should be paid to the fact that the provisions COVRA has included in the balance sheet reflect future liabilities in terms of real cost levels. Underlying assumptions are an average inflation rate of 2% and a real interest rate of 2.3%. These parameters translate into a target return of 4.3% on the financial resources for interim storage and geological disposal. These provisions and underlying parameters are periodically reviewed.

COVRA has several long-term contracts with major radioactive waste producers. The tariffs charged to small-scale producers (known as standard waste tariffs) are available to the public and can be viewed at COVRA's website. The cost prices are periodically recalibrated to reflect current costs. These tariffs are corrected annually by the price index of 2%, or 17.5% when a margin on a waste stream is negative. The final goal is to acquire the financial resources and knowledge needed to have an operational geological disposal facility around 2130.

The cost of the above-ground management of radioactive waste at COVRA was estimated in 2023 at approx. €17.7 million per year.

To provide for economies of scale, it is envisioned that all radioactive waste (including high-, intermediate- and low-level radioactive waste) will be placed in a single final geological disposal facility. COVRA is currently working on the basis of a cost estimate for the geological disposal facility of €2,300,000,000 (price level 2023, source: COVRA 2023 annual report). The cost estimate is based on a definitive decision on the disposal method being made around 2100. The development of the disposal concept and the site selection process are not included in the cost estimate. The provision for geological disposal currently on the COVRA balance sheet will increase in the period up to 2130 (based on the forecasts for income from waste producers, real growth and inflation) to the target amount.

Figure 7: OPERA Safety Case: estimated costs of geological disposal in Boom Clay



Financial resources for other activities

Contaminated scrap
Refer to Section J for information on contaminated scrap.

HASS
The High Active Sealed Sources Directive has been implemented in the Bbs. The Directive is aimed at preventing unregulated sources. It has also a system of financial assurance for safe disposal of a high-activity source. Bbs Article 4.15 states that the entrepreneur, who holds the source, provides for financial security to cover the costs regarding the safe disposal of a discarded high-activity source in the event:

- Of bankruptcy or otherwise termination of the business activities, or;
- The person with whom an agreement was concluded to retrieve the discarded high-activity source is no longer able to recover it.

Non-nuclear activities
Pursuant to Bbs Article 10.8.1, an entrepreneur (of a category designated by ministerial regulation) must provide for provisions regarding the termination of use and the disposal of the radioactive source, including financial provisions. Pursuant to Bbs Article 3.7.f, a license application is refused if no or an inadequate termination plan as referred to in Article 10.8 is appended to the application. This also applies if the termination plan does not provide sufficient understanding into the financial provisions made for the termination. Based on a draft termination plan and a cost estimate, financial provisions shall be established to justify how an entrepreneur is able to bear the future financial burden to pay for the termination of its activity. Following the graded approach, a cost estimate and provision for the termination of a simple operation can be simplified compared to that for the termination of an extensive (set of) operations and/or activities in complex facilities. If none, or an inadequate, termination plan is submitted, then this is a ground for refusal by the competent authority when an entrepreneur is applying for a license.

Financial provision for maintenance and aftercare of landfills

Producers of NORM-waste who wish to dispose of them at a designated landfill, are required to pay a fee to the Province in which the landfill is located. The purpose of this fee is to cover the costs of operating the landfill and the costs of monitoring the landfill after it has been closed. The Province is responsible for the aftercare and the monitoring of landfills.

22(III) Financial provisions for institutional controls

The national research programme on geological disposal 'OPERA' (2011-1017, see Annex 4) addressed the issue of institutional controls and made proposals on the types of institutional control necessary, taking into account the prolonged retrievability of the waste from the geological disposal facility. In OPERA an underground observation phase of ten years is included to facilitate eventual retrieval of waste packages before closure.

23 Quality assurance at COVRA

This section addresses the following.

JOINT CONVENTION

ARTICLE 23. QUALITY ASSURANCE

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

DIRECTIVE 2011/70/Euratom

ARTICLE 7. LICENSE HOLDERS

4. Member States shall ensure that the national framework require license holders to establish and implement integrated management systems, including quality assurance, which give due priority for overall management of spent fuel and radioactive waste to safety and are regularly verified by the competent regulatory authority.

General

The Ministerial Regulation on nuclear safety (implementation of Directive 2009/71/Euratom), specifies in Article 5 that the license holder must ensure that the management systems of the nuclear installation are drawn up and implemented in such a way that sufficient priority is given to nuclear safety.

Due to the limited size of the nuclear industry in the Netherlands, it was not cost-effective to develop a national programme of quality assurance rules and guidelines. As a result, the Netherlands have relied on IAEA guidance on quality assurance. The currently used guide is the IAEA GSR Part 2 'Leadership and Management for Safety'.

IMS of COVRA

By license requirement, COVRA is obliged to apply and maintain an Integrated Management System (IMS) for safe operation. COVRA implements the Integrated Management System currently using GRS part 2.

The IMS of COVRA is part of the operating license and hence is binding for the license holder. Those parts of the IMS that apply specifically to design and construction of the installations and to the safe operation of the spent fuel and waste management facilities require prior approval from the RB.

The core of the system is the 'IMS Blueprint'. The blueprint describes the structure and the organizational framework of the COVRA Integrated Management System. The Integrated Management System is process-based and is divided in 4 components:
- Policies (Why).
- Processes (How).
- Structures, Systems and Components (With what).
- Organization (Who).

At COVRA, provisions from the industrial standards NEN-ISO 9000 – 9004 have also been implemented.

Acceptance criteria
COVRA is responsible for most of the processing and storage of radioactive waste generated in the Netherlands. This responsibility encompasses a large portion of the radioactive waste management chain, from transport and processing to storage and eventual disposal. Requirements are set for different steps of radioactive waste management and arise from legislation and regulations, the license and the company's own policy. The requirements set by COVRA for radioactive waste within the waste management chain aim to form an integral set. For example, the requirements applied on waste (characterisation, physical/chemical states) define the process route; the waste must be delivered in such a way that it can be transported, processed and stored according to COVRA's buildings capacity and limitations. COVRA's Requirement Management System is under development and will be used for the definition and the implementation of the criteria for all waste streams. It will provide insight into what requirements are set for the waste and packaging for each processing or storage building, and what considerations underlie these. COVRA requirements management system is important, not only for compliance with the requirements to be implemented, but also for the completeness and mutual consistency of (existing and new) required properties. Acceptance criteria will be reviewed to include all phases of the management of the waste, from reception at COVRA to disposal.

The acceptance specifications for vitrified waste were used, among other things, as primary input for design and licensing of HABOG. These specifications include guaranteed parameters for contamination and radiation levels of the vitrified waste, heat load and chemical composition. Before shipment from the reprocessing site to COVRA, all relevant data and product files are provided and checked, compliance with transport regulation is assured, and the canisters are witnessed by COVRA and the NPP operator. Upon arrival at the COVRA site a second check is performed.

24. Operational radiation protection

JOINT CONVENTION

ARTICLE 24. OPERATIONAL RADIATION PROTECTION

1. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:
   (I) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;
   (II) no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection;
   (III) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.

2. Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:
   (I) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and

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

3. Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

24.1(I) Implementation of ALARA

As has been stated before (see Section E, text on Article 19), the basic legislation on activities with ionising radiation, including nuclear activities, in the Netherlands is the Nuclear Energy Act. A number of Governmental Decrees have also been issued, containing more detailed regulations based on the provisions of the Act. The most important decrees for the safety aspects of nuclear facilities and the radiation protection of the workers and the public are:

- The Nuclear Installations, Fissionable Materials and Ores Decree (Bkse).
- The Decree on Basic Safety Standards on Radiation Protection (Bbs).

With regard to nuclear facilities, the purpose of the Nuclear Energy Act, according to its Section 15b, is among others to serve the protection of people, animals, plants and property. If exposure or contamination is unavoidable, the level must be as low as is reasonably achievable (ALARA). Also, the number of people exposed must be limited as much as possible and the license holder must act in accordance with the individual effective dose limits. Bkse Article 31 provides further substantiation for this.

Bbs Article 2.6 states that license holders optimise radiation protection of individual persons who undergo or can undergo occupational exposure or public exposure. Optimisation aims to lower as much as reasonably achievable: the magnitude of the equivalent and effective dose, the chance of exposure and the number of exposed persons, considering state-of-the-art techniques, economical and societal factors. The concept of ALARA is a fundamental principle of the Bbs and applies to all applications of ionising radiation and radioactivity.

For the protection of the public there are additional requirements in the Bbs. Bbs Article 9.6 requires license holders to optimize the protection of members of the public and Bbs Article 9.2 obliges an additional dose constraint of 0.1 mSv/y outside the site perimeter.

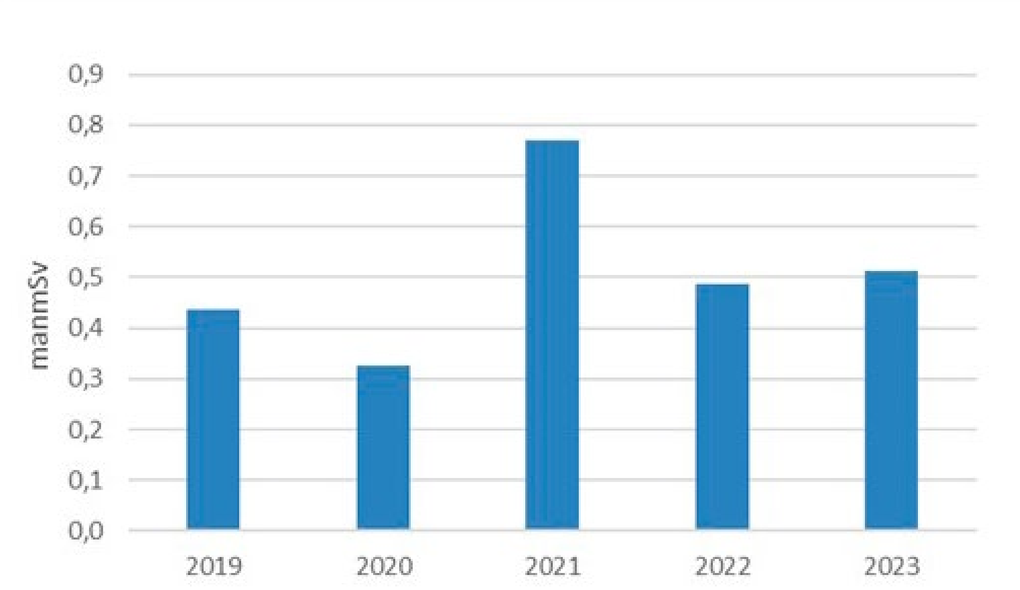
Furthermore, the Bbs states that activities and actions involving ionising radiation must be carried out by or under the responsibility of a radiation protection expert, who shall be registered based on the level of radiation protection education, work experience and (in-service) training. This expert should occupy a post in the organisation such that he or she is able to advise the management of the facility in an adequate way and to intervene directly if he or she considers this to be necessary. Daily work has to be supervised by a radiation protection officer with an adequate level of radiation protection training which includes knowledge on the specific application.

Written procedures must be available to ensure that the radiological protection measures which have to be taken are effective and that the hereinabove mentioned expert is properly informed. Full details of these conditions are given in the Bbs, which includes also more specific requirements on the protection of people and the environment from radiation.

ALARA at COVRA

COVRA continuously applies ALARA in its activities. This starts with the classification of waste in the categories LILW and HLW. This classification is based on the dose rate on contact of the conditioned waste. As a result, radioactive waste with a high dose rate (> 10 mSv/hour on contact of the conditioned waste) is stored in the HABOG. This building is designed in such a way that handling can be done remotely so that no or only a very low dose is incurred during processing and storage. Depending on the dose rate, for LILW extra shielding is applied during transport and buffer storage and, where necessary, remote control of the processes is carried out. This is the case for the immobilisation of liquid waste from the molybdenum production for example. In addition, the presence of people when working with relatively higher radiation waste is kept to a minimum. COVRA has imposed itself a dose constraint of 6 mSv/year per exposed worker (legal limit is 20 mSv/year). With maximum values of 3 mSv/year per individual and an average of 0.5 mSv/year per exposed worker, COVRA manages to keep the received dose as low as reasonably achievable (see figure below).

Figure 8: Average dose (mSv/year) per exposed employee at COVRA



24.1(II) Dose limits

Protection of the public

The source limit for license holders for any activity involving radioactivity or ionising radiation is 0.1 mSv per year. This value is calculated and, if deemed necessary, measured. This source limit is derived from the (effective) dose limit of public exposure (1 mSv per year) by dividing it by ten.

The reason for this is that an individual license holder cannot be held responsible for the exposure caused by other practices or facilities. Therefore, a tenth of the cumulative dose limit of 1 mSv is allocated to every individual license holder as a source limit. This is based on the assumption that, by applying these source limits, it is very unlikely that for an individual member of the public the 1 mSv limit will be exceeded to exposure by all sources together in a single year.

COVRA performs gamma and neutron measurements at specific locations at the perimeter of the site every month. Additionally, COVRA performs continuous gamma measurements (ambient dose equivalent) in order to make unusual events, incidents and accidents visible. The results of the monthly measurements are corrected for background radiation and multiplied by the fixed factor related to the actual use of the adjacent terrain. In 2023, the highest effective dose potentially received at any point close to the site perimeter was 33,8 µSv/y. This is approximately 80% of the limit accorded to COVRA in the operating license. It is common practice in the Netherlands to further limit the source limit for public exposure in nuclear licenses. The limit in COVRA's license is 40 µSv/y.

In addition to the COVRA measurements, the National Institute for Public Health and the Environment (RIVM), on behalf of the ANVS, also performs gamma measurements (ambient dose equivalent) at the perimeter of COVRA. The results of RIVM should match the results of COVRA.

Protection of workers

In conformity with the Euratom Basic Safety Standards, the Bbs stipulates a limit of 20 mSv per year as the maximum individual effective dose for workers. Furthermore, the Bbs stipulates limits to the equivalent dose for the lens of the eye, skin and extremities.

License holders for practices with radioactivity or ionising radiation are required to classify persons as (exposed) workers based on the risk identification and evaluation of all planned work tasks. This is needed for monitoring and supervision purposes. Two categories are defined in the Bbs:

1. Category A workers are likely to receive doses greater than three-tenths of the dose limits for radiation workers, but (obviously) less than the dose limits.
2. Category B workers are likely to be exposed during their work to radiation greater than the dose limit for non-radiation workers (1 mSv per year), but less than the constraints for category A workers.

The Bbs requires that the employer performs registration of dosimetry. Workers who can undergo an annual dose of 1 mSv or more must wear personal dosimetry systems. Only approved dosimetry services are allowed to provide dosimeters, to assess the received dose and to manage the dose records of exposed individuals.

Dose summaries of all dosimetry services are made available to the National Dose Registration and Information System (NDRIS). NDRIS has been established in 1989 by the Ministry of Social Affairs and Employment and has as main objective to retain dosimetric data for the period required by the Euratom Basic Safety Standards as well as to bring together all data from all registered radiation workers, including those of outside workers from abroad whose data are typically identified through the radiation passport.

According to the Euratom Basic Safety Standards, Dutch legislation requires a license holder who hires an outside worker to respect the annual dose limits. If necessary, the license holder and the employer of the external worker cooperate to ensure that the system of individual radiological monitoring affords outside workers equivalent protection to that for exposed workers employed by the license holder.

There are no special ALARA review programmes for workers expected to exceed the 6 mSv dose constraint. In practice, the number of workers with a dose higher than 6 mSv (in one calendar year) is very low, less than 1% of category A and B workers. Furthermore, some license holders have the policy not to hire workers with more than 10 mSv (in one calendar year) in their radiological passport.

The ANVS is responsible for surveillance of the radiation protection of workers at license holders.

Management of NDRIS

NDRIS is designed to process the collected data, to make statistical analyses of the recorded doses and to present various cross-sections for management purposes. It enables employers to collate information on occupational doses and to optimize operational radiation protection.

NDRIS is managed by NRG. In the beginning only data from individuals employed at institutes which had subscribed to the dosimetric services of NRG, were collected, and gradually also data from the other approved dosimetric services were included. In 1994 and 2002 respectively, NDRIS was extended with data from external workers and with data from aircraft crew. NDRIS generates statistical data with the following features:

- Personal data.
- Social security number.
- Dosimetric data.
- Branch of industry (e.g., hospitals, nuclear industry).
- Job category (e.g., veterinary X-ray diagnostics, radioactive waste treatment).

Radiation protection at COVRA

COVRA has taken measures to ensure that radiation doses for the exposed workers remain well under the dose limit. The design of the installations and the work procedures are aimed to maintain a dose constraint of 6 mSv for the individual dose. In 2023 the highest individual dose recorded for the 94 radiological workers (60 COVRA and 34 external) was 1.25 mSv. The collective dose for these persons was about 15 person-mSv in the same year. The last four years show a slight decline in the collective dose for radiological workers.

To comply with the set targets, the outside area (within facility perimeter), the buildings and the working spaces are divided in three coloured-marked zones according to the scheme in the table below. The white zone comprises the non-controlled area. For purposes of radiation protection there are no access restrictions. Under normal circumstances there is no contamination with radioactivity in this zone. If contamination does occur, it is due to an incident and consequently temporary in nature. In this case access restrictions apply until the contamination has been removed and the area has been cleared by the Radiation Protection Department. Radiation levels can be higher in the neighbourhood of vehicles carrying radioactive cargo. The green and red zones constitute respectively the supervised and controlled areas. These zones are located exclusively within buildings and are only accessible by authorization of the Radiation Protection Department. In the green zone the length of stay for radiation workers is unlimited. The working procedures for the other zones are included in written instructions.

Table 7: Operational zones used to control individual exposures

Zone	Dosimeter mandatory	Radiation level (mSv/h)	And/or	Contamination level (Bq/cm2)
White	No	< 0.0025	and	α ≤ 0.04 and β,γ ≤ 0.4
Green	Yes	≤ 0.025	and	α ≤ 0.4 and β,γ ≤ 4
Red	Yes	> 0.025	and/or	α > 4 and/or β,γ > 40

24.1(III) *Measures to prevent unplanned and uncontrolled releases of radioactive materials into the environment*

The buildings and installations of COVRA are designed to retain their integrity or at least to limit the consequences should an unplanned event occur. For the purpose of a consequence analysis, events have been divided into four different categories:

- *Category 1. Standard operation.*
- *Category 2. Incidents.*
  This category describes events, having an irregular frequency of occurrence (in the order of up to once a year) such as failure of the electrical supply for a short period.
- *Category 3. Accidents.*
  In this category all accidents are included which could occur during the operational life of the facility, such as a fire in the installations, a drop of a package with radioactive contents, or failure of the electrical supply during substantial periods. The frequency of occurrence falls in the range of 10-1 to 10-2 per annum.
- *Category 4. Extreme accidents.*
  These are accidents which, without mitigating measures, could have an impact on the environment. Some of these events have been taken into consideration in the design of the buildings and of the installations. The frequency of occurrence falls in the range of 10-2 to 10-6 per annum.
  External events from category 4 which have been considered in the consequence analysis are the following:
  - Flooding of the buildings;
  - Earthquakes;
  - Hurricanes;
  - Gas cloud explosions;
  - Release of toxic and/or corrosive substances;

- Crashing aircraft (military aircraft);
- External fire.

The HABOG has been designed to withstand all of the events mentioned above.

The consequences of the design base accidents of category 4 for the HABOG have also been assessed for the treatment and storage buildings for LILW and have been found to be acceptable: for each accident scenario the risk was lower than 10-8 per year. In addition to that, the cumulative risk was found to be lower than 10-8 per year. Internal fires in the treatment facility for LILW constitute the accident scenario with relatively the highest risk.

Accidents of lower frequency of occurrence such as a crash of an aircraft with higher speed and greater mass than the one used in the design base accident have also been considered. However, it was concluded that the risk is so low that modification of the design was not justified.

24.2 Radioactive discharges

Discharges from COVRA

Both atmospheric and liquid discharges of radionuclides are restricted by requirements in the operating license of COVRA. In the table below the annual discharge limits for different categories of radionuclides are represented. For the derivation of the authorized discharge limits, the annual dose limits for the population are the determining factors. In the second place, a source limit of one tenth of the annual dose limit will be applied to a single facility. In the third place, the operator is required to make a proposal for the discharge limits by applying ALARA, using both specific design options and optimised operational procedures, to the satisfaction of the RB.

The actual emissions of radionuclides are generally a fraction of the limits specified in the license[36], as demonstrated in the diagram in the figures below. Tritium is released during the conditioning of radioactive waste in the AVG and the emitted amount depends on the amount of tritium in the waste supplied in a specific year. During the processing of a batch of escape route signs that are illuminated based on the effect of tritium gas, in 2021 an amount of tritium was released that exceeded the licensed limit of 1 TBq. This tritium was removed via the ventilation system, so no exposure of staff members occurred. Analysis of the emissions has shown that approximately 3.5 TBq has been emitted. Tritium is converted into water (vapour) in the air. This water vapor then distributes itself in the air. This has had no radiological effects outside COVRA, which has been confirmed by calculations by independent external experts. As a result, COVRA has taken various additional measures to prevent such an event in the future, because although there are no consequences for people or the environment, this is of course not desirable.

Table 8: Authorized discharges at COVRA

Category	Annual discharges Air borne[37]	Liquid
Alpha	1 MBq	80 MBq
Beta/gamma	50 GBq	200 GBq
Tritium/C-14	1 TBq	2 TBq

[36] In total, discharges may not exceed 1.5 times the above annual limits for three consecutive calendar years. For the sake of caution, COVRA uses only half of the mentioned values in the figures as the limit per year.

[37] These are the emissions to air from the AVG; there are also emissions from the HABOG but these are very small compared to the AVG emissions.

Figure 9: Emissions of radionuclides to the air from the AVG as a percentage of the annual limit (source COVRA)

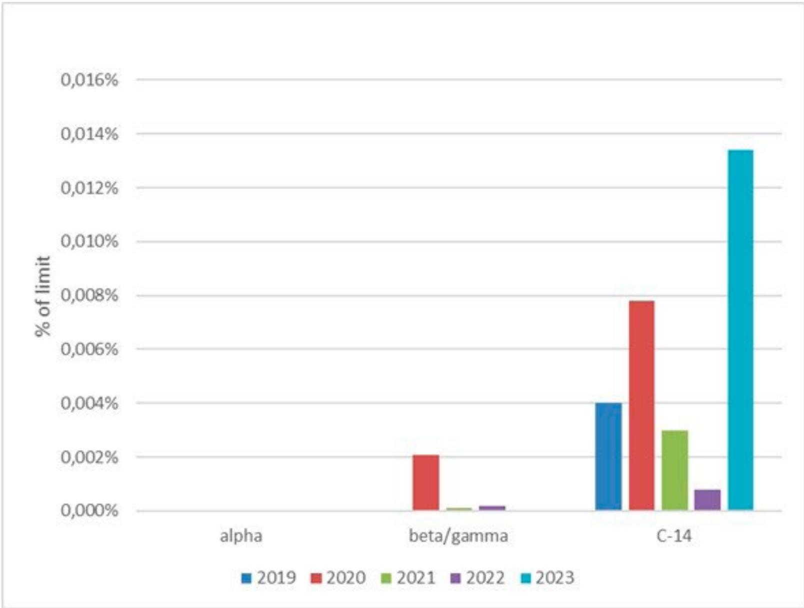
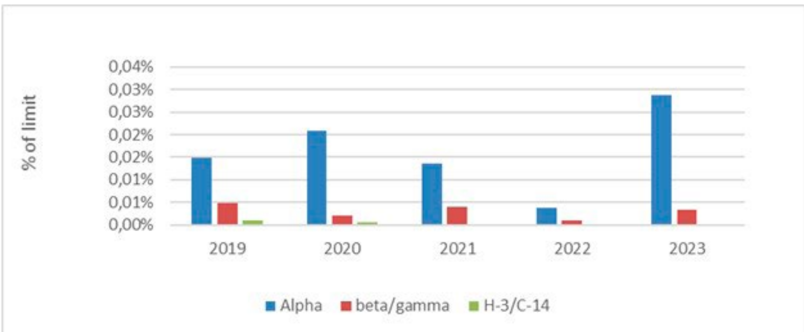


Figure 10: Emissions of radionuclides to water as a percentage of the annual limit (source COVRA)



24.3 Unplanned or uncontrolled releases

On-site emergency response plans of a nuclear facility (which includes COVRA) describe the actions that should be taken during an accident. These plans include the establishment of zones for fire-fighting purposes and radiological criteria for releasing an off-site alarm. The on-site emergency plan forms the first barrier to prevent or to limit accidental emissions of radionuclides into the environment.

For each regulated nuclear facility off-site emergency provisions also apply, with their scope depending on the risks these facilities pose to the population and the environment. These provisions aim to mitigate the consequences of the release. This is described in more detail in the text on Article 25.

25. Emergency preparedness

JOINT CONVENTION

ARTICLE 25. EMERGENCY PREPAREDNESS

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

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

25.1 Emergency plans

The Nuclear Energy Act sets the framework for nuclear safety management. It allocates the regulatory bodies responsibilities for preparedness and response for a nuclear and radiological emergency. In 2017, the transposition of the amended European Nuclear Safety Directive resulted in a new Nuclear Safety Regulation for Nuclear Facilities. In its Article 14, it lists requirements to provisions in the event of accidents. This regulation also refers to the Bbs. The Safety Region Act details the responsibilities for emergency situations in general.

The Bbs requires that license holder make arrangements in preparing for interventions in case of a radiological emergency on-site. The license holder has to prepare an emergency plan for each location, which has to be practiced frequently. This general requirement is applicable for nuclear installations and sources. Based on a graded approach approximately 100 license holders with licenses for the use of Category 1, 2 and 3 sources[38] have to have a specific emergency plan for radiological emergencies. The elements that must be addressed in these emergency plans are mentioned in Annex 6 of the Bbs. This annex is a one-on-one implementation of annex XI of the European Basic Safety Standard.

25.1.a On-site emergency provisions

The licenses for operation of spent fuel and radioactive waste management facilities stipulate that an on-site emergency plan should be established and maintained. In the following, the situation of the facilities of COVRA is used as an example.

The on-site emergency plan includes a specific emergency organisation with adequate staff, instructions and resources.

The emergency plan has three principal goals:
- To ensure that the operating organisation of the facility is prepared for any on-site emergency situation.
- To mitigate as much as possible the effects on the operating personnel of the facility and on the environment in the vicinity of the plant.
- To advise the relevant government bodies as effectively as possible on emergency actions that should be carried out.

Specific procedures have been developed and adopted to prevent emergency situations and mitigate their consequences should they occur. With respect to the operation of the plant in abnormal situations, two types of emergency procedures exist: procedures for abnormal situations (incidents); and procedures

[38] IAEA Safety Guide No. RS-G-1.9.

for emergency situations, i.e., the symptom-based emergency procedures or ‘function-restoration procedures’ that are applicable to design basis and beyond-design basis accidents.

COVRA has implemented on-site procedures for abnormal events as required by the operating license. The procedures include the establishment of maximum radiation levels at the border of the facility. If these levels are exceeded, the RB must be notified.

25.1.b Off-site emergency provisions

Threat categories
A distinction is made between facilities where accidents could potentially have a national impact (category A-objects) and facilities where this is unlikely and consequences are assumed to be restricted to the immediate surroundings of the facility (category B-objects). Facilities classified in category A typically include nuclear reactors. The COVRA facility is classified as a category B-object.

National nuclear emergency response plan
Chapter VI of the Nuclear Energy Act describes the organisation and co-ordination of response to accidents with nuclear facilities by national and local authorities. It also sets out the competences and the dependencies of the authorities that are responsible for nuclear emergency management (preparation and response).

Under Article 40 of the Nuclear Energy Act, the national government is responsible for the preparatory work and for actually dealing with any emergency that may occur in case of nuclear reactor accidents. The operational structure of nuclear emergency preparation and response is based on Article 41 of this Act and is detailed in the National Emergency Radiation Plan (in Dutch: Landelijk Crisisplan Straling, LCP-S). This plan describes the measures and mandates that are available to the national authorities during a nuclear or radiological accident or emergency. It refers to other related documents that address the management of nuclear and radiological accidents.

The LCP-S describes, among other things, the types of nuclear and radiological accidents and the response processes.

For accidents with category A-objects, the national authorities are responsible for decision-making, the regional authorities are responsible for the implementation of the countermeasures (such as evacuation, sheltering). The Safety Region has to be involved in preparing the emergency planning (this is a license requirement).

For accidents with category B-objects, the chairperson of the Safety Region or the mayor of the municipality, depending on the scope of the accident, is responsible for the emergency response. With this type of accident, local authorities can on request be advised by the national nuclear assessment team (in Dutch: Crisis Expert Team – straling en nucleair). An accident with a B-object can also be scaled up as an accident with an A-object. The national authority will then be responsible for decision-making.

Local organisation for off-site emergency preparedness and response
Under Article 41 of the Nuclear Energy Act, the local authorities have a role to play in making contingency plans for emergencies. The mayors of municipalities likely to be affected by accidents involving nuclear power plants located either within their boundaries or in their vicinity (including those across national borders) have drawn up emergency contingency plans in consultation with representatives of central government. These plans encompass all measures that need to be taken at both local and regional levels. Exercises are also held at regular intervals.

These measures will particularly apply to the potentially most dangerous step in the nuclear fuel cycle, i.e., nuclear power generation. The effects of accidents at waste management facilities or at waste management departments of other nuclear facilities are likely to be limited. For example, the safety assessments of the different treatment and storage buildings for radioactive waste at COVRA have demonstrated that even the most severe accident considered would not give rise to high risks outside the perimeter of the facility. Furthermore, the waste management departments of the NPP Borssele and those of the research reactors are not the most vulnerable part of these facilities.

Emergency exercises
Integrated exercises (i.e., involving both the plant staff and the authorities) have proved a useful way of improving the effectiveness of the license holders emergency plan and organisation and the emergency organisation of the authorities.

National full-scale exercises have been held in 2005, 2011 and 2018. In the 2018 exercise, the scenario was an emergency situation focussed on the spent fuel basin at the NPP Borssele. The next full-scale exercise will be held in 2024.

Dose criteria and measures
In 2018, a reference level for emergency exposure situations was introduced as an implementation of the European Basic Safety Standards. The reference level for the public was set to 100 mSv as an acute dose or annual dose. For purposes of emergency planning and response, the intervention levels and measures of the table below are observed.

The intervention measures and levels have been established following discussions with national experts in the relevant fields. International expertise and guidelines were also taken into account. There are also derived intervention levels for foodstuffs, based on the appropriate EU regulations.

Table 9: Intervention levels and measures

Measures	Time a)	E (mSv) b)	H_{th} (mSv) c)	H_{rbm} (mSv) d)	H_{lung} (mSv) e)	H_{skin} (mSv) f)
Taking shelter	7 days	10				
Iodine prophylaxis children <18 years and pregnant women	7 days		50 g)			
Iodine prophylaxis adults ≤40 years	7 days		250 g)			
Immediate evacuation h)	48 hours	1000	5000	1000	4000	3000
Evacuation i)	7 days	100				
Skin decontamination	24 hours					50 j)
Skin decontamination with medical check	24 hours					500 j)
Temporary relocation k)	1 year	100 l)				
Relocation	1 year	20 m)				

a) Time is the period immediately following the start of discharge during which a potential dose is calculated;
b) Effective dose.
c) Thyroid gland dose.
d) Red bone marrow dose.
e) Lung dose.
f) Skin dose.
g) Excluding ingestion.
h) Immediate evacuation: evacuation, even during the passage of the plume, to prevent deterministic effects.
i) Evacuation to prevent stochastic effects. Preferably before or otherwise shortly after the passage of the plume.
j) Decontamination above 50 mSv skin dose. Above 500 mSv skin dose, also medical checks following decontamination.

k) Evacuation well after the discharge, if the external radiation by deposited material results in a considerable dose rate.
l) Dose in one year; including the dose following the passage of the cloud.
m) Period following return, 20 mSv per year (each year).

25.2 Cross-border aspects

The policy regarding planning zones has been evaluated, taking notice of the emergency planning policies in neighbouring countries. In case of an emergency in a neighbouring country, the Netherlands will initially follow the protective actions of the country where the accident took place. In case of an emergency in the Netherlands, we will base our protective actions on the policy of intervention levels. In order to do so, the planning zones have been matched with that of the neighbouring countries.

26 Decommissioning

JOINT CONVENTION

ARTICLE 26. DECOMMISSIONING

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

(I) qualified staff and adequate financial resources are available;

(II) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;

(III) the provisions of Article 25 with respect to emergency preparedness are applied;

(IV) and records of information important to decommissioning are kept.

See Section E, 19.4 for information on the regulation on decommissioning.

The table below shows which nuclear facilities in the Netherlands are in operation and which have permanently been shut down or are awaiting decommissioning.

Table 10: Status of nuclear facilities

Name of facility	Type	Power	Status	Date of closure
Borssele	NPP	515 MW_e	Operational	2033
Dodewaard	NPP	60 MW_e	Safe enclosure till 2045	1997
High Flux Reactor (HFR), Petten	Research reactor	45 MW_{th}	Operational	2035[39]
NRG labs, Petten	Hot cell laboratories, decontamination & waste treatment facility	N.a.	Operational	N.a.
Hoger Onderwijs Reactor (HOR), Delft	Research reactor	2 MW_{th}	Operational	N.a.
Urenco	Uranium enrichment	N.a.	Operational	N.a.
COVRA	Waste treatment and storage facility	N.a.	Operational	N.a.

[39] Pending on the start of operation of the Pallas reactor

Dodewaard NPP
The Dodewaard NPP has been granted a special status, it is the only nuclear installation in the Netherlands for which deferred decommissioning has been allowed. In May 2002 a license was granted to GKN, the operator of the Dodewaard NPP, to bring and keep the plant in a state of safe enclosure for a maximum of 40 years. As the plant reached a state of safe enclosure in 2005, a license was granted to keep it in safe enclosure until 2045 at the latest. One of the requirements in the license for safe enclosure is to keep a record system of the inventory of all radioactive materials and components, which have become contaminated or activated during operation, and to update it every five years. Another requirement in the license is that the license holder shall commence dismantling after 40 years.

Borssele NPP
The nuclear power station in Borssele is scheduled to end operations at the end of 2033. Based on the legislation, the first phase of decommissioning should start immediately after shutdown in 2034. At this moment, the possibility to postpone the scheduled end of operation is being reviewed.

Other nuclear facilities
For the other nuclear facilities, there are no concrete dates for shutdown and start of the decommissioning.

26(I) Qualified staff and financial resources for decommissioning

Qualified staff to ensure the safety of decommissioning of a nuclear facility
The Nuclear Safety Regulation for nuclear installations states that the licensee of a nuclear facility must have adequate financial resources and personnel to guarantee nuclear safety of the facilities. This requirement applies to all phases of operation of a nuclear facility, including decommissioning.

The Bbs also applies to nuclear facilities in all phases of operation, setting several requirements for radiation protection, including qualified staff.

Financial resources for decommissioning of a nuclear facility
See Section E, 19.2.a ‘The Bkse and decommissioning’ for information on the financial resources for decommissioning of a nuclear facility.

26(II) Operational radiation protection

Emissions Dodewaard NPP
The provisions with respect to radiation protection as set out in Article 24 of the Joint Convention apply generically to the decommissioning of nuclear facilities. In the specific case of the Dodewaard NPP, liquid emissions of radioactive material are not permitted, while airborne[40] emissions of radioactivity will (per year) be restricted.

Table 11: Release limits of the NPP Dodewaard (in safe enclosure)

Aerosols	1 GBq
Tritium as HTO	2 TBq
Carbon-14	50 GBq

In practice, releases of aerosols and tritium (see table above) are less than 1% of their limits. In January 2011, a license change removed the obligation to measure the release of carbon-14, since there is no new carbon-14 created. The actual releases of carbon-14 had been less than 1% of their limit in the previous years.

[40] No liquid discharges are allowed during the safe enclosure period.

Radioactive waste management Dodewaard NPP
COVRA is responsible for the treatment and interim storage of all kinds of radioactive waste. This comprises also the waste associated with the dismantling of a nuclear facility.

According to the Dodewaard license, any radioactive waste arising during the period of safe enclosure will be kept in a dedicated and controlled area and managed according to applicable safety standards. Waste quantities will be recorded and the records will be kept at least during the full safe enclosure period. Regularly, but at least within two years after packaging, this waste will be transferred to COVRA.

26(III) Emergency preparedness
The provisions set out in Section F, Article 25 apply generically.

26(IV) Record keeping
Record keeping is an important issue during a safe enclosure period of 40 years. The Dodewaard Inventory System (DIS) contains all known radiological data and other information provided by employees familiar with the operation of the reactor. Information stored in the DIS encompasses information on contaminated or activated parts and hot spots in the plant as well as technical information on the plant and its components.

In the preparatory phase to the safe enclosure the license holder of the NPP Dodewaard completed the establishment of the DIS. The objective of the DIS is to describe in detail all relevant radiological data in the controlled zone of the NPP in a database. This database is designed both for present decommissioning activities leading to the safe enclosure, as well as for future dismantling operations. Since the dismantling activities will take place after 40 years, much attention will be given to keep the information in a form that ensures its accessibility by the systems in use at that time.

Relevant records are kept at the plant itself and at the Gelders Archief, an archive controlled by the provincial administration.

The Dodewaard record keeping system, of which the DIS is an important part, appeared as a good practice in an IAEA document of Long-Term Preservation of Information for Decommissioning Projects (Technical Report Series, nr. 467, August 2008).

In the case of the Borssele NPP, preservation of knowledge is more straightforward, as the NPP will be dismantled directly after shut-down. This is also true for the RRs.

Furthermore, legislation requires that the operator keeps records and documentation during operation.

Section G Safety of Spent Fuel Management

4 General safety requirements

This section addresses the following.

JOINT CONVENTION

ARTICLE 4. GENERAL SAFETY REQUIREMENTS
Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management, individuals, society and the environment are adequately protected against radiological hazards.
In so doing, each Contracting Party shall take the appropriate steps to:

(I) ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed;

(II) ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted;

(III) take into account interdependencies among the different steps in spent fuel management;

(IV) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(V) take into account the biological, chemical and other hazards that may be associated with spent fuel management;

(VI) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(VII) aim to avoid imposing undue burdens on future generations.

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ARTICLE 4. GENERAL PRINCIPLES

3. National policies shall be based on all of the following principles:
   (a) the generation of radioactive waste shall be kept to the minimum which is reasonably practicable, both in terms of activity and volume, by means of appropriate design measures and of operating and decommissioning practices, including the recycling and reuse of materials;
   (b) the interdependencies between all steps in spent fuel and radioactive waste generation and management shall be taken into account;

4(I) Criticality and removal of residual heat during radioactive waste and spent fuel management

Management of spent fuel originating from Dutch reactors before transportation to COVRA occurs at several different locations (in the Netherlands and abroad):

a. At the site of the nuclear power reactor in Borssele.
b. At the sites of the research reactors in Petten and Delft.
c. At the site of COVRA in Nieuwdorp.
d. At the sites of the reprocessing plant in la Hague, France.

Ad a) The Netherlands has a (485 MWe net power) pressurized water reactor in Borssele, which is in operation. The design of the NPPs spent fuel pool complies with the provisions in Dutch safety guide NVR NS-G-1.4, which is an adaptation of IAEA Safety Guide Safety Standard Series No. NS-G-1.4, 'Design of Fuel Handling and Storage Systems in NPPs'. The design ensures the removal of residual heat from the spent fuel, while the design of the fuel storage racks in combination with a minimum of boric acid concentration in the pool water ensures non-criticality.

Ad b) The design of the fuel pools of the HFR at the Research Location Petten and the HOR of the Reactor Institute Delft comply with applicable IAEA Safety Standards. The design of the fuel pool ensures the removal of residual heat from the spent fuel, while the design of the fuel storage racks ensures prevention of criticality.

Ad c) The HABOG is designed to store spent fuel from the research reactors, vitrified waste and other (non-heat or heat-generating) high-level waste from reprocessing, research activities or molybdenum production. In November 2003 the first spent fuel of the HFR reactor was stored, followed in 2004 by vitrified waste from reprocessing in France and by spent fuel elements from the HOR. Storage of spent fuel, vitrified waste or other high-level waste in the HABOG takes place regularly. The frequency varies per nuclear installation. To be able to further store high-level waste, the HABOG has been extended. For details of the HABOG design see Section G, text on Article 7(I).

Ad d) The spent fuel from Borssele NPP is reprocessed by Orano in La Hague, France. Depending on the reprocessors operating schedule, some quantity of spent fuel is temporarily stored in the reprocessors storage pools pending (the start of) reprocessing. The spent fuel of Borssele NPP is then being managed under the prevailing regulatory systems in France. The vitrified waste and metallic residues from reprocessing activities will in due time be returned to the Netherlands and stored in the HABOG at COVRA. For more information, see Section B, text on Article 32.1(II). The Netherlands bears no responsibility for safe management of the spent fuel in France.

Spent nuclear fuel mentioned under d) is not being managed in the Netherlands and will not be addressed further in this report.

4(II) Minimization of radioactive waste

This subsection also addresses Article 4.3.a of Directive 2011/70/Euratom.

Prevention and justification

Authorization is required for the use of radioactive substances (Nuclear Energy Act Article 29). One of the criteria for obtaining a license or an authorization is that the requested application is justified. Even if the application is justified, the applicant still has the duty to prevent or restrict the generation of radioactive waste materials both in terms of activity and volume (Bbs Article 10.2).

The quantity of radioactive waste can also be minimized by reuse and reprocessing. The license holder is in principle free to choose its measures to achieve this goal.

See Section F, 24.1(I) for more information on ALARA.

Reprocessing
See Section B, 32.1(I) for information on reprocessing.

4(III) Interdependencies in spent fuel and radioactive waste management
This subsection also addresses Article 4.3.b of Directive 2011/70/Euratom.

The current policy in the Netherlands regarding spent fuel management of the NPP is not to use the full capacity of the storage pools for on-site storage of spent fuel. License conditions require regular transports of spent fuel from the NPP to the reprocessing plant to ensure that the spent fuel inventory in the storage pools is kept as low as reasonably achievable.

For the spent fuel of the research reactors the same approach applies. The objective is to limit as far as practicable the amount of spent fuel in the storage pool at the reactor site. Regular transports of spent fuel to the HABOG take place.

The basic steps in spent fuel management are not fundamentally different from those in radioactive waste management. By having one central waste management organisation (COVRA) for the collection, conditioning, storage and disposal of radioactive waste and spent fuel, the interdependencies between the different steps are automatically taken into account.

Reprocessing of waste is not possible in the Netherlands. If France decides not to reprocess spent fuel of other countries, The Netherland will have to consider other solution for the back end of nuclear installations.

4(IV) Protection of individuals, society and the environment

Radiation protection of the public and the environment
Protection of the public and the environment against the effects of abnormal operational conditions, such as accidents, is ensured by special design features of the buildings and installations (see also text on Article 7).

All regulation regarding protection of the public and the environment, reported in the context of safe management of radioactive waste, also applies to the safe management of spent fuel. For details refer to Section F, text on Article 24, and Section E, text on Article 19.

The license holder must report the relevant data on discharges and radiological exposure to the RB. On behalf of the RB, the National Institute for Public Health and the Environment (RIVM) regularly checks the measurements of the quantities and composition of discharges. The license holder is also required to set up and maintain an adequate off-site monitoring programme. This programme normally includes measurements of radiological exposures and possible contamination of grass and milk in the vicinity of the installation. The results are reported to - and regularly checked by - the RB. Under Article 36 of the Euratom treaty, the discharge data must be submitted to the European Commission each year.

Radiation protection of workers
For information on radiation protection of workers, refer to Section F, text on Article 24.1.

4(V) Biological, chemical and other hazards
Transfer of fuel assemblies from the reactor core to the storage pool and, in a later stage, transport from the NPP to the reprocessing plants in certified and accident proof containers are the only activities taking place at the NPP. Hence biological, chemical or other non-radiological hazards are not considered to be a significant issue in spent fuel management.

At the HFR in Petten and the HOR in Delft, fuel assemblies are also transferred directly from the reactor core to the dedicated storage pool. After a cooling time of five years, the assemblies are transported to

COVRA in licensed and accident proof containers. Therefore, biological, chemical or other non-radiological hazards are not considered to be a significant issue in the context of spent fuel management.

Physical protection measures are implemented on the basis of a security plan, which is site-specific, and has to be approved by the regulatory body.

At COVRA, the spent fuel of the research reactors is received in dedicated casks. These casks are designed to prevent hazards. At the HABOG, the spent fuel is repacked in a steel canister, filled with a noble gas (helium) and stored in a noble gas (argon) atmosphere while the special design of the storage vaults provides for shielding and cooling. The inert gas atmosphere prevents chemical oxidation during long-term interim storage. Other hazards, such as flooding, gas cloud explosions, airplane crashes, and terrorist actions, were taken into account in the design of the facility.

4(VI) Impacts on future generations

The IBC-principle applies to the management of radioactive waste (in Dutch: Isoleren, Beheersen, Controleren; isolate, manage and control) and is the main instrument to manage the possible impact on future generations.

A reversible process for decision-making on disposal allows future generations flexibility on decisions taken in the past. See text on Article 32.1(III) on Evidence-based and documented decision-making processes in this Section.

By designing a road map to a disposal facility, the government takes responsibility today in preparing for the future, thus striving to minimize impact on future generations.

Policies on clearance of sites (green field) are also relevant in minimizing impact on future generations.

4(VII) Undue burdens on future generations

The long timeline until the end of institutional control of a disposal facility implies that future generations will be involved in the management of radioactive waste. The government aims at limiting the burden for future generations by starting now with the design of the road map to a disposal facility.

Until the disposal facility is available, the care for these materials will be passed on to the next generation. However, not only the burden of this care will be passed on to the next generation, but also the collected financial resources and constantly updated technical knowledge required setting favourable conditions for the management of the spent fuel. The regular updates of the roadmap to disposal along the way must prevent that future generations would be unprepared for the long-term care of the waste.

5 Existing spent fuel management facilities

JOINT CONVENTION

ARTICLE 5. EXISTING FACILITIES

Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility.

The ministerial decree on nuclear safety of nuclear installations requires continuous improvement of (nuclear) safety and the execution of periodic safety reviews. See Section E, 19.2.d for more information.

6. Siting of proposed waste management facilities

JOINT CONVENTION

ARTICLE 6. SITING OF PROPOSED FACILITIES

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:
   - (I) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;
   - (II) to evaluate the likely safety impact of such a facility on individuals, society and the environment;
   - (III) to make information on the safety of such a facility available to members of the public;
   - (IV) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

The text below is applicable to spent fuel management facilities as well as radioactive waste management facilities (Section H, Article 13).

6.1(I) Evaluation of site-relevant factors

The applicable design measures aimed to cope with the site characteristics, such as proximity to the sea and consequently the risk of flooding, are described in more detail in the section on Article 7.

6.1(II) to (IV) Impact of waste management facility and providing information about it

COVRA is the only organisation with facilities for the long-term interim storage of radioactive waste and spent fuel in the Netherlands. The storage pools at the research and nuclear power reactor sites are not intended for long-term interim storage and are consequently not considered in this report.

The site selection procedure for COVRA in Nieuwdorp featured a two-track approach.

The first track started with the establishment of a commission of high-ranking officials from the public domain. The first step in the procedure was the formulation of selection criteria for the site of the COVRA facility. The selection criteria for candidate sites were mainly based on considerations of adequate infrastructure and the location in an industrialised area. Twelve sites were selected by the commission based on these rather general criteria as being suitable in principle. For the selection of the preferred sites the co-operation of the local authorities was sought.

To facilitate the negotiations with the local authorities, in a second, separate track, a strategic site-independent EIA was performed (see below). As expected, this demonstrated essentially the absence of any adverse effect on the environment. However, this conclusion did not lead to an offer from local administrators. Although there are legal procedures for overruling a refusal by a local or regional authority to accept a potentially suitable storage or disposal site, it was deemed better to follow the consensus model for the allocation of a site.

The assessment of the possible environmental effects from a spent fuel and waste storage facility for a generic site was published in the Environmental Impact Statement (EIS) in 1985. After site selection, the EIS was re-assessed for the specific location in the Sloe area and submitted as part of the license application to the competent authority. The site-specific EIA was performed considering three operational alternatives (the proposed facility, a facility with maximum volume reduction and a facility with a maximum reduction of handling operations). On both the EIS and the license application the public could express their views.

Since spent fuel management facilities can give rise to discharges of radioactive materials and hence could potentially affect other countries, information on plans for new facilities or major modifications of such facilities is provided to the European Commission, which will provide an opinion based on expert judgement.

6.2 Siting in accordance with general safety requirements of Article 4

The protective measures referred to in the section on Article 4(IV) ensure that the effects imposed on human health and the environment in other countries are not more detrimental than those which are deemed acceptable within national borders.

The design features of these facilities, aimed to provide protection against accidents/incidents as mentioned in the section on Article 7, will ensure that also accidents do not cause undue consequences beyond national borders.

7 Design and construction of spent fuel management facilities

JOINT CONVENTION

ARTICLE 7. DESIGN AND CONSTRUCTION OF FACILITIES
Each Contracting Party shall take the appropriate steps to ensure that:

(I) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(II) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;

(III) the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.

7(I) Limitation of possible radiological impacts from the HABOG

Spent fuel from the RRs and reprocessing residues are stored in the HABOG at COVRA. HABOG was commissioned in 2003. A schematic cross-section of the HABOG is presented in the figure below.

Figure 11: Cross-section of the HABOG

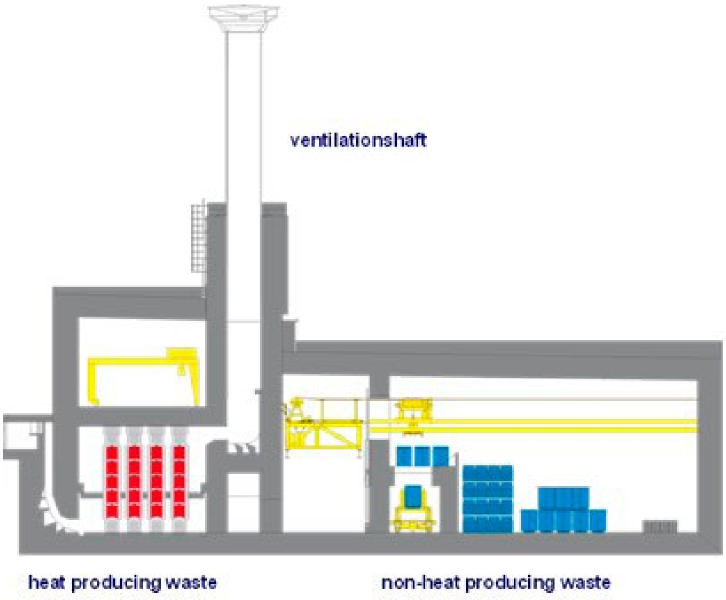
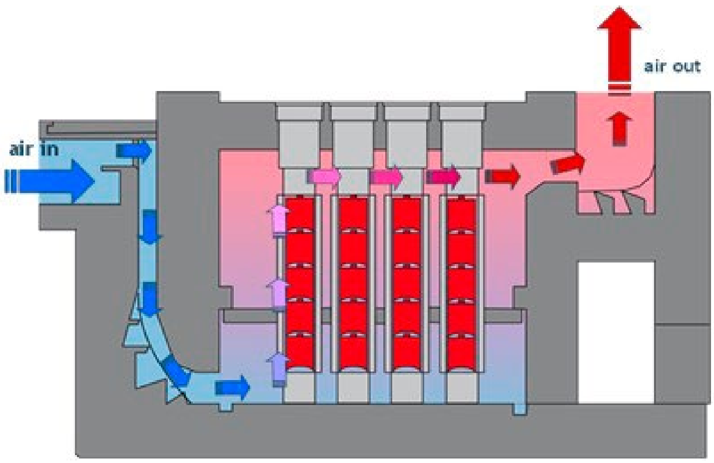


Figure 12: Storage wells for SF and HLW in the HABOG, with passive cooling



The HABOG is a vault-type storage facility divided in two separate compartments. The first compartment is used for the storage of canisters and other packages containing high-level waste that does not need to be cooled (compacted hulls and ends and other high-level radioactive waste). The second one is used for the storage of vitrified HLW from reprocessed spent fuel originating from the NPPs, for spent fuel originating from the research reactors and spent uranium targets from molybdenum production.

Spent fuel and spent uranium targets, and vitrified HLW are stacked on five levels in vertical air-cooled storage wells. The storage wells are filled with an inert gas to prevent corrosion of the canisters and are equipped with a double jacket to allow passage of cooling air. The double jacket ensures that there is never direct contact between spent fuel, spent targets or waste canisters and the cooling air. The cooling system is based on the natural convection concept. A schematic diagram of the storage compartment for spent fuel and vitrified HLW is represented in the figure above.

The leading principles of operational safety in the management of spent fuel (and radioactive waste) are Isolation, Control and Monitoring. For the design of the HABOG the guidelines from ANSI/ANS 57.9-1992 have been applied. Broken down to the abovementioned operational safety measures the following principles should be fulfilled:

- *Isolation*
  Spent fuel (or radioactive waste in general) should be contained in a way that at least two barriers to the release of radioactive material are present. Adequate shielding of the radiation emitted by the waste should be maintained.
- *Control*
  Assurance of a condition of sub-criticality of the spent fuel and targets by application of neutron absorbers and by a suitable geometry of the spent fuel and targets. Assurance of adequate cooling of heat-generating HLW. Possibility to move spent fuel and targets or HLW from the storage wells with a view to repackaging, relocating to another storage compartment or removal from the facility.
- *Monitoring*
  Monitoring the containment of the storage wells, the temperature of the wells, the shielding capacity and the emissions by inspections and/or measurements.

These principles have been implemented in the following ways:

- *Isolation*
  The presence of at least two containment barriers between the spent fuel/HLW and the environment is achieved by passive components, constructions and materials such as the immobilization matrix of the material itself, by the packaging, by the storage wells and by the construction of the building. Adequate shielding is achieved through the presence of 1.7 m thick concrete walls. The HABOG is designed to withstand 15 different design-base accidents in order to prevent consequences for the population or the environment. These design base accidents include for example flooding, fire, explosions in the facility, earthquakes, hurricanes, gas explosions outside the facility, an aircraft crash, and a drop of a package from a crane. The robustness of the construction of the building ensures that none of these accidents, whether arising from an internal cause or initiated by an external event, will result in a significant radiological impact.
- *Control*
  Sub-criticality is maintained by assuring that both under normal operating conditions and under accident conditions the reactivity factor keff will never exceed a value of 0.95.
- Permanent cooling of the canisters with spent fuel, spent targets and high-level radioactive waste is assured by using a passive air convection system. Calculations have demonstrated that the thermal specifications of the spent fuel/HLW will never be exceeded. The HABOG is laid out in such a way that there is always one spare storage compartment for each category of waste available.
- *Monitoring*
  The HABOG has a passive cooling system for spent fuel and HLW based on natural air convection. The cooling air never comes in contact with the radioactive material or any contaminated surfaces but is nevertheless monitored. The HABOG has also a mechanical ventilation system. This system is designed to keep the building (except for the spent fuel and HLW vaults) under pressure (lower pressure inside the building). The air flow through the building is directed from areas with no contamination towards areas with a potentially higher contamination. Both incoming and outgoing air is monitored and filtered.

7(II) Conceptual plans and technical provisions for decommissioning of the HABOG

The HABOG is designed for a storage period of at least 100 years. Following the applicable decommissioning legislation, COVRA has set up a Preliminary Decommissioning Plan (PDP) approved by the authorities. The facility is designed and operated with the objective to prevent contamination of the buildings, which will ease future decommissioning. The spent fuel and waste packages accepted in the building have to be free of (non-fixed) contamination (IAEA Safety Standard SSR-6[41]). The areas in the

[41] IAEA Safety Standards Series, Specific Safety Requirements, No. SSR-6, Regulations for the Safe Transport of Radioactive Material - 2012 Edition.

HABOG which may be contaminated with radioactive material due to handling of spent fuel/HLW are limited. The finishing of all surfaces in places where radioactive material is being handled, is such that any radioactive contamination can be easily removed. Consequently, it is unlikely that major structures and components of the building become permanently contaminated. Keeping the buildings clean is an integral part of the operations, which prevents or limits the build-up and spreading of any contamination. By regularly conducting contamination measurements, any contamination is timely detected and removed. Finally, the consequences of any contamination are limited by compartmentalisation.

7(III) Technologies incorporated in the design and construction of the HABOG

One of the important features in the design of the HABOG is the application of natural convection for the control of the temperature of the spent fuel and HLW canisters. The choice was made in favour of a system of natural convection because of its inherent safety characteristics: cooling is ensured under conditions of loss of electric power and it is insensitive to human errors. It is a reliable passive cooling method, which is common practice these days.

8 Assessment of safety of spent fuel and radioactive waste management facilities

This section addresses the following.

JOINT CONVENTION

ARTICLE 8. ASSESSMENT OF SAFETY OF FACILITIES

Each Contracting Party shall take the appropriate steps to ensure that:

(I) before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(II) before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (I).

DIRECTIVE 2011/70/Euratom

ARTICLE 7. LICENSE HOLDERS

2. Member States shall ensure that the national framework in place require license holders, under the regulatory control of the competent regulatory authority, to regularly assess, verify and continuously improve, as far as is reasonably achievable, the safety of the radioactive waste and spent fuel management facility or activity in a systematic and verifiable manner. This shall be achieved through an appropriate safety assessment, other arguments and evidence.

3. As part of the licensing of a facility or activity the safety demonstration shall cover the development and operation of an activity and the development, operation and decommissioning of a facility or closure of a disposal facility as well as the post closure phase of a disposal facility. The extent of the safety demonstration shall be commensurate with the complexity of the operation and the magnitude of the hazards associated with the radioactive waste and spent fuel, and the facility or activity. The licensing process shall contribute to safety in the facility or activity during normal operating conditions, anticipated operational occurrences and design basis accidents. It shall provide the required assurance of safety in the facility or activity. Measures shall be in place to prevent accidents and mitigate the consequences of accidents, including verification of physical barriers and the license holder's administrative protection procedures that would have to fail before workers and the general public would be significantly affected by ionising radiation. That approach shall identify and reduce uncertainties.

The text below is applicable to COVRA as central organisation for spent fuel and radioactive waste management facility.

8(I) Safety assessment of COVRA

In Section E of this report, the national regulations for the safe management of spent fuel and radioactive waste are already explained including the related licensing system and appropriate control and enforcement by government.

A license for a spent fuel and/or radioactive waste management facility is only granted if the applicant complies with the national requirements and, more in general, with international (IAEA) established safety goals, codes and guides, as well as with the international state of the art. The applicable parts of the IAEA Safety Standards (Safety Fundamentals, Safety Requirements and Safety Guides) must be covered or incorporated in the Safety Report, which is submitted to the RB. A typical example is compliance with the requirements addressing the site-specific external hazards, such as military aircraft crashes, external flooding, seismic events and gas cloud explosions.

The license holder drafts and submits to the RB the Safety Analysis Report (SAR) and supporting topical reports. In these reports detailed descriptions of the facility are presented as well as an in-depth analysis of the way in which the facility meets the requirements and the international state of the art.

After construction and commissioning of the spent fuel and/or radioactive waste management facility the license holder submits the updated SAR with a description of the as-built facility and the results of the commissioning to the RB for approval before start of the routine operation. Since full compliance is expected with the Safety Report, no formal update of the safety assessment or environmental assessment is foreseen and there will be no need for revision of the Safety Report, which is the basis of the license. However, all the results of the commissioning programme are incorporated in a full update of the detailed SAR.

As IAEA regulations are rather abstract and hence lack technical detail, the licensing basis for the HABOG was based on the French state of the art for spent fuel/HLW storage. As an independent assessment tool for the SAR the USA standard ANSI/ANS 57-9-1992 was incorporated. The SAR was submitted to the RB for approval. Selected items or documents in the SAR are studied more in-depth, often using assessment by independent organizations.

COVRA undergoes very extensive safety evaluations on a five-yearly and ten-yearly cycle. The nuclear power plant in Borssele undergoes very extensive safety evaluations every ten years as well, and more limited evaluations every two years, in which the applicable basis for the license is assessed.

8(II) Updated assessments before operation

In the Environmental Impact Assessment Decree, which is based on the EU Council Directive 97/11/EC on assessment of the effects of certain public and private projects on the environment, spent fuel and radioactive waste management facilities are designated as activities which are subject to the Decree. An Environmental Impact Statement (EIS, where the impact was calculated based on the authorized emissions) is always mandatory in the cases indicated in the table below.

Table 12: Spent fuel and radioactive waste management facilities for which an EIA is required

Activities	Cases	Decisions
The creation of an establishment: a. for the treatment of irradiated nuclear fuel or high-level radioactive waste, b. for the disposal of irradiated nuclear fuel c. solely for the disposal of radioactive waste, or d. solely for the storage of irradiated nuclear fuels or radioactive waste from another establishment	In relation to the activity described at d, in cases where the activity relates to the storage of waste for a period of 10 years or longer.	The decisions to which part 3.5 of the General Administrative Law Act and part 13.2 of the Act apply.

The facilities at COVRA meet the descriptions under the entries a and d and an EIA had to be conducted. The first EIS for COVRA was published in 1985 (also refer to Section 6.1). The most recent EIA was carried out in 2022 during the licensing procedure of the multifunctional storage building (licensed in June 2023).

Both the EIS of 1985 and the subsequent EIS of 1995, 2013 and 2022 predicted that the envisaged activities of the COVRA facility would not cause any detrimental effect on the population and the environment.

The actual impact to the environment is lower than assumed in the EIS, because all emissions of radioactive materials and chemical hazardous materials – both airborne and waterborne – remain far below the limits authorized in the operating license. The successive annual reports of COVRA on releases and radiation levels at the perimeter of the facility show that this favourable situation is continuing.

In addition to the update of the EIS in 2022, the Safety Report was updated as well in 2022.

Demonstration of the safety of a facility or activity during the entire lifecycle
This subsection addresses Article 7.3 of Directive 2011/70/Euratom and is not applicable for the Joint Convention.

The Nuclear Energy Act (Article 15b) specifies that a license is needed for the construction, operation and dismantling of nuclear installations – in other words, at the start of each phase in the entire lifecycle. License applications include extensive safety evaluations and the accompanying documentation. In these safety analyses, attention is focused on organisational and technical arrangements that are aimed at preventing accidents and mitigating the consequences of accidents.

For nuclear power plants and research reactors, additional regulations apply for the establishment of a dismantling plan and financial security (for dismantling).

The ministerial decree on nuclear safety of nuclear installations requires continuous improvement of (nuclear) safety and the execution of periodic safety reviews. In line with this, the license holder of the spent fuel and radioactive waste management facility (COVRA) carries out periodic safety reviews as required by the license.

Section E, 19.2 of this report explains the applicable system of licensing and appropriate control and enforcement by the government.

Safety assessments of future facilities
This subsection addresses Article 7.3 of Directive 2011/70/Euratom and is not applicable for the Joint Convention.

A geological disposal facility is envisaged in 2130. Safety assessments will be included in the roadmap to the disposal facility in due time.

9 Operation of facilities

JOINT CONVENTION

ARTICLE 9. OPERATION OF FACILITIES
Each Contracting Party shall take the appropriate steps to ensure that:

(I) the license to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(II) operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article 8, are defined and revised as necessary;

(III) operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures;

(IV) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility;

(V) incidents significant to safety are reported in a timely manner by the holder of the license to the regulatory body;

(VI) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

(VII) decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.

The text on Article 9 is also applicable for Article 16 in Section H.

9(I) License to operate
After the commissioning of the HABOG, COVRA submitted the report with the description of the as built facility and the results of the commissioning to the RB for approval. This document demonstrated full compliance with the license and the associated Safety Report. During the first operational phase, when the storage building received the first batches of spent fuel and HLW, the RB closely followed the safety of the installation by inspections and assessment of the license holders periodic operation reports.

A license condition stipulates that the safety of COVRA shall be periodically reviewed in the light of operating experience and new insights. A review of operational aspects shall be performed once every five years, whilst a more fundamental review shall be conducted once every ten years. The latter may involve a review of the facility's design basis in the light of new developments in research, safety culture or risk acceptance.

According to Article 15, sub b of the Nuclear Energy Act, licenses are required for building, taking into operation and operating a nuclear installation. Necessary conditions to grant a license, are a favourable outcome of the review by the RB of the safety assessment of the facility and a favourable outcome of the EIA.

A safety assessment for the operation of a spent fuel management facility is made by the operator of the facility as part of the application for a license to operate the facility or to modify the facility. The technical specifications and the assumptions underlying the postulated accident scenarios are laid down in a Safety Analysis Report. It is the responsibility of the operator to demonstrate to the RB that the situation as built is in accordance with the technical specifications and that the safety requirements can be met.

9(II) Operational limits and conditions

The license conditions for the operator, which are attached to and form a constituent part of the operating license, specify the obligations that the operator has to meet. Some of these license conditions form the basis for the establishment of operational limits that ensure that under foreseeable circumstances the authorized limits, as set by the license, will not be exceeded. Examples of operational safety limits are conventional safety measures like the availability of emergency power supply, noise limits, and standard crane operational requirements. Other license conditions demand that periodic reviews be carried out with the aim to assess whether the assumptions, which form the basis of the safety assessment of the facility, are still valid. The results of these periodic reviews are submitted to the RB for further evaluation. When deemed necessary a revision of the operational limits will be undertaken.

9(III) Operation, maintenance, monitoring, inspection and testing

The development of a management system for maintenance of safety-related installations and components is required by the license conditions for the operator as specified in the operating license. COVRA has such a management system in place.

Examples of related license conditions included in the IMS:

- Establishment of internal instructions for the proper operation and maintenance of installations, systems and components.
- Demonstration of a condition of sub-criticality in all systems and installations under all foreseeable circumstances.
- Demonstration of compliance with the thermal limits set for the heat-generating waste.
- Record keeping of all authorized discharges of radioactive materials to the environment.
- Provision for a five-year evaluation of all safety-related procedures with the aim to determine whether the criteria under which the license was awarded are still applicable.

9(IV) Engineering and technical support

During the active period of COVRA, waste will be accepted and actively stored in the facility. The HABOG will enter what is called its passive phase, when no waste will be moved into the HABOG anymore. During that phase, maintenance and control will continue. In 2130 a geological disposal facility should be operational.

The provisions needed for maintenance during this passive period (as well as for the disposal) has been paid in advance by the waste producer and was calculated as discounted value. The money is transferred to a capital growth fund, managed by COVRA.

COVRA has a comprehensive ageing management programme, giving attention to aspects of ageing important for nuclear safety. This programme includes in-service-inspection, (preventive) maintenance, monitoring of compliance with acceptance criteria and documenting and learning from operating experience. See Section A.8.3 for more information on ageing management by COVRA.

9(V) Reporting of incidents significant to safety
According to the license conditions the operator is required to report events that have an impact on the safe operation of the facility to the RB. The operator is also required to make arrangements for responding adequately to incidents and accidents. The RB has approved this arrangement.

9(VI) Programmes to collect and analyse relevant operating experience
The conditions attached to the operating license stipulate that both operating experience from the license holder organisation and information obtained from other organisations involved in the management of spent fuel and/or radioactive waste is collected and analysed. This requirement applies both to normal operating experience (continual improvement process) and to incidents or accidents. International operational experience feedback is notably obtained by the RB from the IAEA-OECD/NEA FINAS database. The Netherlands is an active participant in FINAS Technical Meetings and workshops.

9(VII) Decommissioning plans
Following the applicable decommissioning legislation, COVRA has a Preliminary Decommissioning Plan (PDP) approved by the authorities in 2012. The latest revision, also approved by the ANVS, dates from 2022. The next scheduled, mandatory update is in 2027.

10 Disposal of Spent Fuel

JOINT CONVENTION

ARTICLE 10. DISPOSAL OF SPENT FUEL
If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste.

The spent fuel that originates from the research reactors will be stored in the HABOG at COVRA. Geological disposal is foreseen around 2130.

Section H Safety of Radioactive Waste Management

11 General safety requirements

JOINT CONVENTION

ARTICLE 11. GENERAL SAFETY REQUIREMENTS
Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.
In so doing, each Contracting Party shall take the appropriate steps to:

(I) ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed;

(II) ensure that the generation of radioactive waste is kept to the minimum practicable;

(III) take into account interdependencies among the different steps in radioactive waste management;

(IV) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(V) take into account the biological, chemical and other hazards that may be associated with radioactive waste management;

(VI) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(VII) aim to avoid imposing undue burdens on future generations.

See Section G, text on Article 4.

12 Existing facilities and past practices

JOINT CONVENTION

ARTICLE 12. EXISTING FACILITIES AND PAST PRACTICES
Each Contracting Party shall in due course take the appropriate steps to review:

(I) the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;

(II) the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.

12(I) Safety of radioactive waste management facilities

COVRA

For information on COVRA, see Section B, text on Article 32.1(IV).

COVRA is obliged to perform periodic safety reviews. Refer to Section G, text on Article 5 for more information.

WSF

For information on the WSF, see the section on Article 12(II) below.

12(II) Past practices

The radioactive waste storage facility was originally located at the Research Location Petten. The Waste Storage Facility (WSF) was originally intended as a storage facility until the geological disposal facility became available. Policy for radioactive waste changed with the establishment of the Central Organization for Radioactive Waste (COVRA) in 1982 and the policy statement on radioactive waste of 1984: all radioactive waste generated in the Netherlands must be collected, processed and stored by COVRA. As a result, all waste stored in the WSF had to be transferred to COVRA as soon as COVRA was able to receive it. The waste from the WSF could not simply be sent to COVRA. The transport to and the processing and storage at COVRA set requirements in terms of characterization and packaging that the WSF waste did not meet.

In the 1990s, about 1,500 drums of low- and intermediate-level radioactive waste were transported to COVRA after was proven that these drums met the requirements of COVRA. This was only a part of the legacy waste in the WSF. In 2016, NRG still had about 1,600 drums of legacy waste and about 100 drums with fissile material containing waste in the WSF. Transport and storage of the remaining barrels was technically complex, resulting in a sharp increase in costs and a halt in the transfer of waste to COVRA. The complexity was due to the requirements for characterization and packaging which are determined by the chosen waste processing route, but a waste processing route can only be chosen based on characterization of the waste. A solution for the remaining part of the legacy waste had to lie in an integrated chain approach: close cooperation between NRG and COVRA such that knowledge about the waste is combined with knowledge about possible disposal routes.

In 2018, the Dutch administration carried out an investigation on the effectiveness and efficiency of these plans and concluded that the chain of waste management from NRG to COVRA should be optimized and that the project planning and budget was not realistic. A mediator was appointed by the government to boost the cooperation between NRG and COVRA and to seek for chain optimization. Furthermore, the government provided extra budget as a loan to NRG to cover the increased costs of the legacy waste project. The cooperation between COVRA and NRG intensified between 2018-2020. At the Research Location Petten the sorting and repackaging of the waste has been prioritized. This has resulted in a better integrated, more detailed project planning and a steadier transfer of waste from Petten to COVRA.

Based on a four-step procedure, action plans were drawn up for the characterisation, separation and packaging of the various types of waste. A distinction was made between low-level radioactive waste (LLW) and two categories of intermediate-level radioactive waste (ILW-L and ILW-H) based on dose rate. A second distinction was made between alpha emitter and fissile material containing waste and non-alpha emitter containing waste.

Currently all non-alpha emitter containing WSF drums have been sorted and repackaged. The LLW-fraction that is formed in the process has been transferred to COVRA, this is about 70 percent of the waste from these drums. The ILW-fractions of this waste are packaged and stored in the WSF to await transfer to COVRA.

The plans for the transfer to COVRA are worked out in detail. For this, COVRA obtained a license to build a new building (multifunctional storage building). Furthermore, an installation was built at the NRG site to transfer inserts with ILW-waste from ILW-drums into transport containers. The new building at the COVRA site is meant to be operational approximately in 2025 and will also be used for future decommissioning waste. The project is in the construction phase.

Next to the legacy waste drums there are other waste streams at NRG that did not yet have a waste management route to COVRA. These streams, together with the legacy waste drums from the WSF, are part of the Radioactive Waste management programme of NRG which aims at developing a waste management route for all the waste streams. Every few years the plan that describes in which way NRG plans to do this, is revised and sent for approval to the ANVS. This plan contains a brief description of the routes, technological developments, financial plans and timetables. In the most recent plan, approved by the regulatory body in 2022, it is planned by NRG that all legacy waste from the WSF in Petten will have been removed by January 2027. NRG has to submit an updated plan for approval before 1 July 2025.

One of the waste streams consisted of resins and all stored resins have been transferred to COVRA before the end of 2020. The transfer of the resins to COVRA has become a normal, operational route. This route can also be used by other nuclear facilities.

For the alpha emitter containing WSF drums, the process for sorting and repackaging is in place and the necessary changes to current installations and building of new equipment and installations is in process, the repackaging starts in the first quarter of 2024. Part of the unirradiated fissile materials was transported in November 2023, for other unirradiated fissile materials (with higher enrichment) the process is still in development. Low-level caesium filters have been transported to COVRA and the intermediate level filters will follow the same route as the ILW drums. For sodium, beryllium and irradiated fissionable material the process is still in development.

The current process for opening a waste management route to COVRA is that NRG develops a starting document, which contains information about the type of waste and describes how NRG is going to characterize the waste. If COVRA agrees with this plan a new route is created.

The programme to transfer legacy waste to COVRA should be completed at the end of 2026.

13 Siting of proposed facilities

JOINT CONVENTION

ARTICLE 13. SITING OF PROPOSED FACILITIES

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:
   (I) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;
   (II) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;
   (III) to make information on the safety of such a facility available to members of the public;

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

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

See Section G, text on Article 6.

14 Design and construction of radioactive waste management facilities

JOINT CONVENTION

ARTICLE 14. DESIGN AND CONSTRUCTION OF FACILITIES
Each Contracting Party shall take the appropriate steps to ensure that:

(I) the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(II) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;

(III) at the design stage, technical provisions for the closure of a disposal facility are prepared;

(IV) the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

14(I) Limitation of possible radiological impacts

A description of the COVRA building and installations for the handling and storage of spent fuel and HLW is given in Section G, text on Article 7.

A description of the COVRA facilities for the processing and storage of LILW is given below.

Normal operation

Processing of LILW takes place in the waste processing building (in Dutch: afvalverwerkingsgebouw, AVG). Drums of waste collected from license holders from all over the country are sorted with respect to type and/or processing method to be applied. The following categories are distinguished:

- *Vials containing scintillation liquid.*
  Due to aging of both the shredder and the incinerator, vials are stored awaiting a future processing option. Earlier the vials were crushed, the liquid collected and, if possible, separated in an organic and an inorganic part. The organic liquid was burned in an incinerator, the aqueous liquid was treated and the resulting radioactive residues were solidified and conditioned. The solid components are super compacted and immobilised in concrete.
- *Liquid waste.*
  Organic liquid waste: Due to aging of the incinerator, the organic liquids are currently stored awaiting a future processing option. Organic liquid waste represents a very small waste streams delivered to COVRA.

- Inorganic liquid waste: Inorganic liquid waste is firstly biologically treated (if needed) after which physicochemical treatments take place, this results in two waste streams: slabs that are dried out and further treated as solid waste and liquid waste that can be released via the water network of COVRA.

Unless their composition is exactly known, liquids are considered as mixtures of organic and inorganic components. Further treatment takes place in the water treatment system where the dissolved radioactive material is separated by chemical precipitation or by electrochemistry as far as possible. Usually, the radioactivity concentrates in the deposit and can be separated by filtration. The purified aqueous liquid is then almost free of contamination and can be discharged within the authorized limits. The radioactive residue is dried and compacted in the same way as other solid waste. Organic constituents of the wastewater can also be removed through biological route. Liquids that cannot be treated in the water treatment system are incinerated.

- *Animal carcasses.*
  Due to aging of the incinerator, carcasses (a very sporadic waste stream, only 11 carcasses are now stored at COVRA) are frozen-stored awaiting for a future option.
  Earlier, carcasses of laboratory animals, which are contaminated with radioactivity, were burned in a dedicated incinerator. The ashes were collected, super compacted and immobilised in concrete. Due to aging the incinerator is not in operation anymore.
- *Compactable solid waste.*
  Most of the volume of radioactive waste collected by COVRA is compactable solid waste. Its volume is reduced by compacting the waste container with a 1500 tonnes super compactor. The compacted containers are transferred to larger containers and immobilised with concrete. The conditioned waste is transferred to the storage building.
- *Sources and other waste.*
  Used sealed radioactive sources that cannot be returned to the supplier are mixed with cement and stored in containers. Other radioactive waste consisting of large sized components is first pre-compressed or shredded or cut to fit the compacting drums. Again, conditioning for long-term interim storage is done with cement grout and concrete.

The buildings for the storage of conditioned LILW (LOG) are robust concrete buildings with floors capable of carrying the heavy load of containers stacked in nine layers. The moisture content in the air of the LOG is controlled to prevent condensation and thus corrosion of the metal surfaces of the stored containers.

In the COG building 20-ft containers with large volumes of NORM-waste from the phosphor producing plant are stored. The building is constructed of lightweight materials considering the relatively low radiation levels of the waste. Still, air humidity is controlled to prevent corrosion.

In the buildings VOG and VOG-2, depleted uranium from the uranium enrichment plant in the form of uranium oxide (U3O8) is stored in containers of circa 3 m3. A concrete structure is needed to obtain the required shielding. Air humidity control is standard here as well.
For more information on these buildings see Annex 1.

Accidents and incidents
The buildings for treatment and storage of LILW are designed to withstand small mishaps during normal operation and internal accidents such as fire and drops of a radioactive waste container during handling (see also Section F, text on Article 24.1.(III)). The waste processing building AVG is also designed to withstand the forces of a hurricane.

These buildings are not designed to provide protection against more severe accidents such as:
- Flooding of the buildings.
- Earthquakes.
- Gas cloud explosions.
- Release of toxic and/or corrosive substances.
- Crashing aircraft (military aircraft).
- External fire.

However, an analysis of the consequences of beyond design accidents has demonstrated that not only the probability of occurrence but also the potential radiological impact is limited.

14(II) Conceptual plans and provisions for decommissioning

See Section G, text on Article 9(VII).

14(III) Technical provisions for the closure of disposal facilities

At this moment, there are no specific regulatory requirements supporting the development of planned deep geological repository in the Netherlands, which is intended to be operational in 2130. This led to the following recommendation during the IRRS-mission in 2023: R20 The Government should establish regulatory requirements well before a deep geological repository is established. In addition to that, during the ARTEMIS-mission in 2023 the following suggestion was made: S7 The Government should consider ensuring that all the disposal costs, including siting and post-closure phase, are incorporated in the disposal cost estimate.

For several decades, retrievability has been included as a precondition in the policy for the management of radioactive waste in a disposal facility. This means that the possibility for retrieving waste (packages) must be included in the design of a facility, such that the retrievability of the waste (via the existing shaft) must be possible during the operation of the disposal facility. Research in the past has shown that it is possible to create a retrievable geological disposal facility in clay and salt, for a period of one hundred through to several hundreds of years. Following this period, the radioactive waste can still be retrieved via a new shaft. The costs, however, are many times higher. The period of retrievability offers future generations the possibility of retrieving waste from the disposal facility if new techniques for waste processing or waste management become available. The reversible structuring of the process for (definitive) disposal will also relieve future generations from the burden of decisions taken in the past.

The main reasons for introducing the concept of retrievability were derived from considerations of sustainable development. Waste is considered a non-sustainable commodity and its arising should be prevented or limited. If prevention is not possible, the reuse and/or recycling of this waste is the preferred option. By disposing of the waste in a retrievable way, its eventual management will be passed on to future generations which will thus be enabled to make new decisions. This could include the application of more sustainable management options if such technologies become available. The emplacement of the waste in the deep underground would ensure a fail-safe situation in case of negligence or social disruption.

Retrievability of the waste allows future generations to make their own choices but is dependent on the technical ability and preparedness of the society to keep the facility accessible during a long period for inspection and monitoring. It also entails a greater risk of exposure to radiation and requires a long-term organisational effort involving maintenance, data management, monitoring and supervision. In particular in the case of geological disposal, retrievability will make the construction and operation more complex and implies additional costs.

There might be some conflict between the requirement of retrievability and the requirement to prepare technical provisions for closing a disposal facility. While retrievability demands accessibility of the waste in a geological disposal facility for a prolonged period – until adequate assurance has been obtained that there are no adverse effects associated with geological disposal, or that no more advanced processing methods for the waste have become available – safety requires that the geological disposal facility is closed as soon as all the waste is emplaced, in order to create an effective barrier from the biosphere.
In practice, the feasibility of keeping a geological disposal facility accessible for retrieval purposes is restricted to a maximum of a couple of hundred years, depending on the type of host rock[42].
While borehole convergence due to plastic deformation of the host rock is rather limited for granite,

[42] Retrievable disposal of radioactive waste in the Netherlands, Final report of CORA study, Ministry of Economic Affairs, 2001 (https://www.covra.nl/app/uploads/2019/08/CORA-eindrapport.pdf).

repositories in salt and clay, without any supportive measures of the galleries, tend to close around the emplaced waste. In safety studies this plastic behaviour of salt and clay has been advocated as a safety asset because of an enhancement of the containment function of the geological disposal facility and a facilitation of the heat dissipation to the rock formation. Consequently, the retrieval period should be limited to a realistic length of time. In consultation with society, it will be important to assess the concept of retrievability. Under all circumstances, radioactive waste must be retrievable during the operational phase of the disposal facility through to its closure. In the Netherlands only salt and clay are available as possible host rock for a geological disposal facility.

14(IV) Technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

For the HABOG, see Section G, text on Article 7(III). As regards the buildings for the treatment and storage of LILW much experience has been acquired by comparable waste management activities at the previous location in Petten.

15 Assessment of safety of radioactive waste management facilities

JOINT CONVENTION

ARTICLE 15. ASSESSMENT OF SAFETY OF FACILITIES
Each Contracting Party shall take the appropriate steps to ensure that:

(I) before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;
(II) in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;
(III) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (I).

See Section G, text on Article 8.

16 Operation of radioactive waste management facilities

JOINT CONVENTION

ARTICLE 16. OPERATION OF FACILITIES
Each Contracting Party shall take the appropriate steps to ensure that:

(I) the license to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;
(II) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;
(III) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;
(IV) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;

(V) procedures for characterization and segregation of radioactive waste are applied;
(VI) incidents significant to safety are reported in a timely manner by the holder of the license to the regulatory body;
(VII) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;
(VIII) de commissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;
(IX) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

16(I) License to operate
See Section G, text on Article 9(I).

16(II) Operational limits and conditions
See Section G, text on Article 9(II).

16 (III) Operation, maintenance, monitoring, inspection and testing
See Section G, text on Article 9(III).

16(IV) Engineering and technical support
See Section G, text on Article 9(IV).

16(V) Characterization and segregation of radioactive waste
For LILW, the waste producer provides a completed and signed application form on which the radionuclide content and properties of the waste delivered to COVRA is specified. The form is checked and co-signed by COVRA before any waste is accepted.

During treatment and conditioning, the different categories of LILW (see Section B, Table 3) are kept separate.

16(VI) Reporting of incidents significant to safety
See Section G, text on Article 9(V).

16(VII) Programmes to collect and analyse relevant operating experience
See Section G, text on Article 9(VI).

16(VIII) Decommissioning plans
See Section G, text on Article 9(VII).

16(IX) Plans for the closure of a disposal facility
There are no concrete plans at this moment for the closure of a disposal facility and how they are prepared and updated. Geological disposal is foreseen around 2130. The decision-making in that matter is expected around 2100. See Section H, text on Article 14(III) for more information.

17 Institutional measures after closure of a disposal facility

JOINT CONVENTION

ARTICLE 17. INSTITUTIONAL MEASURES AFTER CLOSURE
Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

(I) records of the location, design and inventory of that facility required by the regulatory body are preserved;

(II) active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and

(III) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

Institutional measures for the post-closure phase of the geological disposal facility will be included in the roadmap in due time.

Section I Transboundary Movement

This section addresses the following.

JOINT CONVENTION

ARTICLE 27. TRANSBOUNDARY MOVEMENT

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

   In so doing:
   - (I) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;
   - (II) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;
   - (III) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;
   - (IV) a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (III) are met prior to transboundary movement;
   - (V) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

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

3. Nothing in this Convention prejudices or affects:
   - (I) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;
   - (II) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;
   - (III) the right of a Contracting Party to export its spent fuel for reprocessing;
   - (IV) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

DIRECTIVE 2011/70/Euratom

ARTICLE 4. GENERAL PRINCIPLES

4. Radioactive waste shall be disposed of in the Member State in which it was generated, unless at the time of shipment an agreement, taking into account the criteria established by the Commission in accordance with Article 16(2) of Directive 2006/117/Euratom, has entered into force between the Member State concerned and another Member State or a third country to use

a disposal facility in one of them. Prior to a shipment to a third country, the exporting Member State shall inform the Commission of the content of any such agreement and take reasonable measures to be assured that:

(a) the country of destination has concluded an agreement with the Community covering spent fuel and radioactive waste management or is a party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management ('the Joint Convention');

(b) the country of destination has radioactive waste management and disposal programmes with objectives representing a high level of safety equivalent to those established by this Directive; and

(c) the disposal facility in the country of destination is authorised for the radioactive waste to be shipped, is operating prior to the shipment, and is managed in accordance with the requirements set down in the radioactive waste management and disposal programme of that country of destination.

The national policy on the management of radioactive waste is designed for waste produced in the Netherlands. The storage capacity at COVRA has been dimensioned for the expected volume of Dutch radioactive waste. There is currently no import or export of foreign radioactive waste in The Netherlands.

The Netherlands, as a member state of the European Union, has implemented Council Directive 2006/117/Euratom[43] in its national legislation[44]. This Directive sets out similar requirements as the ones specified in Article 27.1(I)-(V) of the Joint Convention.

Under these regulations, exports of radioactive waste require a license to be issued by the ANVS. License applications for a transboundary shipment of radioactive waste should be made to the ANVS using the standard document laid down in Directive 2006/117/Euratom. Imports into the Netherlands of radioactive waste require approval from the ANVS by request from the Competent Authority of the exporting country.

For the sake of completeness, a license is also required prior to transport, import, export, be in possession of or dispose of fissionable materials and ores. This is specified in Section 15, sub a of the Nuclear Energy Act. The licensing requirements apply to each specific practice mentioned here. Under Article 29 of the same Act, a license is required for certain practices involving certain radioactive materials other than fissionable materials and ores. In addition to that, for transports on Dutch territory, depending on the material, a transport license or transport notification is required based on the Nuclear Energy Act. The transport shall be in compliance with the international transport regulations covering aspects such as transport safety, radiation protection, package design approval certificates and physical protection measures.

Shipments of spent fuel are also subject to the provisions of Directive 2006/117/Euratom and need an import and export license.

Article 27.2 derives from the Antarctic treaty to which the Netherlands is a Contracting Party. This requirement is also incorporated in Article 39 paragraph b of the Decree on the import, export and transit of radioactive waste and spent fuel.

Concerning Article 27.3 of the Joint Convention, the Netherlands has implemented the international agreements on the transport of radioactive materials for the different modes of transport as released by ICAO (air transport), IMO (sea transport), ADR (road transport), RID (rail transport) and ADNR (transport

[43] Directive 2006/117/Euratom of the Council of the European Communities of 20 November 2006 on the supervision and control of shipments of radioactive waste between Member States and into and out of the Community.
[44] Decree on the import, export and transit of radioactive waste and spent fuel, Bulletin of Acts and Decrees, 2009, 168.

over inland waterways). The provisions in these agreements[45],[46],[47],[48],[49] are not affected by the Joint Convention. The implementation of the modal regulations into the national regulatory framework can be found, for instance, in the VLG (road transport)[50], VSG (rail transport)[51] and VBG (transport over inland waterways)[52].

[45] International Civil Aviation Organisation (ICAO), Technical Instructions.
[46] International Maritime Organisation (IMO), International Maritime Dangerous Goods Code.
[47] Accord Européen relatif au Transport de Marchandises Dangereuses (RID).
[48] Règlement International concernant le Transport des Marchandises Dangereuses par Chemins de Fer.
[49] Règlement pour le Transport des Matières Dangereuses sur le Rhin (ADNR).
[50] Regeling vervoer over land van gevaarlijke stoffen (VLG).
[51] Regeling vervoer over het spoor van gevaarlijke stoffen (VSG).
[52] Regeling vervoer over de binnenwateren van gevaarlijke stoffen (VBG).

Section J Disused Sealed Sources

ARTICLE 28. DISUSED SEALED SOURCES

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

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

28.1 Regulation

A license is required for all import, manufacturing, storage, use, export and disposal of radioactive sources with a radioactivity content in excess of the clearance limits, as specified in Annex I of the Euratom Basic Safety Standards[53] and implemented in the Fissile materials, Ores and Radioactive materials Transport Decree, the Bbs and subordinate regulation. A license will only be granted if a qualified expert is available who is knowledgeable with respect to the hazards of ionizing radiation. Persons are considered qualified to use a radioactive source if they have completed a radiation protection course at a level in accordance with the hazard of the source and successfully passed an exam. Transport of disused sealed sources usually does not require a license but is subject to notification to the ANVS.

Directive 2013/59/Euratom[54] aims to further restrict exposure of the population to ionizing radiation from high activity sealed sources (HASS), including orphan sources. This Directive requires that the possession and use of each high activity sealed source is licensed, that it is uniquely identified with a number embossed or stamped on the source, and that countries keep a registry of all license holders and sources. It further provides for financial arrangements to ensure that the costs for management of disused sources are covered by the license holder. In cases where no owner can be identified, the State will cover the costs. The provisions of this Directive are fully implemented in the Bbs and subordinate regulation. After Council Directive 2013/59/Euratom was implemented (February 2018), the transport of HASS is subject to licensing.

In Articles 22 and 33 of the Nuclear Energy Act, a mechanism is put in place in which recovered orphan sources (e.g., lost sources) should be notified to the mayor of the municipality or the city where the sources are found. Subsequently, one of the competent inspection services is alerted, which is authorized to impound such source and have it transferred to one of three appointed institutes. These institutes are equipped to store the source. However, most orphan sources are found during routine radiation monitoring of scrap material with portal monitors at scrap yards. Operators working with large volumes of scrap or highly active sources have statutory obligations for securing the management of these radioactive sources.

[53] Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of health of workers and the general public against the dangers of ionizing radiation, Official Journal of the European Communities, 1996, 39 (L159) 1-114.

[54] Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for the protection against the dangers arising from exposure to ionising radiation and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom). In the new Directive related provisions of the four above mentioned directives have been updated and incorporated. This implies that the current Basic Safety Standards Directive from 1996 (96/29/Euratom) and the four above mentioned directives are repealed with effect from 6 February 2018.

The competent authorities, the ANVS, the Inspectorate for Social Affairs and Employment and the State Supervision of Mines assess the compliance with legislation and regulations regarding sealed sources. Their scope covers safety and security aspects.

28.2 Registration, monitoring and detection of sources

ANVS maintains a database of the licenses of holders of all sources of ionizing radiation. New information received through records is added to this database. Furthermore, the information received through the records is used for the national source register containing all HASS. Besides the information registered on the record of the source (e.g., data of the license holder, identification and features of the source) the national inventory contains a reference to the IAEA source category and the specific use of the source.

Since 2002, large metal recycling companies are obliged to detect all incoming loads of scrap metal on enhanced radiation levels with portal detectors.[55] The purpose is to monitor all scrap at least one time in the Netherlands. This should prevent that an orphan source reaches a foundry and is melted. To avoid this, the melters have portal detectors as well.

There are generally speaking no radiation monitors at points of entry at the borders of the Netherlands to detect orphan sources. However, since 2005 in total 40 portal monitors have been installed at container terminals in the Rotterdam harbour. These monitors were installed on the basis of a Mutual Declaration of Principles between the Netherlands and the United States of America to monitor containers for the purpose of detecting and interdicting illicit trafficking of nuclear and other radioactive material.

28.3 Waste management of disused sources

With respect to disused sources, the regulation and policy give priority to the reuse of the source. When this is not possible, the preferred alternative is to return the disused source to the manufacturer or supplier. Classifying the disused source as radioactive waste, by transferring it to COVRA, is considered to be the less preferred alternative. The license holder is allowed to store radioactive waste onto its premises for the period of 2 years after cessation of the use.

Sources, as any other radioactive waste, are destined for storage at COVRA and eventually disposal in a geological disposal facility in due time. Regular inspections by the official inspection services ensure that individual sources can be tracked during their whole useful life by following the chain of records.

Council Directive 2006/117/Euratom[56] on transboundary shipments of radioactive waste facilitates return of spent sealed sources to the manufacturer or supplier by excluding such shipments from the scope of application of the Directive. However, such shipments of sources are regulated by Council Regulation (Euratom) 1493/93 of 8 June 1993 on shipments of radioactive substances between Member States.

[55] Decree on the detection of scrap material contaminated with radioactivity, Bulletin of Acts and Decrees 2002, 407.

[56] Directive 2006/117/Euratom of the Council of the European Communities of 20 November 2006 on the supervision and control of shipments of radioactive waste between Member States and into and out of the Community.

Section K General Efforts to Improve Safety

K.1 Knowledge management

The process towards the realisation of a geological disposal facility stretches over several generations. In that process, it is essential that the knowledge of radioactive waste management is assured at all responsible parties in the process. This is a multifaceted issue.

The following points must be considered:

- *Knowledge of the properties of the waste.*
  During the period of interim storage, COVRA is responsible for the administration of and assuring the knowledge relating to the waste stored at the location. This is not only important for the future when the waste is transferred to the disposal facility but is also an important aspect of safe day-to-day operations. Based on the properties of the waste (e.g., the type and history of the stored materials, the chemical structure, the activity and nuclide composition and the amount of radiation being emitted by the waste, but also about the conditioning and packaging methods), it is possible for future generations to make a sound choice on the future management method for the various types of waste.
- *Technical and socioeconomic knowledge.*
  Technical substantive knowledge in respect of radioactive waste management is acquired through research, on both a national and international scale. In addition to international cooperation, research programs on the safe disposal of radioactive waste have already been running for decades in the Netherlands.
- *(Transfer of) Knowledge.*
  Maintenance of knowledge of the properties of the waste and the disposal facility is necessary to inform future generations of what will be located in geological disposal facilities, where and why. In (international) research programmes into disposal, much attention is focused on how this information can continue to be transferred for the very long-term. Because the decision has been taken in the Netherlands to store radioactive waste on the surface till 2130, this also allows time to learn from experiences abroad.

K.2 Maintenance of competence

This subsection also addresses Article 8 of Directive 2011/70/Euratom.

DIRECTIVE 2011/70/Euratom

ARTICLE 8. EXPERTISE AND SKILLS
Member States shall ensure that the national framework require all parties to make arrangements for education and training for their staff, as well as research and development activities to cover the needs of the national programme for spent fuel and radioactive waste management in order to obtain, maintain and to further develop necessary expertise and skills.

Maintenance of competence at COVRA
See text on Article 22(I) in Section F for information about COVRA's Personnel Qualification Plan.

Since the radioactive waste policy is based on the concept of long-term interim storage, it is a challenge to maintain nuclear competence at COVRA for a period of at least 100 years. As COVRA is the only organisation in the Netherlands licensed to manage and store radioactive waste and spent fuel, it will need a sufficient number of qualified staff for the foreseen long-term interim storage period. Additional expertise can, if needed, be hired from support organisations in the Netherlands and abroad.

The processing of radioactive waste requires specialist knowledge. Knowledge that is required to take into account the requirements of activities that will be made far into the future during collection and processing. The preservation of information on the stored waste and its history is ensured by technical means: all data are preserved in a double archive, using both digital as well as conventional paper data storage. A distinction is made between the short-term archives (<15 years) and the long-term archives (>15 years). For the long-term archive additional measures are taken. The digital information is stored in two different buildings and a procedure exists to update this information at regular intervals. Paper information carriers are printed on certified durable paper and ink and stored in a conditioned room.

There has been a lot of international developments in the field of geological disposal and much progress is expected due to the expected development of the first disposal facilities for high-level radioactive waste in the coming years. COVRA has attracted new staff to be able to maintain its knowledge on disposal at a sufficient level and started a long-term research programme on geological disposal in 2020 based on international cooperation.

Maintenance of competence at the ANVS
To fulfil its tasks, the ANVS requires qualified and experienced staff. Recently, the number of staff increased. Not all knowledge and competences are always available within the ANVS, but ANVS has contracts with TSOs and research institutes to have access to specialized experts.

All staff receives dedicated training. The ANVS Academy was developed for this purpose and the system of personal education plans is being renewed, as explained in Section A and Section E, 20.1.g.

In the advice of the Advisory Board of the ANVS on the role of the ANVS concerning disposal (2019), the Advisory Board stated that ANVS should have the knowledge and expertise to (among others) perform safety evaluations of a disposal facility and recommends strengthening the associated necessary knowledge.

Maintenance of competence at the Ministry
An interdepartmental working group has been created at the end of 2023. The ANVS, COVRA, the Ministry of IandWM and the Ministry of Climate and Energy participate in the working group. The working group is working on a long-term knowledge management policy for nuclear affairs, which includes knowledge of waste management. The programme should cover all issues related to the nuclear industry, from the building of facilities to closing the disposal facility.

K.3 Suggestions and Challenges identified at the previous Review Meeting

For information on the measures taken to address suggestions and challenges identified at the previous Review Meeting, see Section A.

K.4 Self-assessments and peer review missions

This subsection also addresses Article 14.3 of Directive 2011/70/Euratom.

DIRECTIVE 2011/70/Euratom

ARTICLE 14. REPORTING
3. Member States shall periodically, and at least every 10 years, arrange for self assessments of their national framework, competent regulatory authority, national programme and its implementation,

and invite international peer review of their national framework, competent regulatory authority and/or national programme with the aim of ensuring that high safety standards are achieved in the safe management of spent fuel and radioactive waste. The outcomes of any peer review shall be reported to the Commission and the other Member States, and may be made available to the public where there is no conflict with security and proprietary information.

The Netherlands hosted various international missions at its nuclear facilities. Refer to the latest national report for the Convention on Nuclear Safety for more details.

Results of international peer review missions are made available to the public. The mission reports have been published and were sent to the European Commission and Member States.

The Netherlands strives to implement the recommendations and suggestions from the missions to further improve nuclear safety and radiation protection. Follow-up missions will be requested in due time.

Experts of the Ministry, the ANVS and COVRA participate and contribute to the various IAEA activities and missions in other countries.

This report is limited to the missions that have taken place since the previous review meeting of the Joint Convention.

IRRS and ARTEMIS 2023
The Netherlands hosted IRRS and ARTEMIS back-to-back missions in 2023.

IRRS 2023
The IRRS team concluded[57] that the Government of the Netherlands and the national regulatory bodies have demonstrated their commitment to continuous improvement in nuclear and radiation safety. The team advised the country to ensure adequate regulations and sufficient resources to regulate future facilities and activities.

The IRRS team made several recommendations and suggestions to further improve the regulatory system and the effectiveness of the regulatory functions in line with IAEA safety standards in the Netherlands, including:

- The government should develop a national strategy for safety that sets out the mechanisms for implementing the national policy for nuclear safety and radiation protection, considering a graded approach, in line with the IAEA Safety Fundamentals.
- The Ministry of Health, Welfare and Sports should ensure that diagnostic reference levels for medical exposure, dose constraints for carers and comforters and for volunteers participating in a programme of biomedical research are established.
- The ANVS should implement the improvements of its ANVS Integral Management System, identify and develop its processes and procedures in a coherent manner, integrate them into its management system, and ensure that the management system is consistently used throughout the organisation.

The overall result of this IRRS mission was 26 recommendations, 14 suggestions and 2 good practices.

ARTEMIS 2023
In 2023, the Netherlands hosted the first ARTEMIS mission. It was conducted back-to-back with the IRRS mission. Preparation by performing a self-assessment started in 2022. The ARTEMIS team concluded[58] that the Netherlands has established an effective programme for managing its spent fuel and radioactive

[57] https://www.rijksoverheid.nl/documenten/rapporten/2023/10/30/bijlage-2-irrs-nld-final-report.
[58] https://www.rijksoverheid.nl/documenten/rapporten/2024/03/28/bijlage-3-eindrapport-artemis.

waste for its current needs. The Government of the Netherlands, the ANVS and COVRA have demonstrated a commitment to safety, innovation and openness.

The ARTEMIS team considered the findings from the June 2023 IRRS mission, which assessed the country's overall regulatory framework for nuclear safety and radiation protection.

The ARTEMIS review team noted that the Netherlands is committed to continuous improvement for the safe management of spent fuel and radioactive waste.

The overall result of the ARTEMIS mission was 4 recommendations and 7 suggestions including:
- The Government should enhance the national policy and strategy related to disposal.
- The ANVS should enhance the regulatory framework concerning waste characterization.
- COVRA should proceed from the existing waste specifications to waste acceptance criteria for the management of radioactive waste.

K.5 Actions taken to enhance openness and transparency

See Section E, 20.1.j for information on actions taken to enhance openness and transparency at the ANVS and Annex 2 for information on the communication practice of COVRA.

K.6 Research

See A.7.a for information on the current national research programme COPERA and Annex 4 for information on the previous national research programmes.

Joint research activities on bilateral or multilateral level
The Netherlands participates in several joint research activities. Examples are:
- The joint research programme of the European Commission (EURAD);
- Research performed in various international working groups such as the ERDO Association;
- Collaboration with Belgium in knowledge sharing on nuclear technology and (long-term) radioactive waste management.

K.7 Public participation

See A.7.a for information on the research on the decision-making process on disposal by the Rathenau Institute.

K.8 Strong features of current practices, areas for improvement and challenges

Besides the challenges and suggestions given at the last Review Meeting (see Section A.7), the Netherlands has been given several recommendations and suggestions on (among others) the management of radioactive waste during the IRRS- and ARTEMIS-missions in 2023. The Netherlands will follow up on these areas for improvement.

Strong features of current practices given at the previous Review Meeting were:
- Radioactive waste streams in the Netherlands have been mapped.
  - The study is an addition to the national inventory and a tool to identify waste minimization possibilities.
  - The study gives more insight in waste streams from generation to disposal for each sector and type of waste.

- The Netherlands showed that historical waste issues can be solved by cooperation between waste producer and waste management organization in close contact with regulator.
  - Chain optimization is efficient and effective when dealing with historical waste.
  - Chain optimization results in better planning, steadily transfer of waste and design of a new storage building.
- The Netherlands showed pro-active communication and initiated international cooperation on orphan high-activity sealed sources, from detection to prevention.
  - Close international collaboration between IAEA, the Netherlands, Germany & country of shipment, both by regulatory bodies as well as ambassadors, has resulted in an IAEA Fact Finding Mission to the country of shipment.
  - There is ongoing collaboration to assist country of shipment implementing the recommendations from the mission.
- The Netherlands took initiating steps on the route to multinational disposal in the case of countries with small inventories where this may support safe disposal.
  - COVRA is co-founder and chair of ERDO Association (2021), based at COVRA. COVRA took a lead role in the working group for years working toward the establishment of the ERDO Association.
  - As a formal entity, the ERDO Association enables representation of its members in international fora, participation in international programmes, and launching projects.
- Extension of HABOG and its combination of technology and art aid to communicate and engage with the public with regard to safety.

Section L Implementation of the National programme

This section addresses Articles 11, 12 and 15 of Directive 2011/70/Euratom and is not applicable for the Joint Convention.

Directive 2011/70/Euratom: Article 11 – National programmes

DIRECTIVE 2011/70/Euratom

ARTICLE 11. NATIONAL PROGRAMMES

1. Each Member State shall ensure the implementation of its national programme for the management of spent fuel and radioactive waste ('national programme'), covering all types of spent fuel and radioactive waste under its jurisdiction and all stages of spent fuel and radioactive waste management from generation to disposal.

2. Each Member State shall regularly review and update its national programme, taking into account technical and scientific progress as appropriate as well as recommendations, lessons learned and good practices from peer reviews.

11.1 Implementation of the National programme

The progress of implementation of the National programme is described below in Section L, text on Directive Articles 12 a, b and d - k. The basis for dealing with these articles can be found in the National programme of the Netherlands.

11.2 Update of the National programme

The Netherlands will update its National programme in 2025.

Directive 2011/70/Euratom: Article 12 – Contents of national programmes

DIRECTIVE 2011/70/Euratom

ARTICLE 12. CONTENTS OF NATIONAL PROGRAMMES

1. The national programmes shall set out how the Member States intend to implement their national policies referred to in Article 4 for the responsible and safe management of spent fuel and radioactive waste to secure the aims of this Directive, and shall include all of the following:
   (a) the overall objectives of the Member State's national policy in respect of spent fuel and radioactive waste management;
   (b) the significant milestones and clear timeframes for the achievement of those milestones in light of the over arching objectives of the national programme;
   (c) an inventory of all spent fuel and radioactive waste and estimates for future quantities, including those from decommissioning, clearly indicating the location and amount of the radioactive waste and spent fuel in accordance with appropriate classification of the radioactive waste;

(d) the concepts or plans and technical solutions for spent fuel and radioactive waste management from generation to disposal;
(e) the concepts or plans for the post closure period of a disposal facility's lifetime, including the period during which appropriate controls are retained and the means to be employed to preserve knowledge of that facility in the longer term;
(f) the research, development and demonstration activities that are needed in order to implement solutions for the management of spent fuel and radioactive waste;
(g) the responsibility for the implementation of the national programme and the key performance indicators to monitor progress towards implementation;
(h) an assessment of the national programme costs and the underlying basis and hypotheses for that assessment, which must include a profile over time;
(I) the financing scheme(s) in force;
(j) transparency policy or process as referred to in Article 10;
(k) if any, the agreement(s) concluded with a Member State or a third country on management of spent fuel or radioactive waste, including on the use of disposal facilities.

2. The national programme together with the national policy may be contained in a single document or in a number of documents.

The National programme is publicly available in Dutch[59] and English[60] (non-binding translation). Background documents on which the National programme is based are not part of the National programme.

12.1.a The overall objectives of the Member States' national policy in respect of radioactive waste and spent fuel management

The overall objectives of the policy on waste management appear among others in Section B, text on Article 32.1(III) and in part B (chapter 4) of the National programme.

12.1.b The most significant milestones and clear timetables for the achievement of those milestones in light of the overarching objectives of the national programmes

The most significant milestones and their timetable appear in paragraph 7.2 of the National programme. These include:

- Closure of the Borssele nuclear power plant: closure of the only nuclear power plant still operational in the Netherlands is planned for 2033. At this moment the possibility to keep the NPP longer in operation is being reviewed.
- Return of the last produced waste from the reprocessing of spent fuel in France: the return of radioactive wastes to the Netherlands is planned before 31 December 2052. If the Borssele NPP stays longer in operation and also decides to continue reprocessing fuel, a new treaty with France will be needed.
- End of period of aboveground storage at COVRA: the buildings at COVRA are suitable for safe storage of the radioactive waste for the next 100 years, and due to periodic maintenance, the lifecycle of these buildings can certainly be extended to 300 years. Geological disposal is envisaged in 2130. Around 2100, a decision will be taken on the follow-up process.
- The status of the action points as mentioned in Chapters 7.1.1 and 7.1.2 of the Nationale programme is given in Table 14 in the section on Article 12.1.g of the Directive below.

[59] https://www.rijksoverheid.nl/documenten/rapporten/2016/06/30/rapport-het-nationale-programma-voor-het-beheer-van-radioactief-afval-en-verbruikte-splijtstoffen.
[60] https://english.autoriteitnvs.nl/documents/report/2016/08/09/the-national-programme-for-the-management-of-radioactive-waste-and-spent-fuel.

12.1.c An inventory of all spent fuel and radioactive waste and estimates for future quantities, including those from decommissioning, clearly indicating the location and amount of the radioactive waste and spent fuel in accordance with appropriate classification of the radioactive waste

The administration of COVRA is updated on a day-to-day basis.

Every three years, the amounts of radioactive waste and spent fuel stored at COVRA is reported to the European Commission and the Joint Convention. See Section D for the current inventory on spent fuel and radioactive waste. (Specifically) cleared material is not classified as radioactive waste and thus not included in the inventory.

An extensive national inventory containing forecasts will be made with every update of the National programme. In 2022, COVRA provided the latest extensive national inventory also containing prognosis of waste volumes until 2050 and an estimation of waste volumes upon disposal in 2130. The radioactive waste production and amounts produced by the different activities was estimated based on interviews and administration of COVRA. The interviews were carried out with selected companies from ten sectors: nuclear, medical isotopes, medical care, education and research, oil and gas, scrap metals, industry general, NORM, smoke detectors and other. Waste from decommissioning and dismantling of nuclear installations is included in the inventory.

The final HLW inventory to be disposed of is drawn up based on production data from the producer, the waste already stored at COVRA and expected amounts from decommissioning (as reported in the decommissioning plans). It was further assumed that: the HFR will be shut down in 2030, the NPP Borssele will shut down in 2033, the NPP of Dodewaard will be decommissioned before 2045, the HOR and Urenco in Almelo will both shut down in 2050.

The predicted quantities of LILW and NORM-waste are calculated by extrapolation to 2130 of the current production, to which expected quantities of decommissioning waste and waste stored on location are added. It was assumed that processing routes remain the same until 2130. The current annual production of radioactive waste is averaged over the period 2018-2020.

The NORM-waste described in the inventory, only concerns the NORM-waste that is stored at COVRA and does therefore not include the NORM-waste that is disposed of at the designated landfills. Future waste arisings for disposal at landfills are not yet available. The Ministry of IandWM is currently working on a monitoring programme for NORM going to landfills to make sure sufficient landfill capacity remains available.

In the national inventory, various alternative scenarios have been elaborated regarding an estimate of the amount of HLW, LILW and NORM-waste up to and including 2130. The following principles have been used for these scenarios:

- In 2030, the PALLAS reactor will directly succeed the HFR. The PALLAS reactor is a one-to-one replacement of the HFR for the production of medical isotopes with an estimated lifespan of 70 years.
- A scenario has been worked out with an additional lifetime extension of the NPP Borssele of 10 years until 2044.
- In 2035 and 2040, the NPP Borssele is expected to be succeeded by two new nuclear power plants, each with an assumed capacity of 1600 MW and a lifespan of 80 years. The scenario assumes the current method of storage in which the fuel elements are reprocessed. It is assumed that the quantities of waste are proportional to capacity.
- The American company SHINE intends to build a new installation in the Netherlands for the production of medical isotopes. In the inventory it is assumed that SHINE will start its activities in 2030 for 30 years. The amount of radioactive waste is based on data from the similar production site in America.

Estimates of the waste inventory in 2030, 2050 and 2130 are shown in Table 13. These estimates include the aforementioned waste inventory prognosis considerations of the current nuclear programme and the

PALLAS reactor for which a construction license has been granted. Refer to the national inventory[61] for more details and scenario-dependent future waste quantity estimates.

Table 13: Future waste quantity estimates

Type of waste	2030	2050	2130
HLW	173 m^3	201 m^3	227 m^3
LILWa	14,548 m^3	20,615 m^3	31,461 m^3
Decommissioning waste (LILW)b	1,021 m^3	3,496 m^3	3,814 m^3
NORM	34,882 m^3	56,070 m^3	56,070 m^3

[a] Decommissioning waste is included.
[b] Shown amounts contain decommissioning waste from NPP Borssele with an additional lifetime extension of 10 years until 2044.

To ensure that policies and legislation covers all waste streams, the Ministry of IandWM asked the Institute for Public Health and the Environment to perform a complete study of all waste streams in the Netherlands. The report of this study has been published in 2022[62].

12.1.d The concepts, plans and technical solutions for spent fuel and radioactive waste management, from generation to disposal

The concepts, plans and technical solutions for management of spent fuel and radioactive waste appear in the National programme in Chapter 4.3 and are all in place.

See Section B, text on Articles 32.1(II) and (IV) for the current practices and Section B, text on Article 32.1(III) on the policy for disposal of radioactive waste.

12.1.e The concepts or plans for the post-closure period of a disposal facility's lifetime, including the period during which appropriate controls are retained and the means to be employed to preserve knowledge of that facility in the longer term

Section H, text on Article 14(III) provides information on the plans for the closure of the disposal facility.

12.1.f The research, development and demonstration activities that are needed in order to implement solutions for the management of spent fuel and radioactive waste

See A.7.a for information on the current national research programme COPERA and Annex 4 for information on the previous national research programmes.

12.1.g The responsibility for the implementation of the national programme and the key performance indicators to monitor progress towards implementation

The Ministry of IandWM is responsible for the implementation of the National programme.

The three key performance indicators below show the status of progress of the National programme. A new set of performance indicators is being developed for the update of the National programme.

Key performance indicator 1: Financing

This key performance indicator is defined as: amount available for disposal is sufficient for preparation, construction, operation and closure of the disposal facility.

COVRA charges a (contractual) tariff for all phases of the management of radioactive wastes, including the operational cost for disposal, with the objective of having sufficient financial resources for the

[61] https://www.covra.nl/app/uploads/2022/10/Nationale-Radioactief-Afval-Inventarisatie.pdf.
[62] https://www.rivm.nl/publicaties/radioactieve-rest-en-afvalstromen-in-nederland-inventarisatie.

operation of a GDF around 2130. COVRA manages the provision for disposal. The investment mandate is approved by the Ministry of Finance.

In the 7-year research programme, OPERA, an updated estimate of the cost of disposal was made. The total costs for disposal in 2130 are estimated to be €2,300,000,000 (price level 2023, source: COVRA 2023 annual report). On December 31, 2022, the provision for disposal at COVRA amounted €119,543,000.

Key performance indicator 2: Status of action points/milestones as mentioned in the National programme
This key performance indicator is defined as: timely implementation of the action point from the action list.

The status of the action points and milestones as mentioned in Chapters 7.1.1 and 7.1.2 of the Nationale programme is given in the table below.

Table 14: Status of action points from Chapter 7.1.1 and 7.1.2 of the National programme

The transfer of legacy radioactive waste from Petten to COVRA.	In progress (see Section H, text on 12(II)).
Release thresholds for materials, buildings and sites.	Accomplished. The ANVS published a guide for the release of materials, buildings and sites following dismantling of a nuclear installation was finalised by 31 December 2017. In addition, the National Institute for Public Health and the Environment has published an advise on standards for the clearance of sites. The Ministry of IandWM is currently working on the implementation of that advise in regulations.
Decay storage.	Accomplished. Current practice: license holders may store their radioactive material for 2 years at their own site. COVRA used to offer the possibility to store materials at their facilities for 25 years to decay below the clearance levels, without being reprocessed, but has extended this period to 50 years. During decay storage, materials can decay to below the release threshold, and then be safely released for reuse or discharged to a conventional waste processor. In addition optimization of decay storage possibilities is being investigated by COVRA.
Imposing rules on import and export, storage and disposal of radioactive waste from abroad.	Policy in progress.
Financial aspects in the decommissioning plan of a facility.	Modification of legislation for nuclear facilities is completed. Certain license holders of non-nuclear facilities are obliged to submit a decommissioning plan which contains a description of the required financial provisions. An inadequate decommissioning plan is one of the grounds for not granting a license. Designated categories of license holders are obliged to submit a decommissioning plan, based on the nature and the radiological risks involved (graded approach). The designated categories of non-nuclear facilities submitted to this obligation are currently being reviewed.
Investigating the consequences of new European basic standards on the volume of radioactive waste.	Accomplished. The Bbs was implemented in February 2018. A report on radioactive waste streams has been published in October 2022. Amounts of waste per industrial sector have been updated.
Setting criteria for first environmental impact assessment of disposal.	On schedule, planned to be finalised at the end of 2030. A process has started to set up a strategic environmental impact study for the new National programme. The study should be ready by the end of 2024.
Reporting on implementation of the National programme.	Every three years reports to the European Commission are drafted and published.
Updating the National programme on radioactive waste.	The first update of the National programme is planned for 2025.
Drawing up a waste inventory.	Accomplished. See Section L, text on Article 12.1.c of the Directive.
Appointing a consultation group.	In progress, see A.7.a for information on the research on the decision-making process on disposal by the Rathenau Institute.
Analysis of online debate.	A broader participation plan has been established.

Key performance indicator 3. Capacity of COVRA
This key performance indicator is defined as: volume of space available is sufficient for the expected volume of Dutch radioactive waste.

COVRA has a site available of about 25 ha at the harbour and industrial area of Vlissingen-Oost. Buildings are constructed in a modular fashion, so new capacity can be added when needed.

Needs for extension of specific facilities at COVRA are under responsibility of COVRA. In 2022, COVRA established a waste inventory together with a prognosis of waste volumes until 2050 and an estimation of waste volumes until 2130 which included several scenarios. See Section L, text on Article 12.1.c of the Directive for more information.

At the time of writing, COVRA is drawing up a Masterplan to assess the impact of the possible growth of the inventory and the intended use of a plasma oven on the current location.

12.1.h An assessment of the national programme costs and the underlying basis and hypotheses for the assessment, which must include a profile over time

The largest future cost item for the National programme is the realisation of a national disposal facility around 2130. The applicable financing arrangements are provided in Section F, text on Article 22(II) and will be extensively reviewed in the update of the National programme.

12.1.i The financing scheme(s) in force

Information on the adequate financing schemes for the management now and in the future of spent fuel and radioactive waste, the financing of research into disposal, and for the dismantling of nuclear installations is provided in in Section F, text on Article 22(II).

12.1.j A transparency policy or process as referred to in Article 10

This national report discusses how transparency is anchored in legislation and regulations (see Section E, text on Article 19).

Section E, 20.1.j describes how openness and transparency is implemented at the ANVS.

COVRA operates a transparency policy in which communication with the public is very proactive, see Annex 2 for more information.

12.1.k If any, the agreement(s) concluded with a Member State or a third country on management of spent fuel or radioactive waste, including on the use of disposal facilities

See Section B, text on Article 32.1(II) Spent fuel management practices on the intergovernmental agreement with France.

Directive 2011/70/Euratom: Article 15 – Transposition

DIRECTIVE 2011/70/Euratom

ARTICLE 15. TRANSPOSITION

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive before 23 August 2013. They shall forthwith inform the Commission thereof.
   When Member States adopt these measures, they shall contain a reference to this Directive or shall be accompanied by such reference on the occasion of their official publication. The methods of making such reference shall be laid down by Member States.

2. The obligations for transposition and implementation of provisions related to spent fuel of this Directive shall not apply to Cyprus, Denmark, Estonia, Ireland, Latvia, Luxembourg and Malta for as long as they decide not to develop any activity related to nuclear fuel.

3. Member States shall communicate to the Commission the text of the main provisions of national law which they adopt in the field covered by this Directive and of any subsequent amendments to those provisions.

4. Member States shall for the first time notify to the Commission the content of their national programme covering all the items provided for in Article 12 as soon as possible, but not later than 23 August 2015.

The transposition table for Directive 2011/70/Euratom was updated in 2022 and sent to the European Commission.

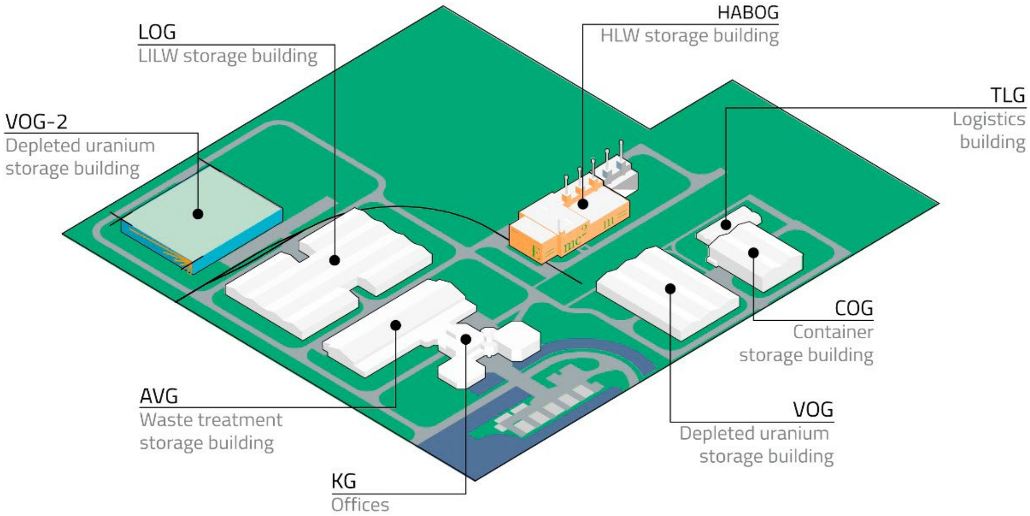
Annexes

Annex 1	Interim Waste Storage Facilities
Annex 2	Communication practice of COVRA
Annex 3	International orientation and collaboration
Annex 4	History of development of the policy and the research programme

Annex 1. Interim Waste Storage Facilities

COVRA has a site of about 25 ha at the industrial area Vlissingen-Oost. A layout of the COVRA facilities as present today, is given in the figure below.

Figure 13: Layout of the COVRA facilities



Buildings

All storage facilities are modular buildings. Since all wastes will be stored for a period of at least 100 years, this has to be taken into account in the design of the facilities, installations and packages.

The storage building for low- and intermediate-level waste (LOG) is H-shaped and consists of a central reception bay surrounded by four storage modules. Each storage module presents a storage capacity for ten to fifteen years of waste production at the present rate. In total 16 storage modules for low- and intermediate-level waste can be constructed which represents at least some 160 years of waste production.

There is a storage building for 20-ft containers, including decay storage (for a maximum of 50 years) and NORM-waste (COG), which can be modularly extended to triple its current size in the future.

The storage building for depleted uranium is the VOG. A second building for the storage of depleted uranium (VOG-2) has been constructed to accommodate the generation of the depleted uranium from 2017 on.

The HABOG has recently been extended. This was necessary because of the Long-Term Operation of the Borssele NPP.

The multifunctional storage building (MOG) for low- and intermediate-level waste is currently under construction. It will consist of a limited-access storage space for low-level waste (dose rate ≤ 2 mSv/hr) and an inaccessible storage space for intermediate-level waste (dose rate > 2 mSv/hr). MOG is designed for the storage of intermediate-level historical waste and waste from decommissioning.

Low- and intermediate-level waste in the LOG

LILW is treated to produce a waste package that is expected to last for at least 100 years and that can be handled after that period. The package should therefore:

- Provide a uniform and stable containment.
- Avoid possible spreading of radionuclides into the environment.

- Lower the radiation dose of handling to acceptable levels.
- Make identification possible to know the content.
- Allow simple repair and monitoring.
- Reduce the volume of the waste.
- Be acceptable for disposal.

For the low- and intermediate-level waste, the desired package that meets the above criteria is a cemented waste package. The size of the resulting package is standardised and limited in size to ease later handling. Generally, packages with a final volume of 200-litre or 1000-litre are produced. The 200-litre package is a galvanised steel drum with inside a layer of five centimetre of clean, uncontaminated concrete, embedding the waste. The 1000-litre packages are full concrete packages wherein a cemented waste form is present. In each package there is at least as much cement as waste volume. 200-litre packages with higher dose rate can be placed in removable concrete shielding containers of the same size as the 1000-litre containers.

Figure 14 (left): The storage of low- and intermediate-level waste in the LOG
Figure 15 (right): The storage of 20-ft containers in the COG

The conditioned waste packages are stored in the LOG. Simplicity, but robustness was leading in the design phase. The storage building is constructed from prefabricated concrete elements. The outer shell, roof and walls, can be replaced while keeping the waste indoors. Technical provisions inside the modules are minimal: only supply of electricity and light. Both can easily be replaced. All other technical provisions are placed in the reception area. With mobile equipment, the air humidity in the storage building is kept around 60%. Waste packages are stacked inside with forklift trucks. Waste packages are placed five rows thick and nine positions high, leaving open inspection corridors. In a group of five rows of packages, higher dose rate packages are placed in the middle to reduce dose to the workers and the environment. The exact position of each individual package is administrated. All containers must be free of outside contamination according to normal transport requirements. As a result, contamination is not present inside the building. Nor fire detection or firefighting equipment is present in the storage modules since burnable materials are almost absent. Floor drainage has been judged to be useless and weakening the structure. The floor has upstanding edges that prevent water entering the building.

Decay storage and NORM-waste in the COG

The NORM-waste stored in the COG is a calcined product resulting from the production of phosphor in a dry/high temperature process. It is a stable product that does not need further conditioning to assure safe storage. The relatively short-lived but highly radiotoxic nuclides polonium-, lead- and bismuth-210, are concentrated in this waste. Radiation levels from these alpha-emitting radionuclides are very low at the outside of a package.

There are forms of radioactive waste that require several tens of years to decay to below the release threshold values. Some of this material is potentially valuable, such as metals or rare earth elements, that could be reused. Decay storage makes it possible to return valuable (raw) materials that are no longer radioactive to the raw material cycle. Bulk material that is slightly activated or contaminated and decays below the exemption limit within a period of 50 years is eligible for decay storage in COG as well.

Economics played an important role in the implementation of the storage solution. The waste for decay storage and the calcinate are stored in a 20-ft container. Where needed, these containers can be tailored to the characteristics of the waste stored. The container for calcinate has three filling positions in the roof of the container that can be closed with a sealed lid and a polyethylene bag that serves as a liner. The inside and outside of the container is preserved with high quality paint. The 20-ft containers can be filled with up to 30 tonnes of material. These containers are stacked four high in the container storage building. Inspection corridors are kept open, as well as an opening to retrieve the containers firstly stored.

The container storage building is a galvanised steel construction frame with steel insulation panels. High quality criteria were set for the construction and materials in order to meet 150 years lifetime with minimum maintenance. This building can also be modularly expanded. Again, technical provisions inside the building are minimal. An overhead crane is present per storage module. The very low dose rate in the facility allows all maintenance to be carried out inside. The air humidity in the storage building is kept around 60% with mobile equipment. As all containers must be free of outside contamination according to normal transport requirements, no contamination is present inside the building.

Depleted uranium in the VOG

Depleted uranium from enrichment activities, is stored in a similar way as calcinate: storage of unconditioned material in larger containers, in this case storage of U_3O_8 in DV70 containers. For depleted U_3O_8, the argument to wait for decay to clearance levels is not applicable. The argument not to embed the material in a cement matrix is the potential value of the material as a future resource. If reuse does not take place in the future and the decision is taken to dispose of the material, this can be done according to then applicable standards. Funds for this treatment and for disposal are set aside in the capital growth fund in the same way as is done for all other waste stored at COVRA.

The storage building is a simple concrete construction with insulation panels. A concrete structure is used because some shielding is required. The building can be expanded modularly and per storage module an overhead crane is present. For maintenance, the overhead crane can be brought to a central reception area that is shielded from the storage module. The same philosophy is followed in this storage building as in the other storage buildings: technical provisions inside the building are minimal. With mobile equipment the air humidity in the storage building is kept around 50%. As all containers must be free of outside contamination according to normal transport requirements, no contamination is present inside the building.

High-level waste in the HABOG

Vitrified waste and compacted hulls and end caps are and will be returned to the Netherlands after reprocessing of spent fuel. The research reactors and the molybdenum production facility in the Netherlands produce spent fuel and other high-level waste. A packaging and storage facility is in operation for high-level waste. This facility, HABOG, is a modular vault with a passive cooling system. Heat-generating waste is stored in vertical wells, filled with a noble gas to prevent corrosion during the long-term interim storage period. Air convection brings cold air in that cools the wells at the outside and is discharged as warmer air via the ventilation stacks. Contamination of the air is not possible.

The choice for this system that has no mechanical components is a direct result of the choice for long-term interim storage. The design of the concrete structure was based on a lifetime of at least 100 years. The facility has further been designed such that all events with a chance of occurrence of 10-6 per year are taken into account and do not create any radiological risk to the outside world. There is spare capacity available to empty each storage module to allow for human inspection or repair. Also repacking is possible within the facility, including space to store the larger over packs. Spent fuel from research reactors are packaged into stainless steel canisters compatible with the storage wells. These canisters are welded tight and filled with helium in order to check the weld and to create a non-corrosive environment for the waste. All waste packages stored are free of contamination on the outside. In the storage areas no mechanical or electrical equipment is present. Maintenance, repair or even replacement can be done in a radiation-free environment.

Figure 16: The HABOG before the extension.

Annex 2. Communication practice of COVRA

Transparency and communication are an integrated part of the operations of the radioactive waste management organisation COVRA. Because of the long-term activities, COVRA can only function effectively when it has a good, open and transparent relationship with the regulatory body, the public and particularly with the local population. When COVRA constructed its facilities at a new site in 1992, it took it as a challenge to build a good relationship with the local population.

From the beginning, attention was paid to psychological and emotional factors in the design of the technical facilities. All the installations have been designed so that visitors can have a look at the work as it is done. Creating a good working atmosphere open to visitors was aimed at. The idea was not just to create a visitors' centre at the site, but to make the site and all of its facilities the visitors' centre.

Over the past decades, there has been a growing social awareness of the need for transparency and openness, and the dialogue with stakeholders in decision-making processes throughout the life cycle of radioactive waste facilities. Dialogue processes can enhance public awareness, trust and understanding and consist of interactions between waste management organizations, local municipalities, regulatory bodies, members of the public and environmental and civil society organisations.

Due to the policy of long-term storage, COVRA has to maintain a dialogue with the local community and other stakeholders for over a century. Maintaining a long-term dialogue around an operational waste facility, is different than during a siting process. To create opportunities for dialogue, people need to notice you: you have to show yourself, standout, be proud of what you do, show that radioactive waste management can be done in not only a safe, effective and efficient manner but also with beauty. This is why COVRA's communication became not only factually and objectively, but also based on emotion.

Looking for opportunities to communicate requires creativity, thinking outside the box and sometimes even outside the nuclear field. Art in particular is able create opportunities as it can connect divergent worlds. Using art you can reach the non-technical part of the population, which is by far the majority. COVRA uses its buildings as canvasses to tell stories about radioactive waste and the long-term involved in the management of it. It aims to bring the work done inside closer to the people and shows that safe can be beautiful. An important element in the dialogue with stakeholders is inviting people to the facility. Site visits are an effective way to facilitate the dialogue about radioactive waste as visitors can form an opinion on the storage based on their own experience. After the tour visitors generally take a more positive attitude towards COVRA. Social media and other online communication tools are also great opportunities for building relationships with stakeholders.

HABOG

During construction of the HABOG - the interim storage building for high-level radioactive waste and spent fuel - the idea was born to take this one step further and to do something special. Discussions with an artist, William Verstraeten, resulted in a provocative idea. The artist launched the idea to integrate the building into an artistic concept. He created 'Metamorphosis'.

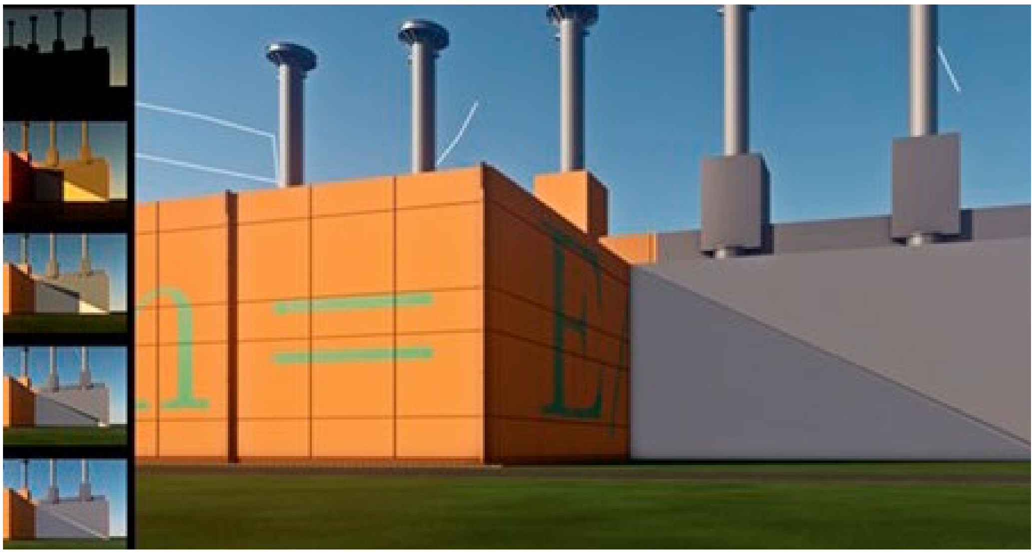
The HABOG features a bright orange exterior and the prominent display of Albert Einstein's equation E=mc2 and Max Planck's E=hv. Designed to last for up to 300 years, it contains the waste resulting from the reprocessing of the spent nuclear fuel from the nuclear power stations Borssele and Dodewaard as well as spent fuel from research reactors and the spent uranium targets of molybdenum production.

The radioactivity of the waste inside the HABOG will decrease in time through decay. This process is symbolised by the changing colour of the building's exterior, which is to be repainted every twenty years in lighter and lighter shades of orange until reaching white. The orange colour was chosen because it is halfway between red and green, colours that usually symbolise respectively danger and safety.

Therewith the HABOG is more than an interim storage, it is a communication tool. It helps to explain the concept of radioactivity in a simple not technical way. It is an 'attraction' that draws people to the COVRA facilities, people from the region, but also from all over the country and abroad. It provokes questions and stimulates discussion about radioactive waste and its management. People remember the story of the building, the changing colour which helps them to understand the process of decay and the safety of radioactive waste storage.

As the HABOG has been extended for extra storage space, the artwork also needed to be expanded. The work of art on the extended building has the sun perform a visual play with the building in the same tradition as in Stonehenge or as in the pyramid of Quetzalcoatl in Mexico. In the morning the sun casts its shadow over a side wall of the extension and the shadow bisects that wall diagonally, symbolizing the half-life of radioactive substances. The colour of a shadow depends, among other things, on the reflection and the contrast of colours in the environment and the light intensity of the sun. By choosing the right colours for the two diagonal parts of the new side wall, the play of the shadow will make the wall optically disappear and a flash will arise at the moment of division, just as radiation is released during the decay of radioactive substances. This special effect will be seen twice a year. It looks a bit like the green flash of the setting sun, a rare phenomenon that can be seen in the month of June with the right weather conditions.

Figure 17: Visual play of sun on the extension of the HABOG occurring twice a year



LOG

Ask people how long we should preserve our cultural heritage such as the paintings of Rembrandt or Van Gogh. The answer is generally: forever. That offers another way to start the dialogue and communication about long-term interim storage, showing people that we have a very long history of preserving things, often things that are far more difficult to store than immobilized waste. The link between the long-term preservation of art and the management of radioactive waste helps people to visualize and trust the concept of long-term management. That is why a real connection with the cultural heritage could be created. Museums in the region where COVRA is situated, have endured shortage of storage capacity for the artefacts that are not on exhibit. This represents generally some 90% of their collection. Looking for suitable storage space, the museums and COVRA found each other. The conditioned COVRA storage buildings for low- and intermediate- level waste have enough unused space to store the museum artefacts. This space is available as result of the robust construction of the storage building and cannot be used for the radioactive waste itself. The climate conditions are favourable because there are only gradual temperature changes and an air humidity under 60%. In 2009 the storage space has been offered for free to the museums in a contract for 100 years. Such a long-term contract is unique even for museums. The National Museum of the Netherlands (the Rijksmuseum) for instance, where works by Rembrandt can be seen, has a 40-year contract with a storage depot.

VOG-2

The second building for storage of depleted uranium offers further opportunities to interest the public and to start a dialogue. To use the building to communicate and tell vivid stories that appeal to emotions. Emotions are subconscious and they will leave a trace long after the words have been forgotten. Art and cultural heritage give such stories and provide compelling metaphors for radioactive waste. For us humans, the concept of time is directly related to our sun. Sundials have shown the passage of time as a shadow progresses for many centuries. The storage facility for depleted uranium is a sundial.

Figure 18: Second depleted uranium building: the largest sundial of Europe

Office building

Inside the office building art exhibits are organized four times a year.

International recognition

In the 2009 IAEA waste safety appraisal, the communication policy of COVRA was recognized as one of its good practices. It was concluded that inviting people to visit the site and presenting its activities through art to facilitate the communication of radioactive waste management activities to the public, has led to increasing transparency and confidence building of the public. At the ENEF Prague Plenary meeting in May 2011, the communication policy was also identified as one of the good practices on information, communication, participation and decision-making in nuclear matters. In 2010, COVRA won an award presented by the Italian foundation Pimby ('Please in my backyard') for its transparent communication about radioactive waste management to the general public. In the 2015 Review Meeting of the Joint Convention, the innovative approach in which COVRA communicates with the public, while taking into account the emotions surrounding radioactive waste by incorporating artistic elements in the design of the storage facilities, has been identified as a good practice. In the 2018 Review Meeting of the Joint Convention, the continuation of the existing practice of incorporating artistic elements into the design of the storage facilities at COVRA, such as the extension of the high-level radioactive waste building and the new depleted uranium storage building, has been identified as an area of good performance.

Annex 3. International orientation and collaboration

European and other international frameworks are closely followed when developing and designing the policy on radioactive waste, regulations and supervision. Furthermore, on a voluntary basis, links are sought with internationally accepted principles, recommendations, practices and agreements as established under the flag of the IAEA or the European Union.

The ANVS and the Ministry of IandWM participate in a number of international organisations involved in the harmonisation of the policy on radioactive waste: the European Community for Atomic Energy (Euratom), ENSREG, WENRA, the OECD/NEA and the IAEA.

To guarantee that radiation protection remains state of the art, the ANVS, the Ministry of IandWM and COVRA participate in international peer review mechanisms. Furthermore, policy on the management of spent fuel and radioactive waste is periodically assessed by other countries, in the framework of the Joint Convention treaty under the flag of the IAEA as well as by the European Union in the framework of Directive 2011/70 Euratom.

Within the European Union, there are several collaborations in respect of radioactive waste management. The Netherlands is a participant in or has participated in a number of these. Below are a few examples:

IGD-TP

COVRA and its contractors participate in the technology platform IGD-TP (Implementing Geological Disposal of Radioactive Waste Technology Platform (http://www.igdtp.eu/) a European collaboration initiative for geological disposal.

ERDO Association

In the dual track strategy currently being followed by the Netherlands towards disposal, international collaboration has been sought within the ERDO Association (http://www.erdo.org). For more information, see Section B, text on Article 32.1(III).

SITEX_Network

SITEX_Network (Sustainable network of Independent Technical EXpertise for radioactive waste Disposal, http://www.sitexproject.eu) is an association founded in 2018 as a follow-up of the Sitex I and Sitex II projects. These projects were carried out in the framework of respectively the seventh framework programme and Horizon 2020 from Euratom. The association gathers institutions or individual party having interest in independent regulatory assessment of radioactive waste management. The aim of SITEX_Network is to *enhance and foster cooperation at the international level in order to achieve a high-quality Expertise Function in the field of safety of radioactive waste management, independent from organizations responsible for the implementation of waste management programs and waste producers, aiming at supporting the Nuclear Regulatory Authorities, as well as the Civil Society* (source: Sitex_Network website).

ENSREG Working Group 2

The ENSREG Working Group 2 on Waste Management and Decommissioning (https://www.ensreg.eu/working-group-2-waste-management-and-decommissioning-wgrwmd) endeavours to improve the safety of the management of spent fuel and radioactive waste and decommissioning in the European citizen's interest. It strives to identify elements, approaches and measures for a continuous improvement of the safe management of spent fuel and radioactive waste and of the decommissioning, to strengthen cooperation, to promote joint effort in building and maintaining competence and knowledge. It provides guidance to facilitate the implementation of EU legislation in the field of nuclear waste safety.

WENRA working group on waste and decommissioning

The WENRA working group on waste and decommissioning (https://www.wenra.eu/wgwd) is mandated to analyse the current situation and the different safety approaches, compare individual national regulatory approaches with the IAEA Safety Standards, identify any differences and propose a way forward to possibly eliminate the differences. The proposals are expected to be based on the best practices among the most advanced requirements for nuclear waste facilities.

EURAD

The aim of EURAD (https://www.ejp-eurad.eu/) is to implement a joint Strategic Programme of research and knowledge management activities at the European level. This brings together and complements EU Member State programmes to ensure cutting-edge knowledge creation and preservation in view of delivering safe, sustainable and publicly acceptable solutions for the management of radioactive waste across Europe now and in the future.

Annex 4. History of development of the policy and the research programs

4.1 Short history of the development of the policy

The basis for the current policy on management of spent fuel and radioactive waste management is a report presented by the Government to parliament in 1984. This report covered two items. The first concerned the long-term interim storage of all radioactive waste generated in the Netherlands, and the second concerned the Government research strategy for the geological disposal of the waste. It also defined the principles on which the current policy is still based.

The report from 1984 led to the establishment of the national waste management organisation, the COVRA in Nieuwdorp, and the launch of a research programme on geological disposal of radioactive waste. Pending the outcome of research on disposal, and assurance of political and public acceptance, it was decided to construct an engineered surface-storage facility with sufficient capacity for all the radioactive waste generated in a period of at least 100 years.

By doing so, the government - via its regulatory body and COVRA - kept and keeps institutional control over all spent fuel and radioactive waste generated in the Netherlands, whereas in the meantime research into the best long-term solution can be conducted.

In 1993 the government adopted, and presented to parliament, a position paper on the geological disposal of radioactive and other highly toxic wastes. This formed the basis for further development of a national radioactive waste management disposal policy. The new policy required that any disposal facility should be designed in such a way that each step of the process is reversible. This means that retrieval of waste, if deemed necessary for whatever reason, should still be possible for decades up to several centuries. Retrievability leaves future generations the possibility to apply other management techniques. The reasons for introducing this concept of retrievability originated from considerations of sustainable development. The retrievable emplacement of the waste in the deep underground would ensure a safe situation in case of neglect of maintenance or social disruption.

Although waste retrievability allows future generations to make their own choices, it is dependent on the technical ability and preparedness of society to keep the facility accessible for inspection and monitoring over a long period. It also entails a greater risk of exposure to radiation and requires long-term arrangements for maintenance, data-management, monitoring and supervision. Furthermore, provision of retrievability in the disposal facility is likely to make the construction and operation more complex and costly.

In 2016, the Netherlands published its first National programme for the management of spent fuel and radioactive waste which describes the policy on the management of spent fuel and radioactive waste now and in the future. The National programme describes (among others) the dual track strategy and the national route to disposal. See Section B for more information.

4.2 Short history of the national research programmes into disposal of radioactive waste and spent fuel

The Netherlands has a history of more than four decades of research into the long-term safe management of spent fuel and radioactive waste. Results from the programmes have been used as input for the development of the policy on the safe management of spent fuel and radioactive waste. Considerable research efforts started as early as 1976.

Notable programmes were:
1976 – 1979, Desktop studies performed by RGD (predecessor of TNO, geological branch) and RCN (predecessor of NRG). A research programme was conducted regarding the geological disposal of radioactive waste in rock salt, also supported by some exploratory drilling.

1984 – 1988, OPLA Phase-1. After the 1984 note on radioactive waste management, start of programme OPLA concerning geological disposal in rock salt formations 'on land', consisting of three consecutive phases: (1) feasibility; (2) exploratory drilling; (3) underground research lab.

1990 – 1993, OPLA Phase-1a. Probabilistic Safety Assessment (PROSA) concerning the geological disposal of radioactive waste in rock salt formations.

1995 – 2001, CORA programme. Development and comparison of retrievable geological disposal options, mainly in rock salt and clay.

2011 – 2017, OPERA Programme. Development of an initial Safety Case for the geological disposal of radioactive waste and spent fuel in Boom Clay and road map for future research.

OPLA
In 1993 the OPLA research programme was completed and it was concluded that there are no safety-related factors that would prevent the geological disposal of radioactive waste in salt. However, the level of public acceptance of geological disposal remained low. Progress of the geological disposal programme was stalled by lack of approval for site investigations in salt formations that are considered suitable for this purpose and, hence, the prospect of a geological disposal facility being available within the next few decades was remote.

CORA
In 1995 the Commission Disposal Radioactive Waste (CORA) research programme was initiated as a continuation of former research, aiming at demonstrating the technical feasibility of a retrievable geological disposal facility in salt and clay formations. The programme finished in 2001. The main conclusions were:

- Retrieval of radioactive waste from repositories in salt and clay is technically feasible. The geological disposal concept envisages the construction of short, horizontal disposal cells each containing one HLW canister.
- Safety criteria can be met. Even in a situation of neglect, the maximum radiation dose that an individual can receive remains far below 10 µSv/year.
- Structural adjustments to the geological disposal design are required to maintain accessibility. This applies particularly to a geological disposal in clay, which needs additional support to prevent borehole convergence and eventual collapse of the disposal drifts.
- Costs are higher than those for a non-retrievable geological disposal facility, mainly due to maintenance of accessibility of the disposal drifts.

Although it was not included in the terms of reference, the CORA programme also addressed social aspects in a scoping study of local environmental organisations. In particular, it considered the ethical aspects of long-term interim storage of radioactive waste versus retrievable disposal. The results may not be representative of the views of a broader public, including other institutions with social or ideological objectives, but some preliminary conclusions could be drawn. The following statements reflected the position of many environmental groups:

- Radioactive waste management is strongly associated with the negative image of nuclear power amongst those groups. As such, geological disposal is rejected on ethical grounds since nuclear power is considered unethical. And a solution for radioactive waste could revitalise the use of nuclear power.
- Long-term control by the government on dedicated surface storage facilities is considered as the least harmful management option, although the possibility of social instability is recognised as a liability for which no solution can be provided.

- While it is clear that widely different views exist between stakeholders, this exchange of views can be considered as the start of a dialogue, which is a prerequisite for any solution.

Because the Netherlands has adopted the strategy of long-term interim storage in dedicated surface facilities, there was and is no immediate urgency to select a specific disposal site. However, further research was and is required to resolve outstanding issues, to preserve the expertise and knowledge, and to be prepared for site selection in case of any change to the current timetable. The CORA committee recommended validation of some of the results of safety studies, under field conditions. Also, co-operation with other countries, particularly on joint projects in underground laboratories was foreseen in this context. Regarding other technical aspects, it was recommended that attention should be given to the requirements for monitoring of retrievable repositories. Non-technical aspects also need to be addressed.

OPERA

The national research programme on geological disposal OPERA (OnderzoeksProgramma Eindberging Radioactief Afval, English translation: research programme disposal radioactive waste, 2011-2017) ended in December 2017. COVRA was asked to coordinate this ten million Euro research program, the costs of which are divided between the nuclear industry and the government. Various organisations have been contracted to perform parts of the research programme.

In OPERA, an initial Safety Case for the geological disposal of radioactive waste and spent fuel in Boom Clay[63, 64] has been developed. The Safety Case indicates that a stable and robust disposal at 500 meters depth in Boom Clay is possible, although several uncertainties are still to be further investigated. The Safety Case also contains a road map for future research.

A separate, complementary report[65] of the OPERA Advisory Group deals with the societal issues of geological disposal, including stakeholder engagement and conditions for the long-term decision-making process on disposal.

OPERA has focussed upon the Boom Clay; however, salt formations and other clay formations are also viable options for geological disposal. Salt as host formation has been explored in the past in the Netherlands and a limited update study has been carried out in OPERA. Much of the information and many of the approaches developed in OPERA are directly transferrable to evaluation of these other formations (e.g., work on waste types, inventories, packaging, overlying geological formations, safety assessment modelling).

COPERA

For information on the current national research programme, see Section K.6.

[63] Summary of OPERA initial Safety Case: https://zoek.officielebekendmakingen.nl/blg-830955.
[64] OPERA initial Safety Case: https://zoek.officielebekendmakingen.nl/blg-830956.
[65] Report of OPERA Advisory Group: https://zoek.officielebekendmakingen.nl/blg-830958.

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