Authority for Nuclear Safety and Radiation Protection

National report for the Council Directive 2011/70/EURATOM

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

The Netherlands, 2018

Contents

List of symbols and abbreviations

Acronym	Full term	Translation or explanation
ANVS	Autoriteit Nucleaire Veiligheid en Stralingsbescherming	Authority for Nuclear Safety and Radiation Protection
Awb	Algemene wet bestuursrecht	General Administrative Act
Bkse	Besluit kerninstallaties, splijtstoffen ertsen	Nuclear Installations, Fissionable en Materials and Ores Decree
Bbs	Besluit basisveiligheidsnormen stralingsbescherming	Decree on Basic Safety Standards Radiation Protection
Bvse	Besluit vervoer splijtstoffen, ertsen en radioactieve stoffen	Transport of Fissionable Materials, Ores, and Radioactive Substance Decree
BZ	(Ministerie van) Buitenlandse Zaken	(Ministry of) Foreign Affairs
COVRA	Centrale Organisatie Voor Radioactief Afval	Central Organisation for Radioactive Waste
ECN	Energieonderzoek Centrum Nederland	Netherlands Energy Research Foundation
EIA	Environmental Impact Assessment	
EZ	(Ministerie van) Economische Zaken	(Ministry of) Economic Affairs
EPZ	N.V. Elektriciteits-Produktiemaatschappij Zuid-Nederland	(Operator of Borssele NPP)
GKN	Gemeenschappelijke Kernenergiecentrale Nederland	(Operator of Dodewaard NPP)
GRS	Gesellschaft für Anlagen- und Reaktorsicherheit	
HABOG	Hoogradioactief AfvalBehandelings- en Opslag Gebouw	High-level Waste Treatment and Storage Building
HFR	Hoge Flux Reactor	High Flux Reactor (Research Reactor of JRC at Petten)
HLW	High-Level Waste	
HOR	Hoger Onderwijs Reactor	(Research reactor at the Technical University Delft)
IAEA	International Atomic Energy Agency	

I&W	(Ministerie van) Infrastructuur en Waterstaat	(Ministry) of Infrastructure and Water Management
ILT	'Inspectie Leefomgeving en Transport'	Inspectorate of the Ministry of I&W
IRRS	Integrated Regulatory Review Service	
ISO	International Standards Organisation	
JRC	Joint Research Centre of the European Commission	
Kew	Kernenergiewet	Nuclear Energy Act
LFR	Lage Flux Reactor	Low Flux Reactor
LH	Licence Holder	
LILW	Low- and Intermediate-Level Waste	
LOG	Laagradioactief afval Opslag Gebouw	Low-level Waste Storage Building
MOX	Mengoxide Mixed Oxide	
NCC	Nationaal Crisis Centrum	National Crisis Centre
NCS	Nationaal Crisisplan Stralingsincidenten	National crisis response plan radiological incidents
NORM	Naturally Occurring Radioactive Material	
NPP	Nuclear Power Plant	
NRG	Nuclear Research & consultancy Group	
NVR	Nucleaire VeiligheidsRegels	Nuclear safety rules (the Netherlands)
OPERA	OnderzoeksProgramma Eindberging Radioactief Afval	National Geological Disposal Research Programme
QA	Quality Assurance	
RB	Regulatory Body	
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	
SAR	Safety Analysis Report	

SF	Spent Fuel	
SZW	(Ministerie van) Sociale Zaken en Werkgelegenheid	(Ministry of) Social Affairs and Employment
VOG	Verarmd uranium Opslag Gebouw	Storage Building for Depleted Uranium
Wm	Wet Milieubeheer	Environmental Protection Act
WSF	Waste Storage Facility	Waste storage building for legacy waste in Petten

Summary

Article 14.1 of Council Directive 2011/70/EURATOM, establishing a community framework for the safe management of spent fuel and radioactive waste, requires Member States to report in a three-year cycle on how they have implemented the obligations of the Directive. This national report of the Kingdom of the Netherlands for the Directive shows how the Netherlands meets the obligations of each of the articles of the Directive and presents the progress in the last three years. The report is the second in its series and has been published in English only.

The Netherlands submitted its national programme on the management of radioactive waste and spent fuel to the Commission in June 2016[1]. The present national report refers in various sections to the national programme as well as to the National Report of the Netherlands for the Sixth Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (October 2017)[2].

This second report has been drafted in line with the guidance provided by the European Nuclear Safety Regulators Group (ENSREG) in their document 'Guidelines for Member States reporting on Article 14.1 of Council Directive 2011/70/Euratom'. As a result, most of the content of the abovementioned National Report for the Joint Convention has been reused in this report.

National framework

The Netherlands has established and maintains a national legislative, regulatory and organisational framework ('national framework') for spent fuel and radioactive waste management, which is part of the framework for nuclear safety and radiation protection. The competent regulatory body (RB) for this framework is the Authority for Nuclear Safety and Radiation Protection (ANVS)[3]. The ANVS is independent in its regulatory activities on radiation protection, nuclear safety and security in the Netherlands, but the Minister of Infrastructure and Water Management is politically responsible for its functioning.

The Netherlands has transposed Council Directive 2013/59/Euratom, laying down basic safety standards for protection against the dangers arising from exposure to radiation, in its national legislation. On 6 February 2018, the Decree on Basic Safety Standards for Radiation Protection and its underlying regulations have come into force. Parts of the directive and its implementation deal with waste and related subjects. The implementation lead to the introduction of a situation based approach (planned, emergency and existing situations). Another change was the introduction of "registration" as one of the two instruments to authorise practices. Licensing is the other instrument. This Decree also regulates the management of waste and orphan sources as well as requirements for the recycling or disposal of unsealed or sealed sources that are no longer used.

[1] https://english.autoriteitnvs.nl/documents/report/2016/08/09/the-national-programme-for-the-management-of-radioactive-waste-and-spent-fuel
[2] https://www.rijksoverheid.nl/documenten/rapporten/2017/10/12/rapportage-joint-convention-on-the-safety-of-spent-fuel-management-and-on-the-safety-of-radioactive-waste-management
[3] Autoriteit Nucleaire Veiligheid en Stralingsbescherming, ANVS

Regulatory body

The ANVS attained its formal status of an independent administrative body (ZBO) on August 1st 2017 with the necessary amendment of the Nuclear Energy Act and subordinate regulation.

In addition to day-to-day contacts between the entities of the RB, a Cooperation Agreement for Radiation Protection was set up in 2017 and signed by the ANVS and the policy departments and inspectorates of other ministries, which have tasks under the Nuclear Energy Act and so are part of the RB. The cooperation agreement describes the interaction, communication and cooperation between different parts of the RB.

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.

Policy on radioactive waste and spent fuel

The prime responsibility for the safe management of spent fuel and radioactive waste rests with the waste producers (i.e. license holders). Dutch radioactive waste management policy aims at minimisation of waste production. Prevention, reuse and use of radioactive decay are important elements of this policy.

The radioactive waste policy should not put any unreasonable burden on future generations. The generations that have benefitted from certain application of radioactivity shall also bear the associated costs of the management of the radioactive waste. (i.e. 'polluter pays'). This principle will be fulfilled by the charges that COVRA assesses to waste producers to cover all costs for processing, storage and disposal. Costs are estimated on the basis of the state of the art of the knowledge.

In addition, with the implementation of the Directive 2013/59/Euratom, the obligation has been introduced to set off the research costs into radioactive waste management, in the charges imposed by COVRA. Following delivery and payment, in return the legal ownership of the waste and the related (financial) risks are transferred to COVRA. This way no (perpetual) claims remain on companies whose long-term existence is uncertain.

COVRA

Waste management shall be safe now and in the future. In the Netherlands, COVRA is the central organisation for the management of all spent fuel and radioactive waste. Every company in the Netherlands must hand over their radioactive waste to COVRA. NORM waste with an activity concentration up to ten times the clearance levels need not be entrusted to COVRA, but is safely managed as very low level waste at two designated landfills. At COVRA long-term above-ground storage is available in specially designed dedicated buildings. These buildings, and the waste packages, were designed upfront for long-term storage (100 – 300 years). So during storage at COVRA the waste is managed safely. Geological disposal is foreseen in 2130.

Since the first report, COVRA completed a new storage building for depleted uranium (VOG-2). The interim storage facility of COVRA for high-level waste (HABOG) is

currently being extended. In June 2018, concrete work for the ground floor has started. Completion of the project as a whole is expected by mid-2021.

COVRA used to offer the possibility to license holders to store materials, that need a period longer than two years to decay below clearance levels (decay storage), at COVRA's site for a time period of 25 years with the intend to reuse it, or to release the decayed materials as conventional waste. Now, this period has been extended to 50 years, as 25 years appeared to be too short to release the radioactive materials from regulatory control.

Historical waste Research Location Petten

Due to past practices, some historical waste is still stored at the Research Location Petten. Currently, the Dutch government is stimulating the transfer of this historical waste from Research Location Petten to COVRA by the following means; the appointment of an official for stimulating cooperation and chain optimization between involved parties, installation of a steering group of Director-generals of the involved ministerial departments, and provision of additional governmental resources (117 million euro in 2018). More information on this topic can be found in Section A.

Route to geological disposal

After long-term storage at COVRA, geological disposal is envisaged around 2130. During the operational period of the disposal facility the waste shall be retrievable. It will be important to assess the optimum period of retrievability in due time, in order to benefit from both the advantages of retrievability and the advantages of a passive, safe (closed) disposal facility.

In January 2018, the results of the Research Programme on Disposal of Radioactive Waste (OPERA) were presented to the public; an initial safety case for geological disposal in Boom clay in the Netherlands and its costs.

After an exploratory phase into the role, goals and agenda of a Disposal Advisory Platform (DAP), the preparations for the establishment of this platform have started. The DAP will be responsible for advising on future decision-making and participation processes in radioactive waste management during the route to final disposal.

Dual strategy

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

A. Introduction

This introduction explains the purpose of the present report: 'National report of the Kingdom of the Netherland for the Council Directive 2011/70/EURATOM'. It gives an overview of current and potential sources of spent fuel and radioactive waste. It provides a description of which Competent Authorities and implementing organisations are involved in the responsible and safe management of spent fuel and radioactive waste.

Purpose of the national rapport

The national rapport demonstrates how the Kingdom of the Netherlands (further: the Netherlands) complies with the obligations arising from Article 14 of the Council Directive 2011/70/EURATOM. Article 14.1 of the Directive obliges the Member States to submit a report to the European Commission on a three-yearly cycle on how they have implemented the obligations of the directive. This report is the second in the series of reports for the Directive.

This report was drawn up using the guidelines[4] of the 'European Nuclear Safety Regulators Group' (ENSREG). References to radioactive waste in this report also include spent fuel, unless stated otherwise.

Relationship between this national report[5] and the report to the Joint Convention[6]

Article 14.1 directs Member States to take advantage of reporting under the Joint Convention on the Safety of Spent Nuclear Fuel Management and on the Safety of Radioactive Waste Management (JC) (i.e. in regards to optimising the use of resources and to providing coherent information) to assist them in preparing their National Report. Although they have different addressees and some differences in scope, the Directive and JC have the same overall objective of the safe management of spent fuel and radioactive waste.
Therefore, this national report contains information that is taken directly from the JC report. However, Member States have obligations under the Directive to fulfil certain requirements that are not covered in the JC report. Consequently, up-to-date information is added where needed in order to fully report on the progress that has been made in the field of responsible and safe management of spent fuel and radioactive waste.

National nuclear programme

In the Netherlands there is one nuclear power plant (NPP) in operation: the Pressurized Water Reactor (Siemens/KWU design, net electrical output 485 MWe) in

[4] http://www.ensreg.eu/sites/default/files/attachments/guidelines_for_reporting_on_directive_2011-70-euratom.pdf
[5] All national reports can be found at the website of the ANVS, http://www.anvs.nl
[6] https://www.rijksoverheid.nl/documenten/rapporten/2017/10/12/rapportage-joint-convention-on-the-safety-of-spent-fuel-management-and-on-the-safety-of-radioactive-waste-management

Borssele, operated by N. V. Elektriciteits-Produktiemaatschappij Zuid-Nederland (EPZ). The other NPP, the Boiling Water Reactor (GE design, 60 MWe)in Dodewaard, operated by Gemeenschappelijke Kerncentrale Nederland (GKN), was shut down in 1997 and is now in 'Safe Enclosure', a stage of decommissioning until 2045.

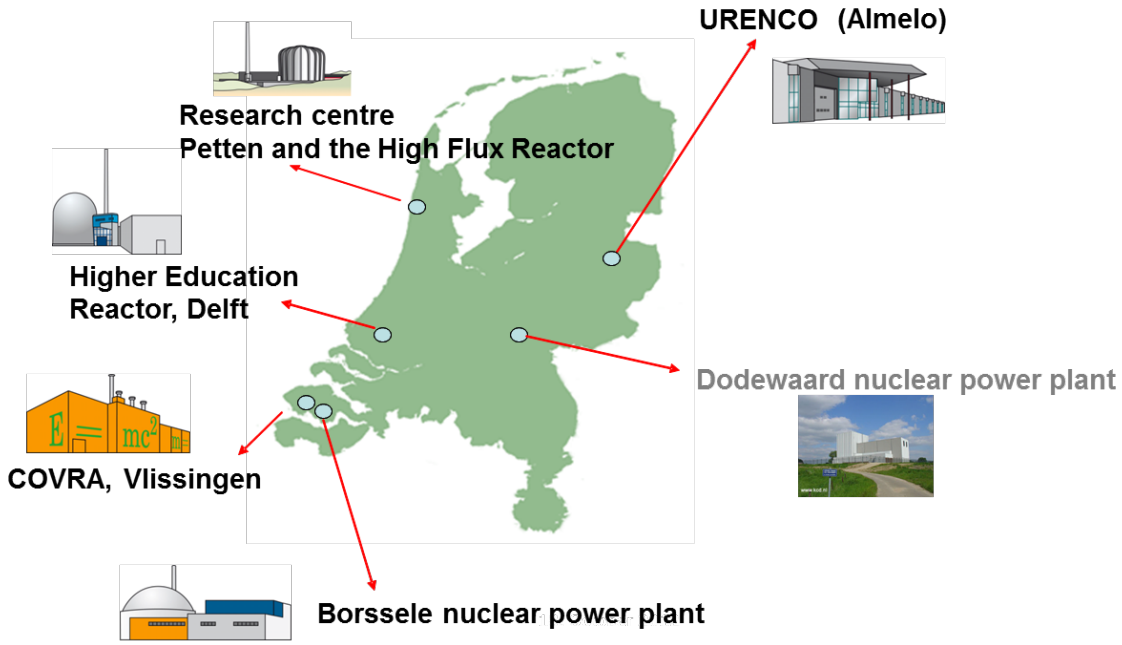


Figure 1: Locations of nuclear installations in the Netherlands

Furthermore, there are two research reactors in operation: the High Flux Reactor (HFR, 45 MWth) of the EU Joint Research Centre (JRC), 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. The Low Flux Reactor (LFR, 30 kWth) on the Research Location Petten was taken out of operation in 2010. Its decommissioning is ongoing and spent fuel has been removed.

The facilities for uranium enrichment of Urenco Netherlands are located in Almelo. Licensed capacity is currently 6200 tSW/a.

The facilities of the Central Organisation for Radioactive Waste (COVRA), the national Waste Management Organisation (WMO), are located at one site in Nieuwdorp. COVRA has facilities for the interim storage of low-, intermediate- and high-level waste. The high-level waste category includes spent fuel of research reactors, waste from molybdenum production and waste from reprocessing of spent fuel of NPPs. COVRA also manages radioactive waste from non-nuclear origin.

Details on the national nuclear programme of the Netherlands can be found in the national report for the CNS[7].

Sources of spent fuel and radioactive waste in the Netherlands

The spent fuel and radioactive waste are generated by various license holders. All companies in the Netherlands that hold a license on the basis of the nuclear energy act are required to tender their radioactive waste to COVRA. The waste produced can be divided into six sectors: nuclear, industry, medical, NORM industry, research and miscellaneous. All licensees in the Netherlands are required to offer their radioactive waste to COVRA. NORM waste with an activity concentration of up to ten times higher than the clearance levels (95 volume% of the Dutch radioactive waste), need not be entrusted to COVRA but is safely managed as very low level waste at two licensed designated landfills.

An inventory of SF and radioactive waste can be found in section C.

The policy in respect of the safe management of spent fuel and radioactive waste

The policy is comprehensively set out in the National Programme, and briefly summarized below.

Policy on radioactive waste and spent fuel and links to other policy fields
The policy on radioactive waste and spent fuel is part of 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.

The policy applies 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 radioactive substances.

The policy on radioactive waste ties in with the policy for conventional waste. The policy strives to close raw materials cycles as far as possible, with priority to be given to the most environmentally friendly processing methods. In the policy on radioactive waste, the same preferred order for processing is assumed as for conventional waste: prevention, reuse, and finally safe management of remaining waste substances.

Furthermore, as with management of conventional waste, the IBC-principle[8] is applied to the management of radioactive waste: isolate, manage and control.

[7] National report for the Convention on Nuclear Safety, 7th Review Meeting – 2017, available at: https://www.autoriteitnvs.nl/documenten/rapporten/2017/04/25/convention-on-nuclear-safety-7th-review-meeting-%E2%80%93-2017

[8] IBC, Dutch acronym meaning: 'Isoleren, Beheren en Controleren, i.e. isolate, manage and control.

Policy principles for the management of radioactive waste and spent fuel

- The policy is aimed at minimising the waste flows. Prevention of waste production, reuse and using radioactive decay are successful policy instruments. The prices set by COVRA for all types of radioactive waste tie in with this policy, and help to make it a success.
- Safe management now and in the future is a key element. During aboveground storage at COVRA, the waste is safely managed. Around 2130 geological disposal is envisaged. The design of the disposal facility must allow the possibility of retrieval of the waste (via the existing shaft) during the operation of the disposal facility. In consultation with society, it will be important to assess the optimum period of retrievability in due time.
- 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 themselves bear the burdens for the costs of managing the waste produced in those activities.
- Causers of radioactive waste bear the costs for the management of the waste. In respect of all costs involved in the management of the radioactive waste the 'polluter pays' principle will apply.

Policy on reprocessing of spent fuel

Government policy in respect of the reprocessing of SF in principle leaves the choice on whether or not to reprocess to the operator of the nuclear power plant.

Policy on long-term management of radioactive waste and spent fuel

The current policy assumes long-term storage of the radioactive waste and spent fuel in specially designed buildings (at COVRA) till 2130. During this period the deep geological disposal is prepared financially, technically and socially in such a way that the disposal facility will be ready to receive radioactive waste around 2130. A decision on disposal will be made around 2100. Up to that moment, society may also opt for another management option, depending on insights at that moment, and assuming that other alternatives are possible at that time.

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

The practice of the management of spent fuel and radioactive waste in the Netherlands and the implementing organisations

Current practice on reprocessing

The choice whether or not to reprocess spent fuel is left to the operator. The operators of the two NPPs Dodewaard and Borssele decided in favor of reprocessing.

In 2012, the Republic of France and the Netherlands signed a treaty that regulates the reception and reprocessing of Dutch spent fuel from the Borssele NPP by Areva (now: ORANO) in France, and the return to the Netherlands of the radioactive residues from reprocessing before 31 December 2052.

The operator of the Borssele NPP has arranged for the recycling of its reprocessing products (uranium, plutonium), and has been granted a license for the use of MOX mid-2011. Regarding the products of past Dodewaard fuel reprocessing, the uranium was sold to a European NPP, while the plutonium stored at La Hague was sold to ORANO, a fuel fabricating company for fabricating MOX fuel. Plutonium stored at Sellafield was sold to NDA.

On February 11, 2011, the government presented a position paper with the preconditions for new nuclear energy to Parliament. In the paper it is stated that it is an obligation for the LH of a nuclear power plant to evaluate their spent fuel management strategy every 10 years. The central government does the same every twenty years. Depending on these evaluations, a different strategy may subsequently be imposed on the license holder.

Spent fuel from the research reactors is not reprocessed, but directly transported to COVRA.

Current practice COVRA
The nuclear programme of the Netherlands is relatively small, but diverse. The total quantities of spent fuel and radioactive waste are modest. By centralizing most of the radioactive waste management activities in the Netherlands in one national WMO (i.e. COVRA), and at one site, benefits of economies of scale are optimized. 100% of the shares in COVRA are held by the State, and this aids to guarantee a system of long-term institutional control.

Nuclear installations do not have their own (long-term) waste storage facilities. The storage capacity at COVRA has been dimensioned to handle the expected Dutch demand for storage capacity till at least the year 2130.

The COVRA site is approximately 25 hectares. On this site, COVRA has various waste processing and storage facilities for radioactive waste and spent fuel. The ‘HABOG facility’ was built for the storage of high level radioactive waste. The building is resistant to the most extreme conceivable external occurrences. It is a modular storage building with a passive cooling system. Currently extension of HABOG is ongoing (planned to be operational in 2021), and a new storage building for depleted uranium (VOG-2) at COVRA has been completed in 2017 (see section B for more information).

COVRA offers the possibility to store materials that need a period longer than two years to decay to below the clearance levels (decay storage). During a period of not more than 50 years, without being processed, materials from the dismantling of large fixed installations can be stored at COVRA as well. 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.

Another task of COVRA is to generate the funds to create capital provisions to cover the cost for both long-term aboveground storage and for the implementation and operation of (geological) disposal facility for the waste. The ‘polluter pays’ principle is fulfilled by the fact that COVRA includes in its charges all estimated costs for

processing, storage and disposal, on the basis of the state of the art at that time. In the implementation of the Directive, the obligation has been introduced to set off the research costs into radioactive waste management, in the charges imposed by COVRA. Following delivery, the legal ownership of the waste and the related (financial) risks are transferred to COVRA. This way no (perpetual) claims remain on companies whose long-term existence is uncertain.

Current practice research on disposal
From 2011-2017 a research programme on feasibility of geological disposal in Boom Clay in the Netherlands (OPERA) has been performed. This research programme amounted a total of €10 million of which half is paid by the government and the other half by the nuclear sector. COVRA coordinated OPERA. The results of OPERA were presented to the public, in January 2018. More information on this is presented in section H, article 8.c.

Historical waste at Research Location Petten
Originally the Dutch radioactive waste storage facility was located at the Research Location Petten (1985 – 1992). This explains why a certain amount of historical, or 'legacy', radioactive waste is still stored at the Research Location Petten in the Waste Storage Facility (WSF). Currently, the low-level waste-part of the legacy waste on this site is being transferred to COVRA. For the intermediate and high-level waste, several options for conditioning, repacking and transport to COVRA have been investigated. The original aim was to transfer these wastes to COVRA before 2022. The latest coordinated planning indicates that by the end of 2026 all legacy waste will be removed from Petten for storage at COVRA. More information on recent developments in this regard in section B.

The competent regulatory authority or 'Regulatory Body' involved in the responsible and safe management of spent fuel and radioactive waste in the Netherlands

The 'Regulatory Body' (RB) is the authority designated by the government as having legal authority for conducting the regulatory processes, including issuing authorizations, supervision and enforcement. In 2015 the various entities that formerly constituted the RB, have largely merged into the one entity, the Authority for Nuclear Safety and Radiation Protection (ANVS). The ANVS brings together expertise in the fields of nuclear safety and radiation protection, as well as security and safeguards. On August 1st 2017, the ANVS attained the formal status of an independent administrative body (ZBO), when the necessary amendment of the Nuclear Energy Act and subordinate regulation took effect.

The ANVS brings together expertise in the fields of nuclear safety and radiation protection, as well as security and safeguards. For each of these subjects, the ANVS is focused on preparing policy, legislation and regulations, the awarding of licenses, supervision and enforcement and (public) information. The ANVS contributes to safety studies and ensures that the Netherlands is prepared for any radiation incidents.

The ANVS is independent in its regulatory activities on radiation protection, nuclear safety and security in the Netherlands, but the Minister of Infrastructure and Water Management is politically responsible for its functioning.

The tasks related to safe management of spent fuel and radioactive waste are within the scope of the ANVS. Therefore this report often will refer to the ANVS as the RB.

Overview matrix of liabilities and current policies and practices

An overview matrix providing the types of liabilities and the current policies and practices for the Netherlands is presented in annex 1.

Procedure for establishment of the national report

This national report was drawn up by the ANVS.

B. Recent developments - summary of major developments since submission of the previous national report

Regulatory framework

- In August 2017, the Authority for Nuclear Safety and Radiation Protection, the ANVS, was legally established in an update of the Nuclear Energy Act (and subordinate regulation) as an independent administrative authority (Dutch acronym: ZBO). More information on this is available in section E, article 5.0.
- The Netherlands has transposed Council Directive 2013/59/Euratom, laying down basic safety standards for protection against the dangers arising from exposure to radiation, in its national legislation. On 6 February 2018, the Decree on Basic Safety Standards for Radiation Protection (In Dutch: "Besluit basisveiligheidsnormen stralingsbescherming") and its underlying regulations have come into force. More information on this is available in section E, article 5.0.

Regulatory body

- On August 1st 2017, the ANVS attained the formal status of an independent administrative body (ZBO) with the necessary amendment of the Nuclear Energy Act and subordinate regulation.
- In addition to day-to-day contacts between the entities of the RB, a Cooperation Agreement for Radiation Protection (signed in 2017) was set up between the ANVS and the policy departments and inspectorates of other ministries with tasks under the Nuclear Energy Act that are part of the RB. The cooperation agreement describes the interaction, communication and cooperation between different parts of the RB. More information on this is available in section F, article 6.1.
- After an exploratory phase into the role, goals and agenda of a Disposal Advisory Platform (DAP), the preparations for the establishment of the DAP have started. This group will be responsible for advising on future decision-making and participation processes in radioactive waste management during the route to final disposal.
- 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. More information on this is available in section F, article 6.1.
- The ANVS signed a cooperation protocol with Belgium's regulatory body 'FANC' (2017). More information on this in section J, article 10.1.
- The ANVS introduced a public portal on their website (2018), providing information about what the government does, and what people can do themselves, in the event of a nuclear crisis or a radiation accident. More information on this in section J, article 10.1.

COVRA

- A new storage building for depleted uranium (VOG-2) at COVRA is completed. Before the building was taken in operation, the building was the venue of the 2017 PIME[9] conference.
- The interim storage facility of COVRA for high-level waste (HABOG) is currently being extended. In June 2018, concrete work for the ground floor has started. Completion of the construction is planned for the end of 2020. This is followed by a test period by COVRA. Completion of the project as a whole is expected by mid-2021.
- COVRA used to offer the possibility to license holders to store materials, that need a period longer than two years to decay below clearance levels (decay storage), at their site for a time period of 25 years. Now, this period has been extended to 50 years. More information on this in section K, article 12.1.g.

Historical waste Research Location Petten

- The Dutch government has recently undertaken the following actions regarding the ongoing transfer of historical waste from the Research Location Petten to COVRA (see also section A): it has appointed an official for stimulating cooperation and chain optimization between involved parties; installed a steering group of Director Generals of involved ministerial departments; and provided additional governmental resources (117 million euro in 2018).

OPERA (Research Programme on disposal of radioactive waste)

- The results of Research Programme on the disposal of radioactive waste in Boom Clay in the Netherlands (OPERA) have been presented to the public in January 2018. More information on OPERA is available in section H, article 8.c.

[9] Public Information Materials Exchange, PIME

C. Scope and inventory (Article 2, Article 12.1 (c), Article 14.2 (b))

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.

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

(…)

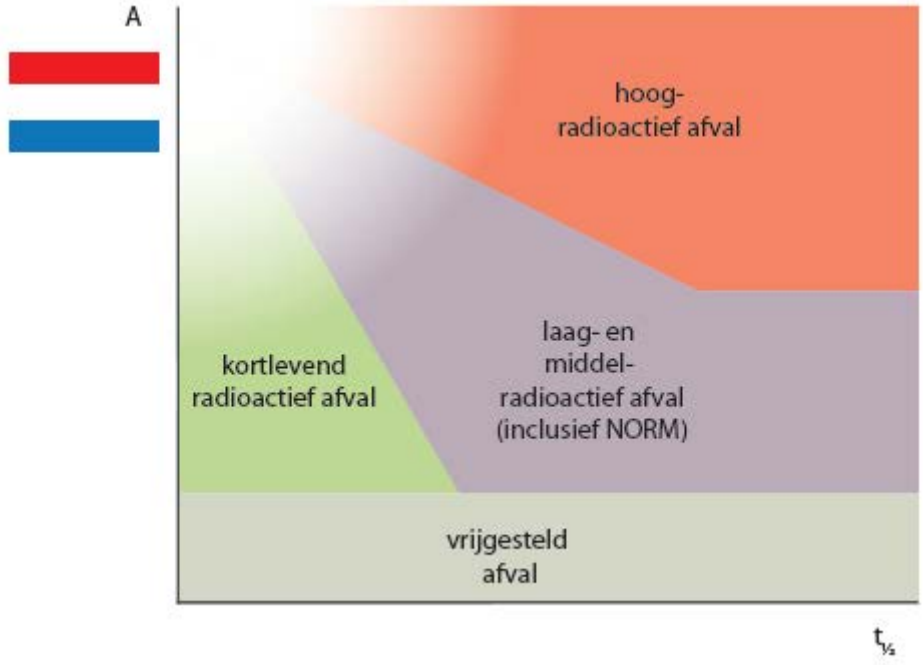
2. On the basis of the Member States' reports, the Commission shall submit to the European Parliament and the Council the following:

(…)

(b) an inventory of radioactive waste and spent fuel present in the Community's territory and the future prospects.

12.1.c Inventory of spent fuel and radioactive waste in the Netherlands

Classification of spent fuel and radioactive waste



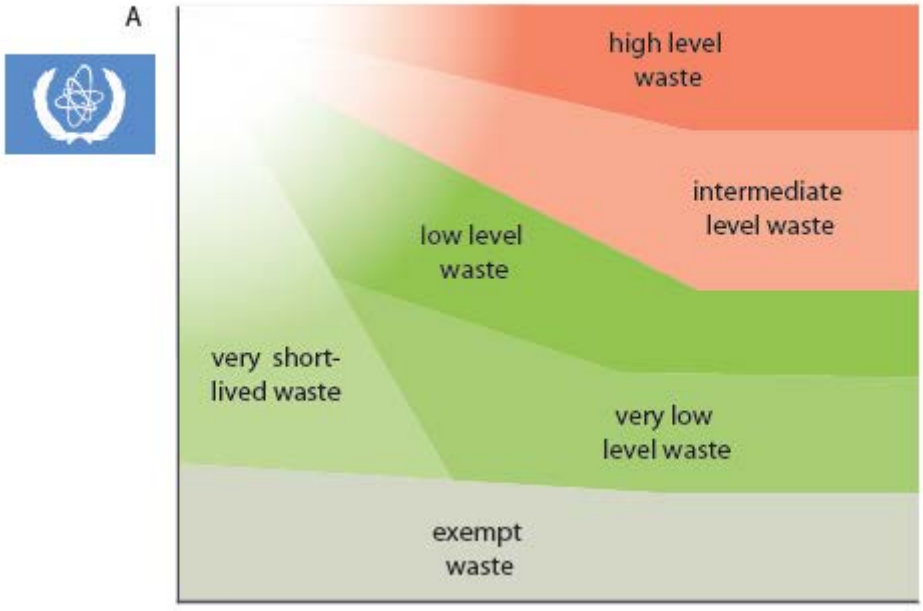


Figure 2: Classification of spent fuel and radioactive waste in Dutch; (above: hoogradioactief afval is high-level waste, laag- en middelradioactief afval (inclusief NORM) is low- and intermediate-level waste (including NORM), kortlevend radioactief afval is very shortlived waste and vrijgesteld afval is exempt waste), according to IAEA standards (below).

Spent Fuel management facilities

Location	Spent fuel storage facility	Features
Nieuwdorp COVRA	Dry storage in vaults at COVRA	COVRA facility for treatment and storage of HLW and SF (HABOG)
Borssele NPP	Fuel storage pool at NPP	Pool belongs to NPP where SF is stored temporarily before shipment to France for reprocessing
Petten RR	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.
Delft	Fuel storage pool of RR HOR	Pool belongs to RR where SF is stored temporarily awaiting shipment to COVRA

Table 1: Spent Fuel management facilities

Inventory of spent fuel

The inventory of spent fuel at the end of 2017, stored at the COVRA facilities, is summarized below:

SF of NPPs[10]	0 m³	0 Bq
SF of RRs	7,0 m³	93,076 PBq
Uranium targets[11]	1,2 m³	2,749 PBq

Radioactive waste management facilities

In table 2 below, a list of the radioactive waste management facilities is given. Only those radioactive waste management facilities are reported whose main purpose is radioactive waste management. This means that small-scale waste management at departments of hospitals, research institutes or industries which store radioactive waste for decay (allowed for waste with a half-life of less than 100 days, which is allowed to be stored for decay on site for a maximum of two years) or which perform simple operations such as compacting waste awaiting collection by COVRA, are not included in the list.

Waste storage departments of the NPP Borssele and of the research reactors are not specifically mentioned either, because a general license condition obliges LHs to limit their inventories by transferring their radioactive waste periodically to COVRA. NRG is not allowed to store new waste in the WSF.

[10] All NPP SF is reprocessed.
[11] Uranium filters with uranium from targets.

Location	Radioactive waste storage facility	Features
Nieuwdorp COVRA	Dry storage of HLW in cannisters	COVRA facility for treatment and storage of HLW and SF (HABOG)
	Dry storage of LILW in conditioned form in drums and containers	COVRA facilities for treatment and storage of LILW (AVG and LOG)
	Dry storage of NORM waste in containers	COVRA container storage facility (COG) for material in unconditioned form
	Dry storage of depleted uranium oxide in small containers	COVRA facility for storage of depleted uraranium oxide as U_3O_8 in unconditioned form to allow for potential future reuse (VOG and VOG-2)
Petten WSF	Dry storage of unconditioned waste in drums.	Partly HLW from irradiation experiments. To be transferred to COVRA.
Nauerna & Rotterdam	Disposal of NORM waste between 1 – 10 times clearance levels	Designated landfills

Table 2: Radioactive waste management facilities

Inventory of radioactive waste at COVRA

The inventory of radioactive waste at the end of 2017, stored at the COVRA facilities, is summarized below:

HLW (including RRSF)	105 m³	2.987 PBq
LILW	11,358 m³	3.408.464 GBq
NORM-wastes	21,509 m³	629.161 GBq

In the 36 years that COVRA exists, on average the increase is 3 m³ / year for HLW and approximately 300 m³ / year for LILW. A temporary increase to approximately 6.3 m³ HLW / year and 504 m³ LILW / year is foreseen in due time caused by the historical waste from Petten.

Nuclear facilities in the process of 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
LFR	2010	Decommissioning ongoing, fuel removed and transported to COVRA.

Table 3: Nuclear facilities in the process of being decommissioned

14.2.b Future prospects of inventory of radioactive waste and spent fuel

The future volumes of radioactive waste and spent fuel have been estimated as follows in the national programme:

The volume of high-level waste in 2130 is estimated at 400 m^3 (Figure 3). Of that volume, almost two thirds is non-heat-producing waste, while more than one third will be heat producing. One uncertainty that influences the volume of HRA is the presence of operational nuclear installations in the Netherlands. In drawing up the inventory, account was taken of the closure of the nuclear power plant in Borssele in 2033 and the dismantling of that plant over the subsequent decades, and the construction of a research reactor in Petten (Pallas). Following the closure and dismantling of the nuclear power plant in Borssele, the volume of HRA produced each year will fall considerably.

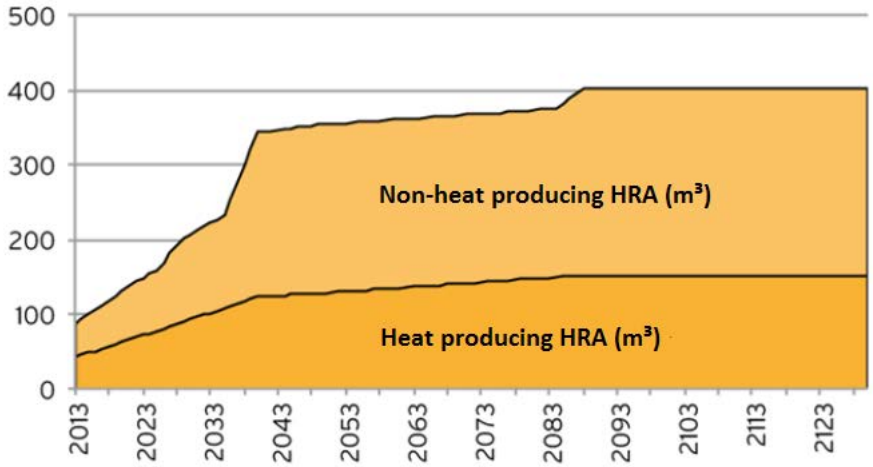


Figure 3: Development of the volume of HRA through to 2130

The volume of LMRA in 2130 is estimated at 70,000 m^3 (see Figure 4). Of this total, approximately two thirds will decay over the next hundred years to below the exemption threshold. Decayed waste can be disposed of as conventional waste, and does not need to be placed in the geological disposal.

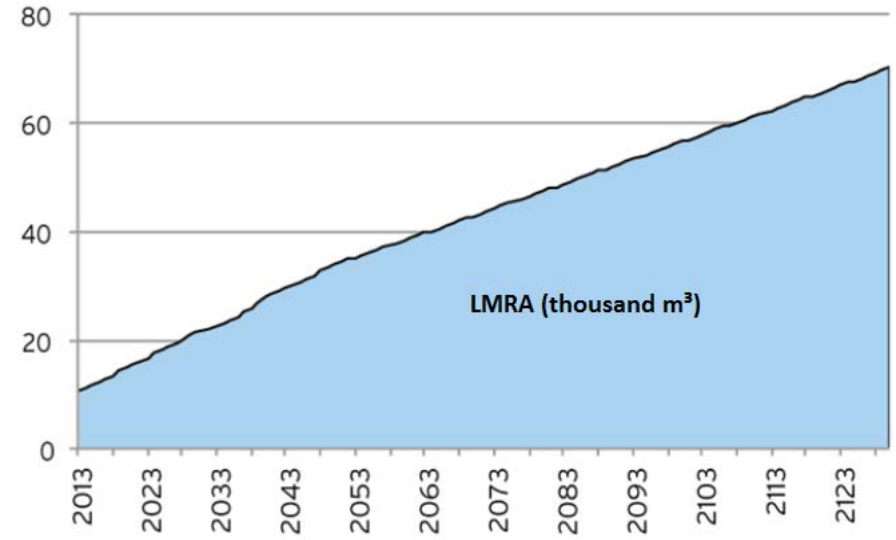


Figure 4: Development of the volume of LMRA through to 2130

The volume of NORM waste in 2130 is estimated at 158,000 m^3 (see Figure 5). Because of this huge volume, minor changes in legislation and regulations could bring about major fluctuations in the volume of NORM waste. Current production has been extrapolated into the future.

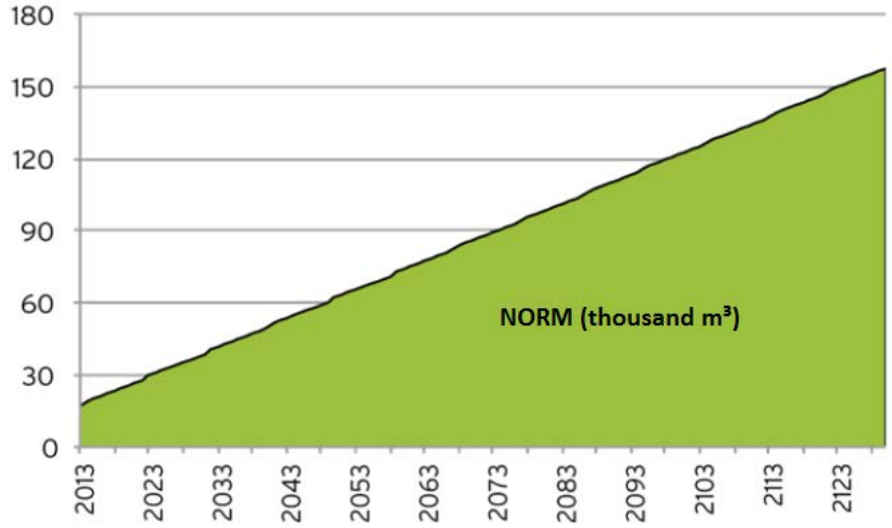


Figure 5: Development of the stored volume of NORM at COVRA through to 2130

D. General principles and policies (Article 4)

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:
(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;
(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;
(e) the costs for the management of spent fuel and radioactive waste shall be borne by those who
generated those materials;
(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.

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.

4.1 / 4.2 Statements about the national policy of the Netherlands in relation to Article 4 of the Directive

The Netherlands has implemented the Directive in national legislation. In accordance with the Directive, the Netherlands bears ultimate responsibility for the management of spent fuel and radioactive waste. This responsibility includes the conditions as formulated in articles 4.2 and 4.4 of the Directive.

The national policy of the Netherlands in respect of the management of spent fuel and radioactive waste is based on the principles as formulated in Article 4.3 of the Directive. See section A for a summary of the national policy on radioactive waste management and below for a summary of the implementation thereof.

The national policy of the Netherlands provides for safe storage management, followed by disposal of all radioactive waste categories in one geological facility.

In Articles 22 and 33 of the Nuclear Energy Act provisions have been made for situations where the owner or other responsible person or organisation of fissionable material (including spent fuel) or radioactive material respectively cannot be identified. This applies for example to orphan sources.

In such cases the RB has been empowered to impound such material and have it transferred to designated institutes, which are equipped and licensed to manage these materials. For fissionable materials two institutes have been designated by a special decree[12]: NRG in Petten and COVRA in Nieuwdorp. The same institutes as well as the RIVM in Bilthoven have been designated for the management of radioactive materials.

Political decisions in relation to Article 4 of the Directive, that form the basis for the national policy

The national programme describes the Dutch policy on the management of radioactive waste, including the route to disposal. The basis of the national policy on radioactive waste management is from 1984. The policy has undergone little change over the past 30 years, and complies with the requirements of Article 4.

Directive 2011/70/Euratom has been fully implemented in the Decree on Basic Safety Standards for Radiation Protection (Bss, Article 10.1) and in the Nuclear Installations, Fissionable Materials and Ores Decree (Article 40a).

4.3 Summary of implementation of policy principles

In the Netherlands, the policy on the management of radioactive waste also applies to SF.

[12] 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

4.3.a Minimization of radioactive waste

Minimization of the generation of radioactive waste is part of the policy on the management of radioactive waste, as referred to in section A. Furthermore, according to the Decree on Basic Safety Standards for Radiation Protection (Bss), a LH in possession of radioactive material is obliged to minimise the generation of radioactive waste. The LH is in principle free to choose its measures to achieve this.

Also by reuse and reprocessing the quantity of radioactive waste is minimized. See *Current practice reprocessing* (section A) for information on reprocessing.

4.3.b Interdependencies in spent fuel and radioactive waste generation and management

The basic steps in SF management are not fundamentally different from those in radioactive waste management. For radioactive waste management the steps identified are generation, collection, treatment, conditioning, storage and disposal.

For SF management under 'pre-treatment' is meant the temporary storage of SF with the aim of cooling down in the storage pool at the reactor site. Treatment is to be understood as reprocessing at a reprocessing plant as the one of ORANO in France. After SF has been shipped to the reprocessing plant, the SF is allowed to further cool down for some five to eight years in pools. Then the fuel is removed and sheared into pieces for further processing.

Solvents are used to separate uranium, plutonium and fission products. The fission products and other reprocessing residues are conditioned in packages that facilitate their long-term storage without significant maintenance.

The fuel from the RRs is also packed in sealed canisters consistent with maintenance-free storage. The final step in waste management is geological disposal.

4.3.c Safe Management in the long term, passive safety features

The Netherlands foresees geological disposal in 2130. Geological disposal is one of the management options that following closure offers passive safety. 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.

4.3.d Graded approach

The policy on management of radioactive waste follows a graded approach (see Table 4 below). COVRA has dedicated buildings for high-level waste (HABOG), low and intermediate level waste and NORM waste (for instance VOG-2).

Category radioactive waste	Interim management	Long term management
HLW	Aboveground storage at COVRA	Geological disposal
LILW	Aboveground storage at COVRA	
NORM, as far as transferred to COVRA	Aboveground storage at COVRA	
NORM subject to notification	Storage on location	Designated landfill
Radioactive waste with T1/2 < 100 days	Storage on location for a maximum of 2 years	Reuse or reprocessing as conventional waste
Radioactive waste decaying below clearance levels in 50 years	Aboveground storage at COVRA	
Radioactive waste below clearance levels	-	

Table 4: Categories of radioactive waste and management facilities

4.3.e Costs for the management of spent fuel and radioactive waste: polluter pays

One of the policy principles is that the 'polluter pays' for the costs of radioactive waste management.

This is implemented as follows:

1. Some of the buildings at COVRA are "dedicated" for 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 new building for depleted uranium (VOG-2), which is paid for by Urenco. The financial construction risk is therefore taken away from COVRA.
2. Upon delivery of the waste, the supplier pays COVRA the stipulated price (contractual) tariff, which serves to cover the costs arising from the services over the entire management cycle (from transport, processing, storage to final disposal) on the basis of 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. COVRA thus mitigates the risks that could arise from a possible future bankruptcy of waste producers.

4.3.f Evidence-based and documented decision-making processes

The reversible structuring of the process for (definitive) disposal will relieve future generations from the burden of decisions taken in the past. This means that during the entire process of preparation for disposal, realisation of the disposal facility and actual disposal of the waste, consideration will have to be given to whether the step should be taken, or whether a step back should be taken in the process.

4.4 Transboundary movement

The Netherlands, as a member state of the European Union, has implemented in its national legislation Council Directive 2006/117/Euratom.

Under these regulations exports of radioactive waste require a license to be issued by the ANVS and imports require approval by the ANVS. License applications for a transboundary shipment of radioactive waste must be made to the ANVS using the standard document laid down in Council Directive 2006/117/Euratom. After 6 February 2018, with the implementation of the Council Directive 2013/59/Euratom (European Basic Safety Standards), also the import and export of NORM-waste falls within the scope of Council Directive 2006/117/Euratom.

The export of spent fuel is not considered to be export of radioactive waste, but does fall within the scope of Council Directive 2006/117/Euratom. The export of spent fuel (destined for reprocessing) therefore requires a license issued by the ANVS.

In addition to the import or export license, a transport license is required based on the Dutch Nuclear Energy Act. The transport shall be in compliance with the international transport regulations covering aspects such as transport safety, radiation protection and package design. Finally, physical protection measures are required based on the IAEA Convention of Physical Protection of Nuclear Material and Nuclear Facilities (CPPNMNF) to which the Netherlands is a party.

E. National Framework (Article 5)

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;
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 licence 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 licence 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 licence 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.

5.0 Overview of national legislative framework

Simplified representation of the hierarchy of the legal framework for applications of nuclear technology

The legal framework in the Netherlands with respect to nuclear installations can be presented as a hierarchical structure (Figure 5).

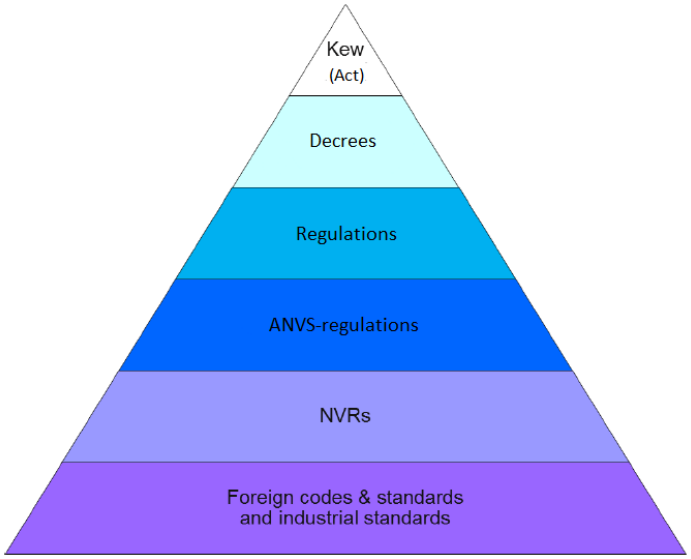


Figure 5: Dutch legal framework in a hierarchical structure

Several laws apply to the governance of radioactive waste and spent fuel. The Nuclear Energy Act (Kew[13]) is the most prominent law governing nuclear safety and radiation protection and the proper management of these materials. It 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.

Other important acts are:

- Environmental Protection Act ('Wet milieubeheer', Wm)
- General Administrative Act ('Algemene wet bestuursrecht', Awb)
- Act on Liability for Nuclear Accidents ('Wet aansprakelijkheid kernongevallen', WAKO)
- Water Act ('Waterwet', Ww)
- Environmental Planning Act ('Wet algemene bepalingen omgevingsrecht', Wabo)

Subordinate to the Nuclear Energy Act, a number of Decrees have been written with additional regulations related to the use of nuclear technology and materials and are updated in the light of ongoing developments. For the management of spent fuel and radioactive waste, in particular the following governmental decrees are relevant:

[13] Dutch: KEW, 'Kernenergiewet', Nuclear Energy Law.

- The Decree on Basic Safety Standards Radiation Protection (Bbs[14]) lays down the most important rules for handling radioactive waste;
- The Nuclear Installations, Fissionable Materials and Ores Decree (Bkse[15]) lays down the most important rules for handling spent fuel;
- The Transport of Fissionable Materials, Ores and Radioactive Substances Decree (Bvser[16]) regulates the transport of spent fuel and radioactive waste;
- the Radioactive Scrap Detection Decree[17] lays down rules for detection of radioactive scrap.

At a lower level there are the regulations[18]. These can be issued by the minister responsible for conducting the regulatory process under the Nuclear Energy Act.

Since August 1st 2017 the ANVS has been established as an independent administrative authority, which is authorized to issue not only NVRs based on IAEA Safety Standards, but also 'ANVS-regulations'. These will be issued if:

- guidance or rules are needed on technical or organisational issues;
- guidance or rules relevant to nuclear safety, radiation protection and security are needed; and
- Decrees or regulations refer to guidance to be provided in ANVS-regulations.

In the hierarchy of the legal framework the ANVS-regulations are positioned between the regulations and the NVRs.

The Nuclear Safety Rules (Dutch: NVRs[19]) are based on IAEA Safety Standards. The Nuclear Energy Act (Article 21 section 1 of the Kew) provides the basis for this system of more detailed safety regulations concerning the design, operation and quality assurance of (mainly) nuclear power plants. In the current NVRs, which also are contained in the license of NPP Borssele, the WENRA Reactor Safety Reference Levels published in 2008 have been implemented. Implementation of the WENRA SRLs published in 2014 is ongoing.

The Netherlands has a diverse nuclear programme with different nuclear installations but it is also a small programme with just one installation of each kind; a nuclear power reactor, a permanently shut down nuclear power reactor in 'Safe Enclosure', three research reactors (of which one is in decommissioning), hot cell facilities, radiological laboratories, an enrichment plant and a central national radioactive waste storage facility. Because of this diversity and to allow maximum flexibility, specific requirements are listed in the license, tailored to the characteristics of the installations, rather than in general ordinances. In the licenses, NVRs can be referred to as well as to other codes and standards.

[14] Dutch: Bbs, 'Besluit Basisveiligheidsnormen Stralingsbescherming'.
[15] Dutch: Bkse, 'Besluit kerninstallaties, splijtstoffen en ertsen'.
[16] Dutch: Bvser, 'Besluit vervoer splijtstoffen, ertsen en radioactieve stoffen vervoer splijtstoffen, ertsen en radioactieve stoffen'.
[17] Dutch: 'Besluit detectie radioactief besmet schroot'.
[18] Dutch: MR, 'Ministeriële Regelingen'.
[19] Dutch: NVR, 'Nucleaire Veiligheids Regels'.

Legal framework within which the RB functions

For the purpose of this report, the RB is the authority designated by the government as having legal authority for conducting the regulatory process, including issuing authorizations, supervision and enforcement and thereby regulating nuclear safety, radiation protection, radioactive waste management, transport safety, security and safeguards. In 2015, various entities that formerly constituted the RB, have largely merged into one entity, the newly established Authority for Nuclear Safety and Radiation Protection, ANVS[20]. The ANVS brings together expertise in the fields of nuclear safety and radiation protection, as well as security and safeguards.

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 authority (Dutch acronym: ZBO). The ANVS as a ZBO is independent in its functioning and organising its activities, but a Minister remains politically responsible for its functioning and he or she is accountable to the Parliament.

The tasks of the ANVS can be summarised as follows:

- preparing legislation, regulations and policy (including the national programme);
- awarding licenses as well as the accompanying review & assessment and evaluation tasks;
- supervision and enforcement;
- informing and communicating to interested parties and the public;
- participating in activities of international organisations;
- maintaining relationships with comparable foreign authorities and national and international organisations;
- supporting national organisations with the provision of knowledge;
- having research in support of the implementation of its tasks.

For more information on the organisation and functioning of the RB, see section F.

Primary legislative framework: acts

Nuclear Energy Act (Kew)

With regard to nuclear energy, the purpose of the Nuclear Energy Act according to its Article 15b is to serve the following interests:

- the protection of people, animals, plants and property;
- the security of the State;
- the storage and safeguarding of fissionable materials and ores;
- the supply of energy;
- the payment of compensation for any damage or injury caused to third parties;
- the observance of international obligations.

[20] Dutch: ANVS, 'Autoriteit Nucleaire Veiligheid en Stralingsbescherming'.

Three areas of application
As far as nuclear installations are concerned, the Nuclear Energy Act covers three distinct areas related to the handling of fissionable materials 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 fissionable 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 fissionable materials and ores. The Central Import and Export Office, part of the Tax and Customs Administration of the Ministry of Finance, is responsible for maintaining the register.

(2) A license is required in order to transport, import, export, be in possession of or dispose of fissionable materials and ores. This is specified in Article 15, sub (a) of the Act. The licensing requirements apply to each specific activity mentioned here.

(3) Licenses are also required for construction, commissioning, operating, modifying or decommissioning nuclear installations (Article 15, sub b), as well as for nuclear driven ships (Article 15 sub c). To date, the latter category has never been of any practical significance in the Netherlands.

General Administrative Act (Awb)
The General Administrative Act sets out the procedure for obtaining a license, and also describes the role played by the general public in this procedure (i.e. objections and appeals). It also details the general procedures for the oversight and the enforcement, and - related to the latter - the possible sanctions. This act applies to virtually all procedures under any act, including the Nuclear Energy Act.

In the Government Gazette, as well as in the national and local press, notice must be given of the publication of a draft decision to award a license to a facility (e.g. for waste management). At the same time, copies of the draft decision and of the documents submitted by the applicant must be made available for inspection by the general public to enable them to express their opinions. All opinions submitted are taken into account in the final version. Stakeholders that have submitted an opinion to the draft decision are 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.

Environmental Protection Act (Wm)
In the case of non-nuclear installations, this act regulates all environmental issues (e.g. chemical substances, stench and noise). In the case of nuclear installations, the Nuclear Energy Act takes precedence over the Wm and regulates both conventional and nonconventional environmental issues.

In compliance with the Environmental Protection Act and the Environmental Impact Assessment Decree, the licensing procedure for the construction of a nuclear installation (including a waste management facility) includes a requirement to draft an Environmental Impact Assessment (EIA) report. In certain circumstances, an EIA is also

required if an existing plant is modified. A permanent committee, 'Commissie m.e.r.', can be consulted for advice to the RB on the desirability of an EIA procedure and on the requirements to be imposed on the EIA-report to be prepared by the licence applicant.

The general public and interest groups often use the EIA as a means of commenting on and raising objections to decisions on nuclear activities. This clearly demonstrates the value of these documents in facilitating public debate and involvement.

Secondary regulatory framework: Governmental Decrees, subordinate to the Nuclear Energy Act

As described above, a number of decrees subordinate to the Nuclear Energy Act have been issued. These contain additional regulations and are continuously updated in the light of ongoing developments. The most important of these degrees in relation to the safety aspects of nuclear installations and radioactive materials are described in somewhat more detail below, including: the Decree on Basic Safety Standards for Radiation Protection (Bbs), the Nuclear Installations, Fissionable Materials and Ores Decree (Bkse) and the Transport of Fissionable Materials, Ores, and Radioactive Substances Decree (Bvser).

The Nuclear Energy Act and the above mentioned decrees are fully in compliance with European Council Directives like:

- Council Directive 2009/71/Euratom, establishing a Community framework for the nuclear safety of nuclear installations.
- Council Directive 2011/70/Euratom, establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste.
- Council Directive 2013/59/Euratom laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation.
- Council Directive 2014/87/Euratom amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations.

Decree on Basic Safety Standards Radiation Protection (Bbs)

The Netherlands has transposed Council Directive 2013/59/Euratom, laying down basic safety standards for protection against the dangers arising from exposure to radiation, in its national legislation. On 6 February 2018, the Decree on Basic Safety Standards for Radiation Protection (In Dutch: "Besluit basisveiligheidsnormen stralingsbescherming") and its underlying regulations: 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"), and ANVS-regulation on Basic Safety Standards for Radiation Protection (In Dutch: "ANVS-Verordening basisveiligheidsnormen stralingsbescherming") have come into force.

The implementation lead to the introduction of a situation based approach (planned, emergency and existing situations). Another change was the 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.

Nuclear Installations, Fissionable Materials and Ores Decree (Bkse)
The Bkse and licensing construction, commissioning & operation of a nuclear reactor
The Nuclear Installations, Fissionable Materials and Ores Decree, regulates activities (including licensing) that involve fissionable materials and nuclear installations. The Bkse sets out additional regulations in relation to a number of areas, including the licence application for the construction, commissioning and operation of a nuclear reactor, and associated requirements. According to its Article 6, applicants are required to supply the following information to the RB:

- a description of the site where the plant is to be located, including a statement of all relevant geographical, geological, climatological and other conditions;
- a description of the installation, including the equipment to be used in it, the mode of operation of the installation and the equipment, a list of the names of the suppliers of those components which have a bearing on the assessment of the safety aspects, and a specification of the installation's maximum thermal power;
- 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 in the installation at any one time;
- a description of the way in which the applicant intends to dispose of the relevant fissionable materials after their use;
- 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);
- a global description of plans for eventual decommissioning and its funding, in line with the recently established ordinance on shutdown and decommissioning.

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

The Bkse requires the LH of nuclear installations to have a decommissioning plan during the lifetime of the facility and submit it to the authorities for its evaluation and decision on approval. The plan shall be periodically (every five years) updated. The Bkse specifies the minimum requirements on the content of the decommissioning plan. The decommissioning plan (1) serves as the safety-basis for all the activities carried out during the decommissioning phase, and (2) it provides the basis for the calculation of the necessary financial provisions for the decommissioning costs.

LHs of nuclear reactors are required to provide a financial security plan for the costs of decommissioning, to update and submit it to the authorities at least every five years for approval. The LH is in principle free to choose the form of the financial provision. Upon approval, the authorities will assess whether the financial plan offers sufficient security for covering the decommissioning costs at the moment of decommissioning.

Modification of the regulation, aiming at the extension of this financial requirement to license holders of non-nuclear facilities (for instance companies operating cyclotrons), is currently being drafted.

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

Regulations and guides issued by the Regulatory Body: ANVS-regulations and NVRs
As explained above, the ANVS can issue ANVS-regulations that provide guidance or rules on various topics.

At a lower level there are Nuclear Safety Rules, the NVRs. The Nuclear Installations, Fissionable Materials and Ores Decree (Bkse, Article 20) provides the basis for a system of more detailed safety regulations concerning the design, operation and quality assurance of nuclear facilities, including the NVRs. These regulations are based on the Safety Standards and Guides issued by the IAEA and apply to an installation or nuclear facility as far as they are referenced in their licenses. This allows the RB to enforce the requirements of the NVRs.

At the same level as the NVRs the 'Guidelines on the Safe Design and Operation of Nuclear Reactors' – Nuclear Safety Guidelines or VOBK for short – exists. These Safety Guidelines provide new reactor license applicants with detailed insight into what the ANVS considers to be the best available technology.

WENRA Safety Reference Levels
The Western European Nuclear Regulators Association (WENRA) has introduced WENRA Safety Reference Levels (SRLs), aiming to harmonise reference levels for nuclear safety, for the safe management of spent fuel and radioactive waste and for decommissioning. In the framework of radioactive waste management, especially the WENRA reference levels for storage of radioactive waste and spent fuel and for decommissioning are relevant; they have impact on how waste management and decommissioning is addressed in the Dutch regulatory framework. 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.

The Netherlands participates in the WENRA Reactor Harmonisation Working Group and the WENRA Working Group on Waste and Decommissioning.

National safety requirements and regulations for radiation safety

This section details the requirements in the regulatory framework with respect to radiation safety as far as it is relevant for the handling of SF and / or radioactive waste.

General requirements

The Nuclear Energy Act (Kew), together with The Decree on Basic Safety Standards for Radiation Protection (Bbs), provides for a system of general goal oriented rules and regulations. The Bbs also regulates general radioactive waste requirements, and prescribes that radioactive material for which no further use is foreseen is declared as radioactive waste.
Besides this, the Bbs stipulates that an authorized user of radioactive material is allowed to transfer radioactive material without a license in only a limited number of ways:

if the material is not declared as waste:

- if the activity or the activity concentration is below the exemption/clearance levels, as applicable;
- in the case of sealed sources, if return of the source to the manufacturer or supplier of the source if possible;
- 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.

If radioactive material is declared as waste:

- the waste should be transferred to: a recognised waste management organisation. COVRA is the only recognized organisation for the collection, treatment and storage of radioactive waste;
- for NORM subject to notification: by transfer to one of two licensed designated landfills for the collection of radioactive waste.

The underlying philosophy for the choice for one central storage facility is that, because of the relatively small amounts of waste to be managed, only a centralised approach can ensure an adequate level of professionalism in the management of the waste. Furthermore, the demands for conditioning and packaging are unequivocal and therefore more easily to manage and enforce. Consequently, most requirements are established in the license of COVRA and few specific rules exist for spent fuel and radioactive waste management facilities.

Radiation safety requirements

The radiation safety aspects during operations in the spent fuel and radioactive waste management facilities of COVRA are (among others) governed by two Governmental Decrees:

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

These Decrees set the criteria for:

- standard operation;
- design base accidents;
- incidents and accidents.

Standard operation
The 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. The applicant for a licence shall provide arguments to the ANVS for the necessary justification. In order to support the justification process, the Dutch regulation features a list of already 'justified' and 'not justified practices'.

The exposure to ionising radiation should be kept As Low As Reasonably Achievable (ALARA). The ALARA-principle is recorded in the Nuclear Energy Act (Article 31), the Bbs Decree and in the Bkse Decree.

The dose limit 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, waste management facilities, isotope laboratories, sealed sources, X-ray machines, industries, etc.), thus excluding natural background and medical exposures.

The annual dose limit for public exposure is a cumulative limit that relates to the sum of the annual public exposure resulting from all practices. Since one undertaking cannot be held responsible for the contributions to public dose resulting from practices performed by other undertakings, national policy is that a maximum of one-tenth part of the cumulative dose limit is assigned to the undertaking applying for authorization of a practice. As a result, the authorized undertaking is obliged to ensure that the effective dose of a member of the public does not exceed the value included in the licence or registration. An application for authorisation will always be refused if the practice results in an effective public dose higher than 0.1 mSv per year.

An employer of a facility where workers can be exposed to ionising radiation is required to classify persons as radiation workers in one of the categories A or B for individual monitoring and supervision purposes. Category A workers are likely to receive doses greater than three-tenths of the dose limit for workers (6 mSv per year for whole body exposure). The employer shall ensure these workers are subject to medical surveillance and an individual monitoring programme arranged in accordance with requirements of the Bss. Category B workers are likely to be exposed during their work to radiation greater than the dose limit for members of the public (1 mSv per year for whole body exposure), but less than 6 mSv per year. The employer of a category B worker shall ensure that these workers are covered in an individual monitoring programme.

Incidents and accidents
Bkse specifies probabilistic acceptance criteria for individual mortality risk and societal risk. The maximum permissible level for the individual mortality risk (i.e. acute and/or late death) has been set at 10^{-5} per annum for all sources together and 10^{-6} per annum for any single source. These numerical criteria were developed as part of general Dutch risk management policy in the late eighties. Based on an average annual mortality risk of 10^{-4} per annum for the least sensitive (highest life expectancy) population group (i.e. youngsters around 12 years old) from all causes, it was decided that any industrial activity should not add more than 1% to this risk. Hence, 10^{-6} per annum was selected as the maximum permissible additional risk per installation. Furthermore, it is assumed that nobody will be exposed to more than 10 installations and the permissible cumulative individual mortality risk is therefore set at 10^{-5} per annum.

Where severe accidents are concerned, not only the individual mortality risk must be considered but also the group risk (societal risk). In order to avoid large-scale disruption to society, the probability of an accident in which at least 10 people suffer acute death is restricted to a level of 10^{-5} per year. If the number of fatalities increases by the factor of n, the probability should decrease by a factor of n^2. Acute death means death within a few weeks; long-term effects are not included in the group risk.

Safety assessments
The license application for a waste storage facility shall include a safety assessment.

The assessment shall demonstrate that criteria for individual risk and societal risk (mentioned above) are met. The license usually includes a requirement to periodically update the assessment.

Furthermore, the assessment shall include the evaluation of a set of Design Base Accidents (DBAs), for which protection is included in the design of the facility.

The Bkse Decree specifies that the risks due to DBAs should be lower than the values given in Table 5.

Frequency of occurrence (F) per year	***Maximum permissible effective dose (E, 50 years)***	
	Persons of age ≥ 16	Persons of age < 16
$F \geq 10^{-1}$	0.1 mSv	0.04 mSv
$10^{-1} > F \geq 10^{-2}$	1 mSv	0.4 mSv
$10^{-2} > F \geq 10^{-4}$	10 mSv	4 mSv
$F < 10^{-4}$	100 mSv	40 mSv
An additional limit of 500 mSv thyriod dose (H_{th}) must be observed in all cases. Non-compliance with the values in the table is a reason for refusing a licence.		

Table 5: Set of safety criteria related to postulated Design Base Accidents for nuclear facilities

5.1. Member states shall establish a national legislative, regulatory and organization framework (national framework)

5.1.a National programme for the implementation of the policy on the management of spent fuel and radioactive waste – provisions in a legal framework

According to articles 11 and 12 of the Council directive 2011/70/Euratom a national programme has been drafted[21]. Both the public and the Netherlands Commission for Environmental Assessment have been consulted on the draft national programma. The redraft has been approved by the Council of Ministers and subsequently the concept has been submitted to the Parliament.

This section does not provide a description of the content of the national programme. The legal framework with its provisions relating to the implementation of the national policy via a national programme is already described in section 5.0.

More information about the national programme in this report is available in section A and D.

5.1.b National arrangements for the safety of the management of spent fuel and radioactive waste

See the previous section. Apart from the legal instruments mentioned there are no national arrangements.

5.1.c A system of licensing of spent fuel and radioactive waste management activities

Licensing Procedures

The procedures to obtain a license under the Nuclear Energy Act (and other acts) follow the guidelines specified in the General Administrative Act (Awb). These procedures allow for public involvement in the licensing process. Any stakeholder is entitled to express his views regarding a proposed activity. If the Environmental Protection Act also applies, everybody may express his or her view. The RB shall take notice of all views expressed and respond to them with careful reasoning. If a member of the public is not content with the reply, the RB can be challenged in court.

Article 15b of the Nuclear Energy Act enumerates the interests for the protection of which a license may be refused (listed above in the section on Article 19.1, sub c). 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, related to the subject of the license condition, as set by the competent RB.

Construction licenses / operating licenses

The Nuclear Energy Act distinguishes between construction licenses and operating licenses. A license to build an installation is issued separately from any license to

[21] https://english.autoriteitnvs.nl/documents/report/2016/08/09/the-national-programme-for-the-management-of-radioactive-waste-and-spent-fuel

actually operate it. However, the licensing of construction of a nuclear power plant or other nuclear installation involves much more than the construction work.

Account must be taken of all activities to be conducted in the installation, during and after its construction. This means that the authorities needs 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 that are to be conducted in the installation.

In practice, the procedure for issuing a license to operate an installation will be of limited scope, unless major differences have arisen between the beginning, the completion of construction work and the commissioning. For example, there may be a considerable difference between the Preliminary Safety Analysis Report (which provides the basis for the construction license) and the Final Safety Analysis Report (for the operating license).

Views on matters of environmental protection may also have changed over the intervening period.

Process and system for relicensing / license renewal
Some changes in installations and procedures do not require a license renewal, and others do.

In the case of very minor modifications, the LH may use a special provision in the Act (Article 17 section 4) that allows such modifications to be made with a minor license change. This instrument can only be used if the consequences of the modification for individuals, society and the environment are within the limits of the license in force. The notification is published and is open to appeal.

With modifications that are not considered minor by the RB, license renewal is needed. The LH will have to update its Safety Analysis Report and supporting documents and submit these to the RB for regulatory review. Under certain circumstances described in the annexes C and D of the EIA Decree, there is also an obligation to conduct an EIA. As with any license application, public can express its views as is the case with ‘normal’ license applications.

Decommissioning
For the decommissioning of nuclear facilities a license is required in a similar way. The requirements to the application are specified in the Bkse Decree and associated subordinate regulation.

Technical advances urging chance of license conditions
A special possibility for the RB provided for by Article 18a of the Nuclear Energy Act, is to change the conditions in a license because of numerous technical advances or new possibilities to protect the population that have become available since the original license was issued.

Prohibition to operate a facility without a license

Article 15, sub b of the Nuclear Energy Act constitutes an absolute prohibition to construct, commission, operate, decommission or modify a nuclear facility, including a spent fuel or radioactive waste management facility, without a license.

Environmental Impact Assessment, Safety Assessment, and processing comments of stakeholders

Under certain circumstances together with a license application, it is compulsory to conduct an Environmental Impact Assessment or EIA (Dutch: milieu-effectrapportage, m.e.r.). It is for instance compulsory for all new reactors with a thermal power higher than 1 kW. The Netherlands has a permanent commission, the Commission for Environmental Impact Assessment ('Commissie voor de m.e.r.') that advises the RB on the requirements of all EIAs conducted in the Netherlands, including those related to nuclear facilities.

The EIA-procedure (chapter 7 of the Environmental Management Act) is:

- The initiator notifies the competent authority of his intention.
- The public can express its view on the scope of the envisaged EIA.
- An independent external committee advises on the content of the EIA for the initiative, taking into account the views of the public.
- The competent authority draws up a memorandum on the scope and the level of detail to be developed in the EIA, taking into account the views of the public.
- The initiator draws up the EIA.
- The independent external committee advices on the environmental report in relation to the memorandum on the scope and level of detail and the views of the public.

Prior to the license application, the RB and the initiator enter into a stage of informal dialogue. During this stage, the concept for the application, the EIA (if applicable), and the Safety Assessment Report (SAR) are reviewed.

The initiator submits the application and the documents (including the EIA if applicable) and information pertaining to it. The RB assesses the application and draws up a draft decision. The public can express its views on the draft, and, if applicable, on the EIA.

Subsequently the RB draws up the final decision taking into account the submitted views. Finally, interested parties can lodge an appeal at the Administrative Law Judicial Division of the Council of State.

The RB will consider all views expressed by the public. When appropriate, it will group the views into a number of unique topics/views. The RB then will respond to all unique views and all responses are recorded with the documentation of the definite license.

Common responses of the RB include elaborations on policies, (assessment) techniques or other issues that need clarification.

5.1.d System of inspections, audits, assessments and evaluation

See section 5.1.e.

5.1.e Institutional control, regulatory inspection and documentation and reporting

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[22] 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 LH 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 LH is conducting its activities in accordance with its QA system;
- to check that the LH is conducting its activities in accordance with the best technical means and/or accepted industry standards.

Inspection activities are supplemented by international safety review missions. An important piece of information for inspection is the safety evaluation report, which is to be periodically updated. In this report the LH 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. Dependent 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 requires continuous improvement of (nuclear) safety and the execution of periodic safety reviews. In line with this, the LH of the spent fuel and radioactive waste management facility (COVRA) carries out periodic safety reviews as required by the 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 an 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.

[22] Dutch: 'Besluit aanwijzing en taakvervulling toezichthouders Kernenergiewet'

Enforcement actions

If the ANVS identifies serious shortcoming in the actual operation of an installation or in an activity, the ANVS is empowered to take all measures as deemed necessary. The ANVS may modify, add or revoke restrictions and conditions in the license in order to protect man and environment. The ANVS is even empowered to withdraw the license, if this is required in order to protect those interests. Regulations offer to the ANVS the possibility of using administrative enforcement, sometimes with a reference to the Wabo.

The General Administrative Law Act (Awb) provide a further description of 'Order subject to administrative enforcement' granting the authority the power to impose an administrative enforcement order subject to a penalty.

Article 18a of the Nuclear Energy Act empowers the ANVS to compel the LH 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 even better protect the population have become available since the license was issued.

The ANVS has published its 'Oversight and Intervention Strategy' on its website in 2017 to inform all LHs. Among others the strategy describes the means of intervention available, a set of administrative proceedings and criminal proceedings. Also in these administrative proceedings a graded approach is applied starting with formally addressing the LH, placing the LH under intense supervision, imposing an order subject to a penalty for noncompliance, an administrative enforcement order and finally revoking of the license. As part of the criminal proceedings, staff of the ANVS can impose a fine on a LH or prepare an official report for the public prosecutor, should the need occur.

5.1.f A clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management

The LHs hold prime responsibility for the safe management of SF and radioactive waste generated by them, as explained in section B and G. However, as soon these materials are transferred to COVRA, responsibility for safe management of the waste and SF lies with COVRA.

The RB is described in detail in the text under section F. The RB advices on policy and prepares regulation in respect of the safe management of spent fuel and radioactive waste. The RB issues licenses and ensures compliance with applicable conditions from regulations and licenses.

Almost all[23] of the waste management activities have been centralised in one waste management organisation, COVRA. After accepting the radioactive waste COVRA is responsible for all further stages of radioactive waste management including disposal. This ensures clarity on the responsibility for those stages. The central collection,

[23] NORM subject to notification is managed at one of two designated landfills.

processing and storage of radioactive waste also ensures implementation of key aspects such as environmental hygiene, cost effectiveness and industrial hygiene. In addition, COVRA collects and manages the funds for the long-term above-ground storage and final disposal.

5.1.g National requirements for public information and participation

The General Administrative Law Act (Awb) is the item of legislation that among other points regulates public interaction in the procedures. The Awb applies to the procedures of practically every law. The Awb also provides for the procedures for the publication of information about draft decisions, for example a decision to grant a licence. Such issues must be published in the Netherlands Government Gazette and in the national and local media. According to the Awb, the documentation for a licence application must be made available to the public. Every member of the public is permitted to present his or her views on the application and to demand a hearing.

In what is known as the Publication Act, specific requirements are laid down for the publication of new regulations. All new regulations are published on the Internet, in the Bulletin of Acts and Decrees and in the Government Gazette.

More information on this is also available in section J.

5.1.h Financing schemes for the management of spent fuel and radioactive waste – legal framework

Part of Dutch policy in respect of the financing of waste management is the principle of 'the polluter pays'. This principle also applies to the management of spent fuel and radioactive waste.

Legislation therefore includes requirements for governing the securing by licence holders of the financing for dismantling of their nuclear reactors.

For operators working with large volumes of scrap or with high level radioactive sources, regulations do apply for the financial security of management.

5.2 Improvement of the national framework

Operational experience, national and international

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

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

Documented decision-making processes

The ANVS has documented decision-making processes. However, the ANVS is a learning organisation and attempts to improve constantly its decision-making processes.

Technological developments and results of relevant research

The Nuclear Energy Act offers the competent RB the possibility to take the initiative to adapt the scope of a licence and the accompanying licensing conditions, if new technological insights make this necessary in the judgement of the authority.

For its policy preparation work, the ANVS uses evaluation of technological developments and other studies, often undertaken by contracted parties.

Results of self-assessments and Peer Reviews

See section L, article 14.3.

F. Competent regulatory authority

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.

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).

6.1 Competent regulatory authority - ANVS

There is one large entity, the Authority for Nuclear Safety and Radiation Protection (ANVS), and some smaller entities at other ministries that together constitute the RB.

The tasks related to radioactive waste management are largely within the scope of the ANVS only. Therefore this report often refers to the ANVS as the RB. The RB is the authority designated by the government as having legal authority for conducting the regulatory process, including issuing authorizations, inspection and enforcement and thereby regulating nuclear, radiation, radioactive waste and transport safety, nuclear security and safeguards.

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.

Legal status

The ANVS is an independent administrative authority, a so-called ZBO, with its own legal authorities. The ANVS is independent in its regulation of nuclear safety and security in the Netherlands, but the Minister of Infrastructure and Water Management (I&W) bears ministerial responsibility for the ANVS and its functioning. The legal basis for the functions of the competent regulatory authority appear in the Nuclear Energy Act, Decrees, Regulations and regulations of the RB (ANVS-regulations).

The ANVS brings together expertise in the fields of nuclear safety and radiation protection, emergency preparedness as well as security and safeguards. For each of these subjects, the ANVS is focused on preparing policy and legislation and regulations, the awarding of licenses, supervision and enforcement and (public) information. The ANVS contributes to safety studies and ensures that the Netherlands is well prepared for possible radiation incidents.

Entities of the RB

Several ministers also have responsibilities in specific areas related to the use of radioactivity and radiation under the Nuclear Energy Act, therefore there are still various organisations that together constitute the RB. However, since beginning of 2015, most of the RB staff is employed at the ANVS.

Below the status and tasks of the entities of the RB for nuclear safety and radiation protection are summarized:

- The ANVS has a staff of approximately 130 fte, to be increased to 141 (including two members of the board). Its legal authorities include licensing and independent supervision (safety assessment, inspection and enforcement) of compliance by the LH(s) and other actors with the requirements on the safety, security and nonproliferation. For some technical and organisational issues it has the authority to formulate and issue regulation (like NVRs and ANVS Guidelines). The ANVS supports the Minister of I&W in the preparation of legislation, formulating policies and regulatory requirements on nuclear safety, radiation protection, emergency preparedness, security and safeguards. Furthermore it has responsibilities

regarding public communication, international cooperation and knowledge management regarding the areas of expertise mentioned above.

- The Ministry of Social Affairs & Employment (SZW[24]) has tasks in the area of protection of the safety of workers against exposure to radiation.
- The Ministry of Health, Welfare and Sports (VWS[25]) has tasks in the area of protection of patients against exposure to radiation.
- The ministry of Justice and Security is responsible for maintaining the rule of law in the Netherlands. One of its topics is preventing crises and disasters, of which public information on crises and disasters, and regional cooperation during crises or disasters, are major themes.
- The Ministry of the Interior and Kingdom Relations. The Spatial Planning department deals with national spatial policy with the associated (legal) system responsibility and the effects on regions and areas.
- The State Supervision of Mines (SodM, part of Ministry of Economic Affairs and Climate Policy) oversees the safe and environmentally sound exploration and exploitation of natural resources like natural gas and oil.
- The Netherlands Food and Consumer Product Safety Authority (NVWA[26]) monitors food and consumer products to safeguard public health and animal health and welfare. The NVWA controls the whole production chain, from raw materials and processing aids to end products and consumption. The NVWA is an independent agency in the Ministry of Economic Affairs and a delivery agency for the Ministry of Health, Welfare and Sport.
- The Inspectorate of the Ministry of I&W (ILT[27]) has general supervision responsibilities for the compliance with the requirements of modal transport regulations.
- Minister of Defence has its inspectorate military healthcare (IMG[28]) for overseeing a healthy and safe work environment for the civilian and military staff of the Ministry of Defence. Its scope includes applications of ionizing radiation and accounting for the use of radioactive sources within the military.

Apart from the ANVS, most entities of the RB employ a limited number of staff for the Kew-related tasks.

Collaboration agreement

In addition to day-to-day contacts between the entities of the RB, there is a collaboration agreement on radiation protection between the ANVS and the policy departments and inspectorates of other ministries with tasks under the Nuclear Energy Act that are part of the RB[29]. The Cooperation Agreement for Radiation Protection (2017) describes the interaction, communication and cooperation between different parts of the RB.

The Cooperation Agreement for Radiation Protection promotes the mutual cooperation between the various parties who have statutory duties in the area of

[24] Dutch: 'ministerie van Sociale Zaken en Werkgelegenheid' (SZW), i.e. ministry of social affairs and employment.
[25] Dutch: 'ministerie van Volksgezondheid, Welzijn en Sport' (VWS), i.e. ministry of health, welfare and sport.
[26] Dutch: 'Nederlandse Voedsel en Waren Autoriteit', NVWA.
[27] Dutch: 'Inspectie Leefomgeving en Transport', ILT
[28] Dutch: 'Inspectie Militaire Gezondheidszorg', IMG
[29] Signed on 28 September 2017

radiation protection, in the light of providing adequate protection of the environment, members of the public, employees and patients in the Netherlands. The Cooperation Agreement sets out the framework for working arrangements, made between two or more parties on the basis of the Cooperation Agreement. The working arrangements relate to interdepartmental policy development and policy implementation, licensing, supervision and enforcement, communication, research and education, and participating and representation in international fora.

Advisory Board

The ANVS has 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.

The board consists of independent experts from the Netherlands and abroad. They have expertise in the areas of nuclear safety, radiation protection, security, supervision and enforcement, and public administration. The members of the Advisory Board are appointed until 30 June 2022.

6.2 Independency of the Regulatory Body regarding energy policy

The competent RB is in no way involved in the development of energy policy. Development of the energy policy is carried out by the Ministry of Economic Affairs and Climate Policy, which is not part of the RB.

Nuclear facilities - such as a waste storage facility like COVRA - operate under license, awarded after a safety assessment has been carried out. The license is granted by the ANVS under the Nuclear Energy Act. The ANVS is responsible for handling the license applications and performing related review and assessment. The ANVS is legally established as an independent regulator in the Nuclear Energy Act since August 1, 2017. The decisions taken by the ANVS on licensing, supervision and enforcement can only be overruled by the Minister if they are conflicting with the law, not on the basis of any other public interest.

The ANVS is also responsible for review and assessment activities in relation to its oversight activities.

The ANVS may seek expertise by contracting TSOs and other national and/or foreign expert organisations; this is a common practice.

6.3 Expertise and skills in nuclear safety & radiation protection at the RB

Consequences of the merger of former entities of the RB into the ANVS is a large improvement for the development and maintenance of the human resources in most disciplines. All primary functions of the ANVS benefit from that. On the other hand being a larger and independent entity, the ANVS needs to develop its secondary supporting processes.

Recently, it has been decided that the ANVS will also be responsible for assessing and advising about a number of financial issues, amongst others the financing of

decommissioning. So this discipline is being developed. For areas in which its competence is not sufficient or where a specific in-depth analysis is needed, the ANVS has a budget at its disposal for contracting external specialists.
The RB provides tailor-made training for its staff. A strategic HRM-plan is under development, including related training and qualification programmes.

Apart from the general courses, training dedicated to the technical discipline is provided. This includes international workshops, but also conferences and visits to other regulatory bodies. In addition there is information exchange through the international networks of IAEA, EU, OECD/NEA etc. To be mentioned are the contributions to WENRA, ENSREG, HERCA, WASSC, TRANSSC, NUSSC, RASSC, EPReSC, NEA/RWMC, CRPPH and several of its Working Groups.

Financial & Human Resources

From 2015 ANVS started with a dedicated budget within the national budget. The starting point of its budget was the sum of the budgets of the merged entities. The budget is awarded by the Ministry of Infrastructure and Water Management and totals € 29.1 million (2018). Of this budget about € 10.5 million is spent on contracted support provided by organisations like RIVM, GRS and NRG.

Legal powers

The statutory basis for the activities of the competent RB appears in the Nuclear Energy Act. The tasks and authorities of the authority are laid down in underlying regulations.

The correct management of the process of licensing according to the Nuclear Energy Act has been mandated to the ANVS. For more information, see section 5.1.c. The authority also formulates additional licensing conditions, at licence level, that apply alongside the rules generally applicable according to the Nuclear Energy Act. See section 5.1.c. and elsewhere.

Licences may have to be amended due to initiatives by licence holders, or as a result of new insights that force the authority to make changes. See section 5.1.c. and elsewhere.

Via enforcement procedures, if serious shortcomings are observed at a licence holder, the authority can take any measure considered necessary by the authority in that situation. See section 5.1.e.

G. License holders (Article 7)

Article 7 – Licence 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 licence holder. That responsibility can not be delegated.

2. Member States shall ensure that the national framework in place require licence 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 licence 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.

4. Member States shall ensure that the national framework require licence 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.

5. Member States shall ensure that the national framework require licence 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.

7.1 Prime responsibility for safe management of spent fuel and radioactive waste

Several legal provisions ensure that the LH is primarily responsible for the safe management of radioactive waste and spent fuel. However as soon these materials are transferred to COVRA, responsibility for safe management lies with this organisation.

The Netherlands has transposed Directive 2009/71/Euratom and Directive 2014/87/Euratom establishing a Community framework for the nuclear safety of nuclear installations. The same is valid for Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste as well as for Directive 2013/59/Euratom laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation. Articles of the Directives states that the prime responsibility lies with the LH. This includes the requirement to develop an institutional safety policy at the corporate level and pursue continuous improvement. In the regulation transposing Directive 2014/87/Euratom it has been further stipulated that the responsibility for the safety of radioactive waste and spent fuel management cannot be delegated and includes responsibility for the activities of contractors and sub-contractors whose activities might affect the nuclear safety of a nuclear installation.
A further elaboration can also be found in the Governmental Decree on Basic Safety Standards for Radiation Protection (Bbs), as the licence holder is required to keep exposure of the population and workers as a result of its activities as low as reasonably achievable. There are many regulations in the Bss that specify "The operator ensures that ..... ". The Bbs also includes requirements in respect of the competence of the operator or licence holder.

The Nuclear Energy Act (Articles 15 and 29) forbids practices with radioactive materials (including radioactive waste and spent fuel) without a proper license. During the license application procedure the prospective LH has to present, among others, a safety case, which shall be assessed by the ANVS. Once the license is issued, the LH is charged with the prime responsibility for compliance with the license and license requirements. Besides this, a number of general requirements apply for LHs.

Regarding the operation or decommissioning of a nuclear facility, a similar reasoning applies, based on Article 15b of the Nuclear Energy Act. The associated license covers both the safety of the facility as well as the safety of the waste or spent fuel.

Article 70 of the Nuclear Energy Act specifies that a license issued according to this Act is personal. In case of a license transfer this regulation requires that the new LH needs to have the necessary expertise and reliability in relation to safety. Reliability in relation to safety can also be related to financial solvency.

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 delivery of the waste the supplier pays COVRA the stipulated (contractual) tariff, which serves to cover the costs arising from the services of the entire management cycle (from transport, processing, storage to final disposal) based on the current insights. COVRA takes legal ownership and thereby the responsibility for the radioactive waste. This prevents

waste suppliers from being unable to meet their obligations in the future in the event of financial problems. COVRA thus mitigates the risks that could arise from a possible future bankruptcy of waste producers.

Producers of waste may keep radioactive material with a half-life shorter than 100 days at their own site for a maximum of two years, with the purpose to have the material decayed below the threshold limits. This would make the material suitable for reusing purposes, in which case the material is not defined as waste.

Radioactive waste policy
As already outlined in the Introduction to this report, the radioactive waste policy ties in with the policy in respect of conventional waste. In the conventional waste policy, responsibility for the sound management of the waste streams is placed primarily with the waste generator. The same applies for the management of spent fuel and radioactive waste.

7.2 Safety assessment

In section 5.1.b of this report the national regulations for the safe management of spent fuel and radioactive waste are already explained. Section 5.1.c explains the related licensing system. Appropriate control and enforcement by government are discussed in section E, article 5.1.d and 5.1.e.

A license for a 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 for its facility. The applicable parts of the IAEA Safety Standards (Safety Fundamentals, Safety Requirements and Safety Guides) must be covered or incorporated in the Safety Report (SR), which is submitted to the ANVS. 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.

After obtaining the license but before construction, the LH drafts and submits to the ANVS 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 waste management facility the LH submits the SAR with a description of the as-built facility and the results of the commissioning to the ANVS 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 fairly general and hence lack technical detail, the licensing basis for the HABOG building was based on the French state of the art for SF/HLW

storage. As an independent assessment tool for the SAR the USA ANS/ANSI standard 57-9-1992 was incorporated.

Selected items or documents in the SAR are studied in more depth, often using assessment by independent organizations. These key documents are submitted to the ANVS for approval. Other documents are submitted for information only.

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, and more limited evaluations every two years, in which the applicable basis for the licence is assessed.

Updated assessments before operation

In the Environmental Impact Assessment Decree[30], 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) is always mandatory in the cases indicated in Table 6 below.

Activities	*Cases*	*Decisions*
The creation of an establishment: a. for the treatment of irradiated nuclear fuel or high-level radioactive waste, b. for the final disposal of irradiated nuclear fuel c. solely for the final 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.

Table 6: Activities for which an Environmental Impact Statement (EIS) is mandatory

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. The most recent EIS was carried out in 2013 as a consequence of the extension of the HABOG facility and the construction of a new storage building for depleted uranium (the VOG-2).

Both the EIS of 1985 and the subsequent EIS of 1995 and 2013 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 even 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

[30] Environmental Impact Assessment Decree, Bulletin of Acts and Decrees 1999, 224.

licence. The successive annual reports of COVRA on releases and radiation levels at the fence of the facility show that this favourable situation is continuing.

In addition to the update of the EIS in 2013, in 2014 the Safety Report was updated as well.

Safety assessments of future facilities

A geological disposal facility is envisaged in 2130. Safety assessments will be carried out at that time.

7.3 Demonstration of the safety of a facility or activity during the entire lifecycle

Section 5.1.c of this report explains the applicable system of licensing. Appropriate control and enforcement by the government are discussed in 5.1.d and 5.1.e.

The Nuclear Energy Act (Article 15b) specifies that a licence is needed for the construction, operation and dismantling of nuclear installations – in other words, at the start of each phase in the entire lifecycle. Licence 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.

The obligation to carry out periodic safety evaluations as described in section 7.2 helps ensure that during the entire lifecycle, the safety of a facility is regularly demonstrated.

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

Annex 2 exemplifies how the HABOG facility at COVRA is safely managed and assessed.

7.4 Integrated Management System and quality assurance

General

Due to the limited size of the nuclear industry, it was not cost-effective to develop a specific national programme of QA rules and guidelines. As a consequence the Netherlands have relied on IAEA guidance on QA. The current guide is the IAEA GS-R-3 “The management system for facilities and activities”. The implementation of GS-R-3 has been completed at the NPP Borssele and at COVRA this process will be concluded in 2018. It is anticipated that the GS-R-3 will be replaced by another IAEA guide, considering the development of the GSR Part 2 (2017).

The Ministerial Regulation on nuclear safety in implementation of European Directive no. 2009/71, specifies in Article 5 that the licence 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.

Nuclear Safety Rule NVR GS-R-3 'The Management System for Facilities and Activities' requires that every licence holder adopts and employs a management system in which priority is given to safety. The requirements in the NVR apply to all nuclear facilities.

In the licences for installations, reference is also made to additional NVRs with more detailed requirements on the management system, adapted to what is necessary for those facilities.

License COVRA

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

The Integrated Management System (IMS) of COVRA is part of the operating license and hence is binding for the LH. 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 Integrated Management System Manual. This IMS Manual contains:

- Internal policy statements of COVRA;
- The values and expectations of senior management;
- A description of the structure of the organization;
- A description on how the management system complies with the requirements imposed on the organization;
- A description and flowchart of the processes as well as supporting information that explain how work is to be prepared, reviewed, carried out, recorded, assessed and improved.

7.5 Adequate financial and human resources at license holder

Nuclear Safety Rule NVR-GS-R-3 'The Management System for Facilities and Activities' requires of the management of the organisation that it makes available those resources needed for correctly implementing the activities of the organisation. Resources also include the financial resources. The Ministerial Regulation on nuclear safety in implementation of European Directive no. 2009/71 specifies in Article 7 that the licence 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.

Financial resources

One of the principles of the national policy for the management of spent fuel and radioactive waste is 'the polluter pays'. All costs arising from radioactive waste management must therefore be borne by the waste generator. There are private agreements (contracts) between major producers of radioactive waste and COVRA.

For the transfer of low level and intermediate level radioactive waste to COVRA, lists of charges are published at COVRA's website. Standard waste packaging is used, and for this type of waste, COVRA is paid for each waste package received. The charges already include the costs for disposal in a geological disposal facility at 2130 after aboveground storage.

With respect to the management of spent fuel and high-level radioactive waste, the operators of nuclear power plants and research reactors have jointly decided to build a special storage facility, the HABOG. This building was commissioned on the COVRA site in 2003. Both the construction costs and the operating costs are borne by the waste generators.

The charges employed by COVRA are corrected annually by the price index. Every five years, however, the charge structure is evaluated to determine whether structural adjustments are needed.

Because for the time being disposal has been envisaged following a long period of aboveground storage, the cost estimate for the construction and operation of a national disposal facility has been updated within the OPERA research programme. The funds for final disposal are managed by COVRA in a separate fund, on an account held by the Ministry of Finance.

Decommission

As a consequence of the general accepted understanding that the "polluter pays principle" applies, the operators of the nuclear reactors had made financial reservations for decommissioning. The decommissioning funds are managed by the utilities.

LHs of the NPP and RRs are required to have a financial provision to cover the costs of decommissioning, which will have to be updated and approved by the authorities every five year, when the decommissioning plan is updated. The LH is in principle free to choose the form of the financial provision. Upon approval, the authorities will assess whether the financial provision offers sufficient security that the decommissioning costs are covered at the moment of decommissioning.

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. The decision which license holders are obliged to submit a decommissioning plan is based on the nature and size of the radiological risks involved (graded approach). The obligation for financial assurance for decommissioning of major non-nuclear facilities is in a more preliminary phase and currently being investigated.

Human resources

The Nuclear Energy Act specifies that a licence application must contain an estimate of the number of staff required, and information about their tasks, responsibilities

and where applicable qualifications. The Radiation Protection Decree also imposes requirements on the competence of the staff.

The previously mentioned NVR-GS-R-3 safety rule 'The Management System for Facilities and Activities' requires from the management of the organisation that it makes the resources available needed for correctly implementing the activities of the organisation. In NVR-GS-R-3, members of staff are included among the Resources, together with such elements as infrastructure, working environment, information, knowledge and material and financial resources. With any licence application, the applicant must submit a training and education plan to the competent regulatory authority.

The above referred to requirements also apply to COVRA and its facilities for the management of spent fuel and radioactive waste. COVRA has drawn up a Staff Qualification Plan that is part of the generic 'Integrated Management System'. This plan describes the numerous aspects of human resources such as responsibilities, lines of communication, interfaces between various levels in the organisation, the required level of expertise and the requirements in terms of education and training.

An elaborated training plan ensures that sufficient numbers of trained personnel with sufficient expertise are always available. Any change to the organisation, for example to the management, must be reported to the authorities.

H. Expertise and skills (Article 8)

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.

Expertise and skills in nuclear safety & radiation protection at the RB

Consequences of the merger of former entities of the RB

The merger of several entities into the ANVS is a large improvement for the development and maintenance of the human resources in most disciplines. All primary functions of the ANVS benefit from that. On the other hand being a larger and independent entity, the ANVS needs to develop its secondary supporting processes.

Disciplines and training

The expertise of the RB spans disciplines such as radiation protection, waste management, nuclear safety, risk assessment, security and safeguards, emergency preparedness, legal and licensing aspects. Recently it has been decided that the ANVS will also be responsible for assessing and advising on a number of financial issues, amongst others the financing of decommissioning. So this discipline is being developed.

Public Communication is a discipline that is further being developed. More information on recent developments in this regard can be found in section J, article 10.1.

For areas in which its competence is not sufficient or where a specific in-depth analysis is needed, the ANVS has a budget at its disposal for contracting external specialists.

The ANVS cooperates with other national and regional authorities and organisations, like the industrial safety inspectorate, the inspectorate of health, several safety regions (including the regional fire brigades), provinces and communities, the national coordinator for terrorism and public safety, and the national crisis centre. Also, cooperation takes place with inspectorates in the domain of road transport (dangerous good transport supervision at the ILT) and the domain of air transport (safety culture/safety management).

The RB provides tailor-made training for its staff. A strategic HRM-plan is under development, including related training and qualification programmes.

Apart from the general courses, training dedicated to the technical discipline is provided. This includes international workshops, but also conferences and visits to other regulatory bodies. In addition there is information exchange through the international networks of IAEA, EU, OECD/NEA etc. To be mentioned are the contributions to WENRA, ENSREG, HERCA, WASSC, TRANSSC, NUSSC, RASSC, EPReSC, NEA/RWMC, CRPPH and several of its Working Groups.

Financial & Human Resources

From 2015 ANVS started with a dedicated budget within the national budget. The starting point of its budget was the sum of the budgets of the merged entities. The budget is awarded by the Ministry of Infrastructure and Water Management and totals € 29.1 million (2018). Of this budget about € 10.5 million is spent on contracted support provided by organisations like RIVM, GRS and NRG.

The role of the ANVS is growing. Therefore it was felt that the total number of staff to make a robust and sustainable independent authority was not yet sufficient. During

the IRRS mission of November 2014, IAEA recommended to assess the sufficiency of the staffing levels of the RB. In 2016 the tasks and costs of the ANVS were evaluated, including its required staffing level. Staff has grown the past few years from about 90 FTE to about 130 FTE, to be further increased to 141, including the two members of the board.

Expertise and skills of the licence holders

See section G, article 7.5.

Research and development activities – OPERA

The results of Research Programme Disposal of Radioactive Waste (OPERA) have been presented to the public in January 2018. The OPERA programme was coordinated by COVRA and was funded by the National Government and EPZ (50/50, total €10 million). OPERA looked at the conditions and requirements that must be set for safe disposal in Boom clay and not at specific locations. This has resulted in an initial Safety Case. An initial Safety Case is the first step towards a safety study for a possible design of a disposal facility for radioactive waste in Boom clay, which must then be supplemented and worked out step by step. The results of OPERA give an indication that a stable and robust disposal at 500 meters depth in the Boom clay in the Netherlands is possible, although there are still uncertainties that need further investigation. OPERA has included these uncertainties in a roadmap for follow-up research.

Within OPERA the expected waste inventory in 2130 is further detailed and a cost estimate has been made for the geological disposal in Boom clay (approximately 2 billion Euro, price level 2017). OPERA provides further insight into what it takes to develop a Safety Case for geological disposal, how this can be further developed and what expertise is needed in the long term to assess a Safety Case. These insights can also be used during the drafting of initial Safety Cases for disposal of radioactive waste in rock salt and Ypresian clay. The preparation of these Safety Cases is included in the roadmap for follow-up research.

With the implementation of the directive, COVRA is obliged to finance the costs incurred for future research and development for the management of radioactive waste and spent fuel by charging on these costs via its tariffs.

Before the OPERA research programme, there have been other multiyear research programmes on disposal in the Netherlands. See section K, article 12.1.f.

I. Financial Resources (Article 9)

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.

9. Adequate financial resources

As explained in sections A and D, one of the basic principles governing radioactive waste management is the 'polluter pays' principle. This principle requires that all costs associated with radioactive waste management are borne by the organisations or institutes responsible for the generation of this waste. This principle is fulfilled by the fact that COVRA includes in its charges all estimated costs for processing, storage and geological disposal, on the basis of the state-of-the-art knowledge.

After payment of the tariffs, the financial liability is transferred to COVRA. Allowance should be made for 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 storage and geological disposal. These provisions and underlying parameters are periodically reviewed.

The cost of waste management can be roughly subdivided into storage costs and the costs of geological disposal. The cost of the above-ground management of radioactive waste at COVRA is estimated at approx. €7.5-8.5 million per year (excluding transport and processing costs).

Moreover, the main producers of radioactive waste generally directly pay the construction costs of the buildings in which their waste is stored; so these construction costs are not included in the waste management tariffs. This applies for example to the HABOG and VOG-2. COVRA has several long-term contracts with major radioactive waste suppliers.

Details of the tariffs charged to small-scale suppliers are available to the public and can be viewed at COVRA's website. These tariffs are corrected annually by the price index.

Research

With the implementation of Directive 2011/70/Euratom, the obligation to add a surcharge to the tariffs of COVRA for future research of waste management has been introduced. The final goal is to acquire the financial resources and knowledge needed to have a geological disposal around 2130.

The CORA (2001) research programme produced a cost estimate for geological disposal in salt and clay strata. The cost estimate for geological disposal in Boom Clay has been updated in the OPERA research programme (approximately €2 billion). COVRA is currently working on the basis of this cost estimate for geological disposal. 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 an amount within the 25% bandwidth of the target amount.

Financial resources for dismantling nuclear installations

The Netherlands has established arrangements that require nuclear power stations and research reactors to have a dismantling plan and financial security (Nuclear Energy Act, Article 15f). The financial security must be approved by the Ministers of

Infrastructure and Water Management and Finance. The financial security guarantees that even in the event of unexpected closure of business, sufficient financial resources are available for the responsible dismantling of the installations.

Financial resources for other activities
For operators working with large volumes of scrap or highly active sources, there are statutory obligations for securing the management of these potential waste flows.

A volume of historical radioactive waste that predates the establishment of COVRA in Nieuwdorp is still present at the research location in Petten.. A project is ongoing to transfer the historical waste to COVRA (more information on this project can be found at Section A.). The costs for thistransfer are for the account of the owner of the waste, Energieonderzoekscentrum Nederland (ECN). These costs include adapting installations to make them suitable for repackaging the waste for transport, transport to third parties and treatment of the waste at third parties, transport to COVRA and the costs charged by COVRA for the storage and disposal of the waste.

As mentioned in section B, the Dutch government has recently undertaken the following actions regarding the ongoing transfer of historical waste from Research Location Petten to COVRA: it has appointed an official for stimulating cooperation and chain optimization between involved parties; installed a steering group of Director Generals of involved ministerial departments; and provided additional governmental resources (117 million euro in 2018).

One disposal facility

Due to economies of scale, it is envisioned that all radioactive waste (including high-, intermediate- and low-level radioactive waste) will be placed in a single geological disposal facility. This will make a near surface depository for intermediate and low level waste superfluous. NORM waste is safely managed as very low level waste at one of the two licensed designated landfills.

J. Transparency (Article 10)

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.

10.1 Provision of information to the public and employees

General obligations

The General Administrative Law Act (Awb) is a piece of legislation that among other things regulates the involvement of the public in the (licensing) procedures and the publication of information on decisions and decrees. See section 5.1.g of this report where this is described.

There is also a Publication Act that lays down requirements for the publication of new regulations. All new regulations are published on the Internet and in the Bulletin of Acts and Decrees and in the Government Gazette, following ratification by Parliament. Ministries can also make their own additional arrangements to improve the accessibility of their regulations.

The Dutch Government Information (Public Access) Act (Wob) specifies that information managed by public bodies is in principle open to the public. Exceptions are listed in Article 10 of the Wob, and relate to such issues as 'State Security' and confidential commercial information. The Wob specifies that authorities must make information public, unsolicited, because this is in the interests of good democratic government. According to Article 3 of the Wob, any individual may request information about an administrative issue. This information may be contained in documents in the possession of public bodies or businesses carrying out work on behalf of those public bodies.

Obligations in the field of nuclear safety and radiation protection

Council directives emphasize for provision of information to the public and employees. The transposition of Council Directive 2011/70/Euratom, establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste and of Council Directive 2013/59/Euratom laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation and of Council Directive 2014/87/Euratom amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations provides for regulations to inform the public as well as employees.

The Minister of Infrastructure and Water Management bears ministerial responsibility for the ANVS and reports to Parliament. Everything reported to Parliament is immediately available on the government website www.rijksoverheid.nl and is therefore available to any interested party.

International reports, such as this report for the Directive, the national programme and the report for the Joint Convention, are made available to any interested party via reporting to Parliament and subsequently publication on the internet.

Communication strategy of the competent regulatory authority

General communication by the competent regulatory authority fulfils the statutory requirements as described above.

The ANVS has been mandated to implement the tasks of the authority. One of the legally established tasks of the ANVS is informing and communicating to interested parties and the public. The ANVS is transparent in its communication about its strategy and decisions; decisions and background information relating to its activities are published on the website. For example, the ANVS Vision Document ('koersdocument'), the strategy for inspection and enforcement, and the policy for licensing have been published. This website is available in both Dutch and English.

More recently, the ANVS introduced a public portal on their website[31], providing information about what the government does, and what people can do themselves, in the event of a nuclear crisis or a radiation accident and, among other things, answers questions about the safety and risks of nuclear reactors. A National Crisis Plan for Radiation Incidents (NCS), and corresponding Response Plan NCS and Crisis Communication Plan NCS can also be found on the website (in Dutch).

In 2017, the ANVS and Belgium's regulatory body 'FANC' signed a cooperation protocol. With this they have reaffirmed existing agreements and, where necessary and possible, intensified existing cooperation. Because of the cross-border aspects of the security policy and public communication, both organizations attach great importance to an even better cooperation. In order to formalize, expand and concretise the existing cooperation, agreements have now been laid down in a protocol. These agreements are based on relevant guidelines from the European Atomic Energy Community, Euratom. The cooperation protocol is available on the ANVS-website[32].

Use of language
The ANVS is aware of the different backgrounds of interested groups and the public. Ministries and the ANVS often publish both easy-to-ready press releases, questions and answers, annual reports, manuals, as well as detailed specialists reports. From certain international reports, summarised versions are available (in Dutch). The majority of information addressed to the Dutch public (general public, employees of public bodies, Parliament, etc.) is published in Dutch.

The national programme for waste and spent fuel is published in Dutch and 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.

Frequency of updating the information
Information about laws, regulations, licences and related decisions is published on the government site as soon as it becomes available. In other words, this information is constantly kept up to date.

The start of licensing procedures and the related information meetings are announced in good time in major newspapers and on the Internet.

[31] Accessible through this website: www.infonucleairrisico.nl (in Dutch)
[32] https://www.autoriteitnvs.nl/documenten/publicatie/2017/09/14/samenwerkingsprotocol-fanc-%E2%80%93-anvs

Every reported incident is published on the Internet. An annual report is also submitted to the Parliament containing an overview of registered incidents at nuclear installations.

Information provision in emergencies

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. In line with the responsibility for the response in emergency situations from the government, the government is also responsible for information provision. In such situations, information provision will be undertaken in close collaboration with local governments in the threatened or affected area.

If there is a threat or an emergency situation that requires national coordination and the intervention of different Ministries, the so-called National Crisis Centre (NCC) will swing into action and establish a national crisis communication center.

The government websites contain information about the subject 'crisis'. Information can be found on many aspects of nuclear incidents. Another section of the government websites is only available during a crisis and then for example will contain a detailed list of questions and answers.

Handling non-publishable information

As is the case with all public bodies, the ANVS does comply with the requirements of The Dutch Government Information (Public Access) Act (Wob). In Article 10, the Wob offers a number of exceptions to public access to government information, as described above.

10.2 Participation by the public in decision making

Participation by interested parties via public consultation during the licensing process is laid down in the already mentioned Awb Act. Participation is also compulsory in the procedures of an environmental impact report. The environmental impact report procedure includes meetings where the licence holder, the authority (ANVS) and the public participate. The public can present its views on proposed decisions, and the competent body will respond in its rulings. There are opportunities for individual citizens to appeal, if they disagree with a decision.

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 procedures, the public is able to participate in the decision-making processes involving licensing for installations in which spent fuel and/or radioactive waste are managed. See section E, article 5.1.c., for more details on how the public is involved in licensing procedures.

Current policy does not envisage definitive disposal or site selection in the short term. A decision on disposal is envisaged around the year 2100. Therefore, at present there is no specific licensing procedure for a disposal facility yet.

For more information about decision making on disposal and public involvement in that process, see chapter 6 of the national programme. This topic is also on the agenda of the to be established Disposal Advisory Platform (DAP); see section B for more information.

K. Implementation of the national programme (Articles 11 and 12)

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.

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) a 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.

11.1 Implementation National Programme

The progress of implementation of the national programme is described below in the section on Article 12 sub a, b and d through to k. The basis for dealing with the sub-articles can be found in the national programme of the Netherlands.

11.2 Update National Programme

The Netherlands will update its national programme at least once every ten years. This complies with the regulations of the Directive.

Article 12 - Contents of national programmes

The national program is publically available and can be found in Dutch and English at www.anvs.nl. 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 the Introduction (section A) to this report 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 important milestones and their timetable appear in the national programme in paragraphs 7.1 and 7.2. These include:

- Defining criteria for the start of the first environmental impact report: the potential environmental effects of disposal must be considered in the decision making, and this will take place in the future in the form of an environmental impact report. The definition of criteria is planned for 2030.
- Reporting on the implementation of the national programme; a national report must be submitted in a three-yearly cycle to the Commission; this report is the second to be submitted to the Commission.
- The national programme is updated every ten years; the first version of the programme was submitted to the Commission in 2016.
- Drawing up a waste inventory: in the national report a waste inventory must be included. The national report will be updated every three years.
- Establishing a Disposal Advisory Platform: see section B.
- Closure of the Borssele nuclear power plant: closure of the only nuclear power plant still operational in the Netherlands is planned for 2033.

- Receipt of last waste from reprocessing of spent fuel in the Netherlands: is envisaged at the latest in 2052.

- End of period of aboveground storage at COVRA: the buildings at COVRA are suitable for safely storing the radioactive waste for the next 100 years, and thanks 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.

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

See section C of this report.

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 SF and radioactive waste appear in the national programme in section 4.3.

The Netherlands has opted for a single central organisation for the management of all spent fuel and radioactive waste, at a single location. That is COVRA. The aboveground storage buildings at COVRA comply with all applicable regulations on nuclear safety and radiation protection. The policy assumes disposal of all radioactive waste around 2130 in one geological disposal facility, with decision making envisaged around the year 2100. For that reason, no definitive choice has been made for a design or location of the disposal facility.

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

The policy is that a decision will be taken around the year 2100. In paragraph 4.3.3. of the national programme, it is said that 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, so that the retrievability of the waste (via the existing shaft) must be possible at least during the use of the disposal facility. It will be important to assess the optimum period of retrievability in due time, in order to enjoy the greatest possible profit from the advantages of retrievability and the advantages of a passive, safe (closed) disposal facility.

Until the disposal facility is definitely closed, each generation will be able to reconsider whether the disposal facility should be kept open or closed. Following definitive closure of the disposal facility, the waste will no longer be retrievable via the original shafts. Given the development of drilling techniques, it will of course at all times be possible to retrieve the waste, but the costs of retrieval could be very high.

Experiences in countries in which a waste disposal facility is already operational, can be taken into account.

The importance to preserve knowledge is fully recognized. In the National Programme it is said (in paragraph 4.3.4) that "monitoring and knowledge assurance are relevant at different moments of the process of creating a disposal facility. There are many international developments in these fields, and a great deal of progress is expected, because the first disposal facilities for high level radioactive waste have not yet been commissioned. It is important that the Netherlands remains up to date on these developments. This is achieved in the Netherlands through research, tying in with international studies and consultation groups in which the knowledge and results are shared. Annex E provides more information about monitoring, knowledge assurance and research."

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

The Netherlands has a history of several national research programmes into disposal. Two programmes from the past were OPLA[33] (1985 – 1993) and CORA[34] (1996 – 2000). The results of Research Programme on disposal of radioactive waste in Boom Clay (OPERA, 2011-2017) have been presented to the public in January 2018. More information on OPERA is available in section H.

In the past, Dutch researchers participated in experiments in Germany (in salt formations). At present there is collaboration in underground facilities in Belgium (clay).

12.1.g The responsibility for the implementation of the national programme and the key performance indicators to monitor progress towards implementation

Advice on policy and preparation of regulation for the implementation of the national programme is done by the ANVS, in its advisory role to the Minister of I&W.

The three performance indicators below show the current status of progress of the national programme:

1. Financing – the available sum for disposal must be sufficient for the preparation, construction, operation and closure of the disposal facilities.

COVRA charges a (contractual) tariff for all phases of the management of Dutch radioactive wastes, including the operational cost for disposal, with the objective of having sufficient financial resources for the operation of a GDF around 2130 . In the 7-year research programme, OPERA, an updated estimate of the cost of disposal was made. The total cost for disposal in 2130 are estimated to be 2.05 billion in 2017 Euros. At December 31, 2017, the provision for disposal at COVRA amounted €89.550.000 million.

[33] OPLA: OPberging te Land (Land-based storage)
[34] CORA: Commissie Opberging Radioactief Afval (Commission for the Storage of Radioactive Waste)

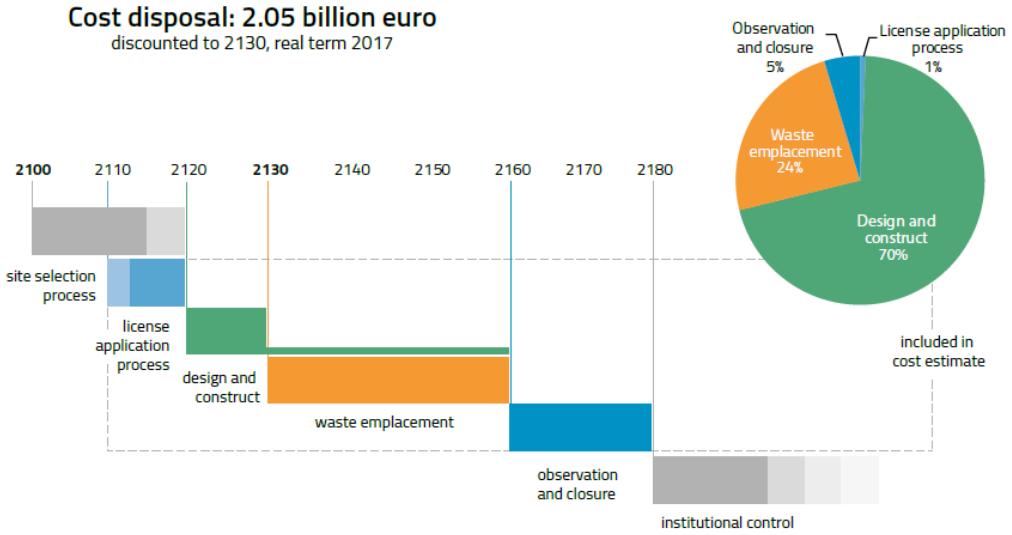


Figure 6: cost estimates of geological disposal as reported in OPERA (2017)

2. Status of action points / milestones as mentioned in nationale programme

Action points	Status
From chapter 7.1.1 of the national programme	
The transfer of historical radioactive waste from Petten to COVRA.	In progress; see section B.
Release thresholds for materials, buildings and sites.	Accomplished. The completion and publication of a guide for the release of materials, buildings and sites following dismantling of a nuclear installation was finalised by 31 December 2017.
Guide and licencing regulations for dismantling of non-nuclear applications.	In progress. A guide for dismantling of non-nuclear applications is expected by the end of 2018/beginning of 2019.
Decay storage.	Accomplished. Current practice: licence 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.
Imposing rules on import and export, storage and disposal of radioactive waste from abroad.	Policy in progress. Research has been done by the National Institute of Public Health and the Environment on secondary waste, and regulation of imports of NORM residues in surrounding countries.
Financial aspects in the decommissioning plan of a facility.	Modification of legislation for nuclear facilities is in progress. See section E, page 29. Modification of legislation for non-nuclear facilities is in a more preliminary phase and currently being investigated. See section G, article 7.5.a.
Investigating the consequences of new European basic standards on the volume of radioactive waste.	In progress. The Bbs was implemented in February 2018.
From chapter 7.1.2 of the national programme	
Environmental impact assessment of disposal	On schedule, planned to be finalised at the end of 2030.
Reporting on implementation of the national programme.	Every three years in this report.
Updating the national programme on radioactive waste.	First update of the NP is planned for 2026, ten years after the first NP.
Drawing up a waste inventory.	Accomplished. See section C.
Appointing a consultation group.	In progress. The establishment of a Disposal Advisory Platform was adopted by Parliament. See section B and M.
Analysis of online debate.	Start and frequency to be determined by the Disposal Advisory Platform.

3. Capacity of COVRA – the storage capacity at COVRA must be sufficient for the expected volume of radioactive waste in the Netherlands.

COVRA has a site available of about 25 ha at the harbour and industrial area of Vlissingen-Oost. The current storage capacity at COVRA has been dimensioned to handle the expected Dutch demand for storage capacity for the coming period of at least 100 years. Buildings are constructed in a modular fashion, so new capacity can be added when needed. In 2017, a new building for the storage of depleted uranium (VOG-2) has been constructed and commissioned (Figure 7 below).

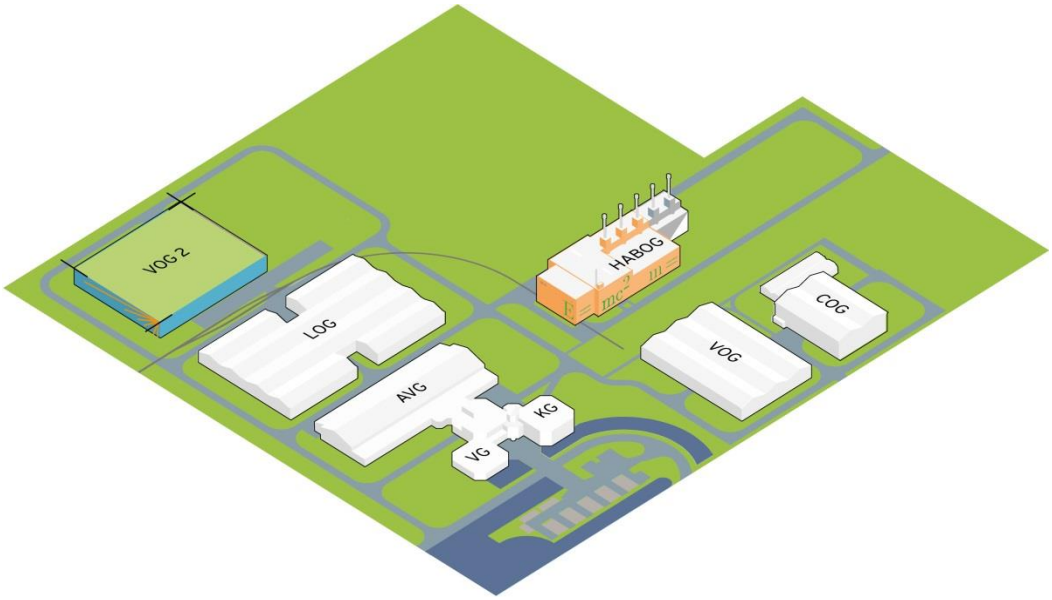


Figure 7: Map of waste management facilities at COVRA

Currently, work on the extension of the orange HLW building (HABOG) has started. When the construction is finished (2021), the capacity has increased from three to five storage modules (one spare module) for heat-generating HLW (Figure 8).

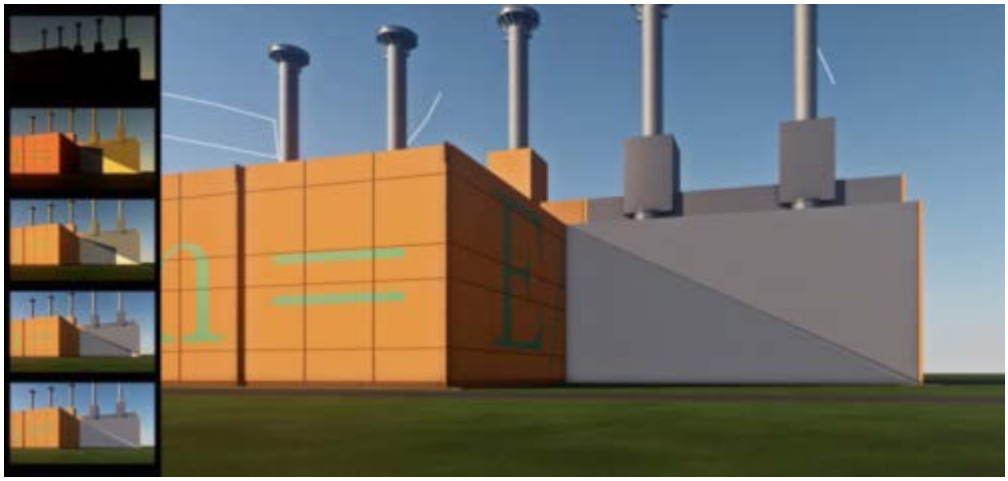


Figure 8: Visualization of extension of HABOG at COVRA.

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 I of this report.

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 section I of this report.

12.1.j A transparency policy or process as referred to in Article 10

This national report discusses transparency in section J, as well as how transparency is anchored in legislation and regulations in the communication policy of the ANVS. COVRA, an important partner to the national programme, operates a transparency policy in which communication with the public is very proactive.

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

In 2012, a treaty was signed by the Republic of France and the Netherlands that regulates the receipt and reprocessing by ORANO in France of Dutch spent fuel and the return to the Netherlands of the radioactive residues from reprocessing at the latest in 2052.

L. Peer reviews and self-assessments (Article 14.3)

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.

14.3 Results of self-assessments and Peer Reviews

Competent regulatory authority

Although there are no explicitly formulated legal requirements, current practice is that the expertise and effectiveness of the competent regulatory authority must be regularly evaluated. The resultant follow-up actions ensure that the authority remains effective.

Recently (2013 – 2014), the authority undertook a major self-assessment in the framework of an IRRS mission of the IAEA, which was concluded at the end of 2014.

The findings of this assessment supported the Dutch effort to establish a single entity for the competent RB in which all necessary knowledge and expertise about nuclear safety and radiation protection have been brought together. Prior to 2015, the tasks of the authority were undertaken by various mandated entities in different Ministries. The recommendations of the IRRS will be taken up in the framework of the ANVS. A follow-up mission of the IAEA is scheduled for November 2018 to assess how the IRRS-recommendations and suggestions have been implemented.

Representatives of the authority regularly participate in international missions (under the auspices of the IAEA) in other countries. This too contributes to broadening knowledge and understanding among the staff of the authority.

Licence holders of nuclear facilities

The Netherlands has a long tradition of Periodic Safety Evaluations, better known as ‘Periodic Safety Reviews’ (PSRs). These are largescale self-evaluations carried out by licence holders. The PSRs are assessed by the ANVS. The obligation to carry out PSRs has been included for more than 20 years in the licensing conditions, and for a slightly shorter period in guidelines drawn up by the authority. Directive 2009/71/EURATOM of 25 June 2009 on nuclear safety has also been implemented by a Ministerial Regulation, and that arrangement also includes this obligation about PSRs.

Licence holders welcome Peer Review teams with some regularity, such as those organised within the framework of WANO, or under the auspices of the International Atomic Energy Agency of the UN, the IAEA. The results of review activities under the auspices of the IAEA are always evaluated by the authority.

Peer review Joint Convention (May 2018)

The Netherlands has undergone a peer review during the sixth Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, in May 2018. Through this peer review process, the Netherlands continues to improve the levels of safety related to spent fuel and radioactive waste management. The results of the convention are summarised below.

Closed challenges relative to the previous national report to the Joint Convention (2015):

- Ensuring the availability of qualified and experienced staff at the waste management organizations and the regulatory body:
    - New staff at ANVS and COVRA
    - Staff qualification and HRM plans
    - Knowledge management
- Long-term knowledge management on radioactive waste management:
    - One central organization responsible for the whole radioactive waste management cycle
    - Quality assurance system, double archive method to preserve information
    - Research has been done to develop an initial safety case
    - International cooperation

Challenges which remained from the previous national report to the Joint Convention:

- Proceeding from storage to disposal including public acceptability
- Transfer of historical waste from Petten to COVRA

New challenges identified during the 2018 Joint Convention:

- Establishment of Disposal Advisory Platform (exact role, members, goals, research agenda)
- Further development of decommissioning policy

Areas of good performance identified during the 2018 Joint Convention:

- Establishment of ANVS as a consolidated independent regulatory body
- Integration of technical aspects and societal involvement into radioactive waste management
    - Continuation of public engagement in current storage practices
    - OPERA – research project (2011-2017); results presented at a public symposium
    - Pathfinder's report for a societal process (2018)
    - Route to disposal
- Upfront design of packages and facilities for long term storage (100 – 300 years)

M. Future plans to improve safe and responsible management of spent fuel and radioactive waste

Research

As mentioned in section H, article 8.3, OPERA provides further insight into what it takes to develop a Safety Case for final disposal, how this can be further developed and what expertise is needed in the long term to assess this. These insights can also be used during the drafting of initial Safety Cases for disposal of radioactive waste in rock salt and Ypresian clay. The preparation of these Safety Cases is also included in the roadmap for follow-up research.

Public participation

As mentioned in section B, one of the recent developments is the planned establishment of a Disposal Advisory Platform. After an exploratory phase into the role, goals and agenda of a Disposal Advisory Platform, the preparations for the establishment of the Platform have started. This group will be responsible for advising on future decision-making and participation processes in radioactive waste management during the route to geological disposal. The group is expected to be established in 2018/2019.

Action points / milestones as mentioned in nationale programme

See section K, article 12.1.g.

Annex

1. Overview matrix of liabilities and current policies and practices

Type of liability	Long-term management (LTM) policy	Funding of liabilities	Current practices / facilities	Planned facilities
SF	It is up to the licensee to decide if SF is to be reprocessed. RR-SF and HLW resulting from reprocessing of NPP-SF, are to be stored at the facilities of COVRA, the national WMO organisation. Licensees pay all-in tariffs that are determined by COVRA and which cover all expected costs of storage and disposal of radioactive waste (RW). It is envisaged that all radioactive wastes, including HLW from reprocessing and RR-SF, ultimately will be disposed of in one single geological repository.	If applicable, SF producers fund the reprocessing of SF and management of resulting wastes Via RW tariffs, LHs fund storage and disposal of their SF. Upon transferral of the waste to COVRA, all liabilities, including the responsibility for safety, are transferred to COVRA.	SF of NPP is reprocessed in France; resulting vitrified HLW stored in HABOG at COVRA. SF of RRs in dry storage in HABOG at COVRA.	A geological disposal facility is envisaged around 2130. As a result of Long Term Operation of the NPP till end of 2033 an extension of HABOG at COVRA is ongoing.
Nuclear Fuel Cycle waste	All radioactive wastes from NFC facilities 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 RW. It is envisaged that all radioactive wastes, including HLW from reprocessing and RR-SF, ultimately will be disposed of in one single geological repository.	Via RW-tariffs, LHs 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 LH to COVRA followed by storage in aboveground facilities at COVRA.	A geological disposal facility is envisaged around 2130.

Type of liability	Long-term management (LTM) policy	Funding of liabilities	Current practices / facilities	Planned facilities
Application wastes	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 RW. It is envisaged that all radioactive wastes, including HLW from reprocessing and RR-SF, ultimately will be disposed of in one single geological repository.	Via RW tariffs, LHs 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 LH to COVRA followed by storage in aboveground facilities	A geological disposal facility is envisaged around 2130.
NORM waste	Disposal of NORM waste between 1 – 10 times the clearance levels at designated landfills. For NORM waste with an activity concentration > 10 times the clearance levels: see application wastes.	Via RW tariffs, waste producers fund disposal of their radioactive wastes.	Disposal of NORM waste between 1 – 10 times the clearance levels at designated landfills.	No planned facilities.
Decommissioning Liabilities	Since 2011 it is mandatory for LHs of nuclear facilities to choose the immediate decommissioning strategy in their decommissioning plan. In exceptional circumstances, the Minister can allow different strategies. Bkse requires the LH of a nuclear facility to have and periodically (every five years) update a decommissioning plan during the lifetime of the facility and submit it to the RB for its evaluation and decision on approval. Furthermore, the LHs of nuclear reactors are required to have a	LHs of nuclear reactors are required to have Financial Guarantee (FG) to fund future decommissioning and resulting waste management costs. The Ministers of Finance and of Infrastructure & the Environment are responsible for the evaluation and approval of FGs.	LHs of NFC facilities are required to have an up-to-date decommissioning plan throughout their entire lifecycle. LHs of nuclear reactors are required to have also an updated FG.	Currently a RR (LFR) is under decommissioning. A NPP is in Safe Enclosure (Dodewaard).

Type of liability	Long-term management (LTM) policy	Funding of liabilities	Current practices / facilities	Planned facilities
	secured financial provision (Financial Guarantee, FG) to cover the costs of decommissioning (including a contingency add-on). The FG will have to be updated and approved by the authorities at least every time the decommissioning plan is updated. Ultimate responsibility rests with the LH.			
Disused sealed sources	All import, manufacturing, storage, use, export and disposal of radioactive sources needs a licence. 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 RW. It is envisaged that all radioactive wastes, including HLW from reprocessing and RR-SF, ultimately will be disposed of in one single geological repository.	HASS (High Active Sealed Sources) are regulated according to EU regulations[11], 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 envisaged around 2130.

2. Safety demonstration HABOG facility at COVRA

SF from the RRs and reprocessing residues are stored in the HABOG facility at COVRA. HABOG was commissioned in 2003. A schematic cross-section of the HABOG facility is presented in the figure 8.

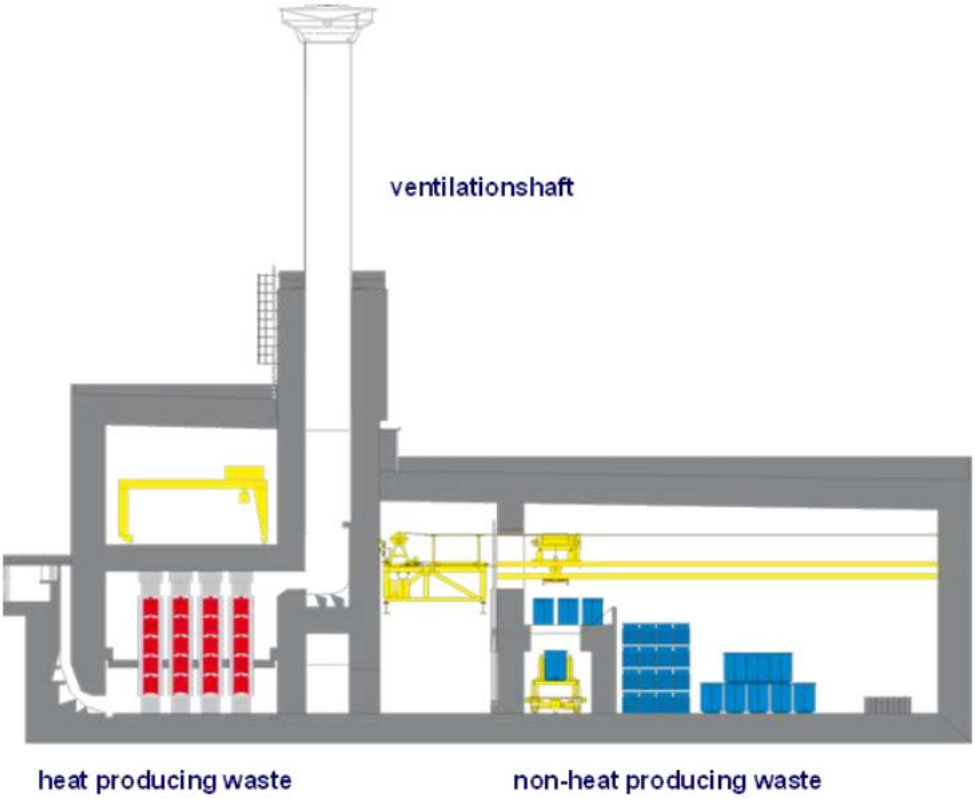


Figure 8: Cross-section of the HABOG facility

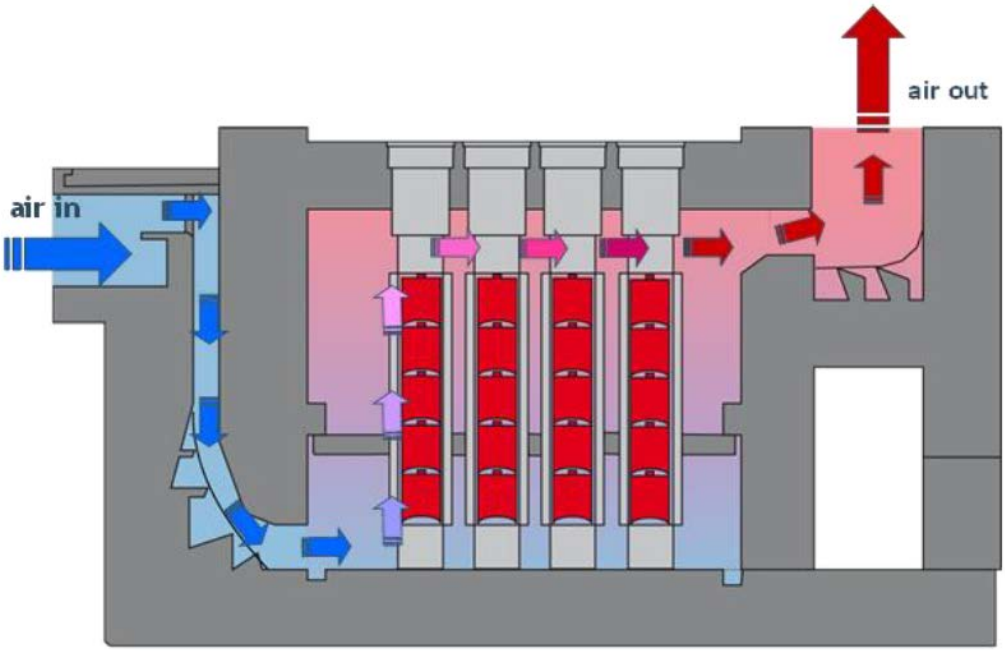


Figure 9: Storage wells for SF and HLW in the HABOG, with passive cooling

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 SF originating from the NPPs, for SF originating from the research reactors and spent uranium targets from molybdenum production. SF and spent uranium targets, and vitrified HLW are stacked on 5 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 SF, spent targets or waste canisters and the cooling air. The cooling system is based on the natural convection concept and is one of the passive safety features of HABOG. A schematic diagram of the storage compartment for SF and vitrified HLW is represented in Figure 9.

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 principles the following requirements should be fulfilled:

- *Isolation*

SF (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*

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 have to be assured as well as adequate cooling of heat-generating HLW.

It also has to be possible 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*

The containment of the storage wells, the temperature of the wells, the shielding capacity and the emissions by inspections and/or measurements have to be monitored.

These requirements have been implemented in the following ways:

- *Isolation*

The presence of at least two containment barriers between the SF/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 facility 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 flooding, fire, explosions in the facility, earthquakes, hurricanes, gas explosions outside the facility, an aircraft crash, a drop of a package from a crane etc. A stress test has been performed for HABOG in 2013.

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 k_{eff} will never exceed a value of 0.95. Permanent cooling of the canisters with SF, 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 SF/HLW will never be exceeded. The HABOG facility is laid out in such a way that there is always one spare storage compartment for each category of waste available.

- *Monitoring*

HABOG has a passive cooling system for SF 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. HABOG has also a mechanical ventilation system.

This system is designed to keep the building (except for the SF and HLW vaults) at an underpressure. 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.

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 ANVS for approval. This document demonstrated full compliance with the license and the associated Safety Report. During the first operational phase, when the storage building was accepting its SF and HLW, the ANVS closely followed the safety of the installation by inspections and assessment of the LH's periodic operation reports.

For the long-term storage phase a license condition stipulates that the safety of the installation 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 thinking 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. In the specific case of a SF and radioactive waste management facility these licenses are usually granted

by one ministerial decision. The issue of a license is conditional on a favourable outcome of the review by the ANVS of the safety assessment of the facility and on a favourable outcome of the EIA.

A safety assessment for the operation of a SF 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 ANVS that the situation as built is in accordance with the technical specifications and that the safety requirements can be met.

Technologies incorporated in the design and construction

For the HABOG technology, see the text under section 7.3. 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.

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