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

National Report of the Kingdom of the Netherlands

Fourth review conference (May 2012)

Ministry of Economic Affairs, Agriculture and Innovation

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Contents:

LIST OF SYMBOLS AND ABBREVIATIONS

Acronym	Full term	Translation or explanation (in brackets)
Awb	Algemene wet bestuursrecht	General Administrative Law Act
Bkse	Besluit Kerninstallaties, Splijtstoffen en Ertsen	Nuclear Installations, Fissionable Materials and Ores Decree
Bs	Besluit Stralingsbescherming	Radiation Protection Decree
BV	Besloten Vennootschap	Private limited company
Bvser	Besluit Vervoer Splijtstoffen, Ertsen en Radioactieve stoffen	Transport of Fissionable Materials, Ores, and Radioactive Substances Decree
BWR	Boiling Water Reactor	
BZ	(Ministerie van) Buitenlandse Zaken	(Ministry of) Foreign Affairs
COG	Container Opslag Gebouw	Container Storage Building
COVRA	Centrale Organisatie Voor Radioactief Afval	Central Organisation for Radioactive Waste
DIS	Dodewaard Inventory System	
ECN	Energieonderzoek Centrum Nederland	Netherlands Energy Research Foundation
EIA	Environmental Impact Assessment	
EL&I	(Ministerie van) Economische Zaken, Landbouw en Innovatie	(Ministry of) Economic Affairs, Agriculture and Innovation
ED	(Directie) Energie en Duurzaamheid	(Directorate of) Energy and Sustainability
EPA-n	Eenheid Planning en Advies nucleair	National Nuclear Assessment Team
EPZ	N.V. Elektriciteits-Produktiemaatschappij Zuid-Nederland	(Operator of Borssele NPP)
ERH	Energy Resources Holding	
GKN	Gemeenschappelijke Kernenergiecentrale Nederland	(Operator of Dodewaard NPP)
HABOG	Hoogradioactief AfvalBehandelings- en Opslag Gebouw	High-level Waste Treatment and Storage Building
HEU	High Enriched Uranium	
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	
IenM	(Ministerie van) Infrastructuur en Milieu	(Ministry) of Infrastructure and the Environment
ISO	International Standards Organisation	
JRC	Joint Research Centre of the European Communities	
Kew	Kernenergiewet	Nuclear Energy Act
KFD	Kernfysische Dienst	Department of Nuclear Safety, Security and Safeguards (the Netherlands)
LEU	Low Enriched Uranium	
LFR	Lage Flux Reactor	Low Flux Reactor
LILW	Low- and intermediate-level Waste	
LOG	Laagradioactief afval Opslag Gebouw	Low level Waste Storage Building
MOX	Mengoxide	Mixed Oxide
NABIS	Natuurlijke Bronnen van Ioniserende Straling	Natural Sources of Ionising Radiation
NCC	Nationaal Crisis Centrum	National Crisis Centre
NDRIS	Nationaal DosisRegistratie en Informatie Systeem	National Dose Registration and Information System
NEWMD	Net-enabled Waste Management Database of the IAEA	
NMR	Nationaal Meetnet Radioactiviteit	National radiological monitoring network
NORM	Naturally Occurring Radioactive Material	
NPK	Nationaal Plan Kernongevallenbestrijding	National Nuclear Emergency Plan
NPP	Nuclear Power Plant	
NRG	Nuclear Research & consultancy Group	
NV	Naamloze Vennootschap	Public Limited Company
NVR	Nucleaire VeiligheidsRichtlijn	Nuclear safety rule (the Netherlands)
OPERA	OnderzoeksProgramma Eindberging Radioactief Afval	National Geological Disposal Research Programme
PWR	Pressurized Water Reactor	
QA	Quality Assurance	
RID	Reactor Institute Delft	(Operator of the HOR research reactor in Delft)
RIVM	Rijks Instituut voor Volksgezondheid en Milieu	National Institute of Public Health and the Environment
SAR	Safety Analysis Report	
SF	Spent Fuel	
SZW	(Ministerie van) Sociale Zaken en	(Ministry of) Social Affairs and

	Werkgelegenheid	Employment
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material (see also NORM).	
VI	VROM Inspectie	VROM Inspectorate
VOG	Verarmd uranium Opslag Gebouw	Storage Building for Depleted Uranium
VROM	(Ministerie van) Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer	(Ministry of) Housing, Spatial Planning and the Environment
Wm	Wet Milieubeheer	Environmental Protection Act
WSF	Waste Storage Facility	(historical radioactive waste storage building at the Petten site)

Section A

Introduction

Objective of the report

On 10 March 1999, the Netherlands signed the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, which was subsequently formally ratified on 26 April 2000 and entered into force on 18 June 2001. The Joint Convention obliges each contracting party to apply widely recognized principles and tools in order to achieve and maintain high standards of safety during management of spent fuel and radioactive waste. It also requires each Contracting Party to report on the national implementation of these principles to meetings of the parties to this Convention. This report is the fourth in its series. It describes how the Netherlands meets the obligations of each of the articles established by the Joint Convention.

Structure of the report

The report follows closely the structure as suggested in INFCIRC/604/Rev.1, "Guidelines regarding the form and structure of national reports". Where appropriate, more detailed information is provided in the Annexes. This updated report has been designed to be a 'stand alone' document to facilitate peer review. Consequently, in this fourth national report the different articles from the Joint Convention are addressed as follows:

Section A – Introduction

Section B – Article 32.1, policies and practices

Section C – Article 3, scope of application

Section D – Article 32.2, inventories and lists

Section E – Articles 18 - 20, legislative and regulatory system

Section F – Articles 21 – 26, other general safety provisions

Section G – Articles 4 – 10, safety of spent fuel management

Section H – Articles 11 – 17, safety of radioactive waste management

Section I – Article 27, transboundary movement

Section J – Article 28, disused sealed sources

Section K – Planned activities to improve safety

Section L – Annexes

Overall situation

The Netherlands has a small nuclear programme with one nuclear power plant (NPP) in operation: the Borssele PWR (Siemens/KWU design, 515 MWe), operated by EPZ, in the South-West of the country. Another NPP, the Dodewaard BWR (GE design, 60 MWe), operated by GKN, in the East, was shutdown in 1997 and is now in safe enclosure, a stage of decommissioning.

Furthermore, there are two research reactors in operation: the High Flux Reactor (HFR, 50 MWth) of the EU Joint Research Centre (JRC), operated by the Nuclear Research & consultancy Group (NRG), located on the Research Location Petten and the Hoger Onderwijs Reactor (HOR, 3 MWth) at the Reactor Institute Delft (RID), located on the premises 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.

In the Eastern part of the country in Almelo are the facilities for uranium enrichment of Urenco Netherlands. Licensed capacity is currently 4950 tSW/a, but it is the intention to licence an expansion of the capacity to 6200 tSW/a by the end of 2011.

As a consequence of this relatively small nuclear program, both the total quantities of spent fuel and radioactive waste, which have to be managed, as well as the proportion of high-level and long-lived waste are modest. Most of the radioactive waste management activities are therefore centralized in one waste management organisation; the facilities of the Central Organisation for Radioactive Waste (COVRA), are located at one site in Borsele[1], in the South-Western part of the Netherlands. In this way as much benefit as possible is taken from the economy of scale. COVRA has facilities for the interim storage of conditioned low-, intermediate- and high-level waste. The latter category includes spent fuel of research reactors, waste from molybdenum production and waste from reprocessing of spent fuel of NPPs. COVRA also manages radioactive waste from non-nuclear origin. The COVRA buildings have been designed in such a way that, if necessary, the interim storage period may last for at least 100 years.

Originally the Dutch radioactive waste storage facility was located at the Research Location Petten. This explains why a certain amount of historical radioactive waste is still stored at the Petten site. Currently, the low level 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 are under investigation. It is, however, scheduled to be transferred to COVRA before 2020.

Major developments since submission of the third national report

- Since October 2010, a new government is in office. This new government has the policy that a licence to build one or more new NPPs will be granted providing that the application satisfies all the (safety) requirements. The accident in Fukushima didn't change this policy.
- In February 2011 a letter of the government was sent to the Parliament with conditions for nuclear new build (see Annex 1). The most relevant issues in this letter are: a national radioactive waste plan in 2014, the continuation of the 'polluter pays' principle, decommissioning immediately after the operating life ends, an initial decommissioning plan when applying for a license for new build, the introduction of a rise of the COVRA-tariffs in order to raise a disposal research fund, and the obligation for the licensee of a nuclear power plant to evaluate their spent fuel management strategy every 10 years. The government decided to continue the existing policy on reprocessing, allowing the licensee to decide on this. However, this policy will be evaluated every 20 years.
- In 2009 plans were revealed by company Delta N.V. for nuclear new build adjacent to the current NPP Borssele. Delta owns 70% of the current NPP but also generates power using coal, biomass, natural gas and wind. In June 2009, Delta started the EIA procedure for realising 2500 MW of new nuclear power. The EIA guidelines were established in June 2010. The licence procedure is expected to start by the end of 2012.

[1] Borsele (with one 's') is the name of the municipality in which the village of Borssele (with a double 's') is located.

- In addition in 2010 plans were revealed by company Energy Resources Holding (ERH) B.V. for nuclear new build, also at the site of the NPP Borssele. In 2010, ERH started the EIA procedure for realising 2500 MW of new nuclear power. The EIA guidelines were established in April 2011.
- A study by Arcadis commissioned by of the Minister of Economic Affairs, Agriculture and Innovation (EL&I) showed that it is not possible to build two NPPs at the same time at the site near the current NPP in Borssele. The publication of this national report to IAEA is too early to report on the proceedings regarding the applications of Delta and ERH.
- NRG has plans to replace the HFR in Petten by the PALLAS research reactor. In October 2009 a statement by the former government backed the idea of the construction of PALLAS. In November 2009 NRG started the procedure for the environmental impact assessment (EIA) with a notification of intent. The EIA guidelines were established in June 2010. In 2011 NRG will develop and test the feasibility of various financing schemes. The present report to IAEA is published too early to report on the outcome. The licence procedure has not started yet.
- In June 2006 the Dutch government signed an agreement with the owners of the Borssele NPP, which allows for operation until the end of 2033. On basis of the Nuclear Energy Act (Art. 15a) the license of the Borssele NPP will end on 31 December 2033. This postponed closure will imply the generation of an extra 30 years of waste and spent fuel, for which additional capacity at COVRA will have to be built, and for which extra capacity in the future disposal facility will have to be made. The owner of the Borssele NPP will have to pay for the additional costs.
- In the case a new NPP would be built in the Netherlands, corresponding additional storage and disposal capacity will be needed. The COVRA site allows for these expansions (although a new licence is needed).
- Following the formation of the new government a reshuffle of responsibilities and a reorganisation of tasks among several ministries took place. Relevant for this convention is that the ministries of Housing, Spatial Planning and Environment (VROM) and of Economic Affairs (EZ) were eliminated and that the new ministries of Economic Affairs, Agriculture and Innovation (EL&I) and of Infrastructure and Environment (IenM) were formed. The responsibility for all tasks of the regulatory body lies now with the minister of EL&I, whereas formerly the minister of VROM was responsible. Activities regarding licensing, coordination, contribution to legislative activities and policy development on nuclear safety and radiation protection have been moved from the former ministry of VROM to the ministry of EL&I. The activities for inspection and assessment of licensee's compliance with licensing conditions has been moved from the former ministry of VROM to the inspection of the ministry of I&M; KFD. Under the responsibility of the Minister of EL&I the KFD carries out its activities (supervision, assessment, inspection, enforcement, technical advising and support) independently.
- A proposal for a revision of the Nuclear Energy Act (Kew) was adopted by the Parliament in 2009 and came into force on 1 April 2011. The most relevant issues for this Convention are the introduction of a legal basis to a more specific regulation on decommissioning, as well as a requirement for the licensee of a nuclear facility to make available adequate financial resources for decommissioning on request. On the level of decree and ordinance this regulation is further elaborated,

stipulating requirements regarding the dismantling strategy for nuclear installations, the conduct of decommissioning and financial provisions for decommissioning. Furthermore, the licensee of a nuclear facility is made formally responsible for the timely provision of storage capacity of radioactive waste and spent fuel at COVRA. In practice it means that the licensee has to provide COVRA with the necessary financial means, allowing it to build extra storage capacity at its site.

- A new bilateral agreement between the governments of France and the Netherlands about reprocessing of spent fuel entered into force in July 2010. As a result the transports of spent fuel from Borssele to AREVA in France for reprocessing, which couldn't take place since 2006, have been resumed. The first shipment of 21 fuel elements was sent to France in June 2011.
- Uranium and plutonium from reprocessed fuel from the Borssele NPP was already reused in mixed oxide (MOX) fuel for other NPPs. The Borssele NPP applied for a licence to use MOX fuel. The licence was granted in June 2011.
- In September 2009 was the kick-off of the National Geological Disposal Research Programme OPERA. The goal of OPERA is to evaluate the existing safety and feasibility studies in safety cases for disposal in clay and rock salt formations. Results of OPERA are expected around 2016. The costs of this 10 million euro research program are divided by the nuclear industry and the government.

Main themes addressed at the third Review Conference

No specific recommendations for improvement have been made at the third Review Conference. The identified challenges focused on themes as specified below. In the report these themes will be covered in more detail.

- At the time of the third review meeting for various reasons a number of important decisions linked to nuclear energy were waiting for political approval for quite some time. The most important were a proposal to revise the Nuclear Energy Act and a bilateral agreement with France on reprocessing, both to be adopted by the Parliament. As explained above, and also in section E and B respectively, these decisions have now been approved.
- The radioactive waste policy in the Netherlands is based on the concept of long-term interim storage, for a period of at least 100 years. It was noted that the continuity of knowledge during this storage period may require that expertise will have to be hired outside the country. This will be addressed in section K.
- After the interim storage period of 100 years, geological disposal is foreseen. Given the long period, investigation efforts are currently focused on the technical feasibility of a disposal facility on our territory. With regard to the schedule for geological disposal it was noticed that no specific further milestones were indicated. This will be addressed in section B.
- It was mentioned that the increasing public awareness could lead to challenges regarding the acceptance for radioactive waste disposal. This will be addressed in section B.
- Finally, a continuous challenge was identified in maintaining and refreshing the regulatory expertise. This will be addressed in section K.

Section B

Policies and Practices

Article 32. REPORTING

1. In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:

(i) spent fuel management policy;

(ii) spent fuel management practices;

(iii) radioactive waste management policy;

(iv) radioactive waste management practices;

(v) criteria used to define and categorize radioactive waste.

32.1 (i) Spent fuel management policy

The policy in the Netherlands on spent fuel management is that the decision on whether or not to reprocess spent fuel is in the first place a matter of the operator of a NPP. In the early days the operators have decided in favour of reprocessing their spent fuel for economic reasons (and reuse of plutonium in breeder reactors). Contracts for reprocessing were concluded for all spent fuel of the NPPs until 2015. These decisions were endorsed by the government. Until now, there have not been made any decisions on reprocessing of spent fuel after 2015. It is up to the licensee to decide on this.

32.1 (ii) Spent fuel management practices

Spent fuel from the NPPs

Spent fuel from the Borssele NPP is kept in storage in the spent fuel pool at the reactor site to reduce residual heat. The design of the fuel pool complies with the provisions in NVR publication 2.1.10, which is an adaptation of IAEA Safety Series No. 50-SG-D10. This design ensures the removal of residual heat from the spent fuel, while the design of the fuel storage racks in combination with a minimum of boric acid concentration in the pool water ensures non-criticality. After a cooling period of at least 3 years (dependent on the safety requirements of the transport packages and the reprocessors' specifications), the spent fuel is transferred to La Hague (France) for reprocessing. Regular transports should ensure that the fuel pool inventory is kept to a practical minimum, as required by the plant operating licence.

But, as was mentioned in section A, since 2006 no transports from Borssele to La Hague could take place. According to the current contract between the operator of the Borssele NPP, EPZ, and AREVA, spent fuel from the Borssele NPP is sent to AREVA in France for reprocessing. The vitrified waste residues and the compacted hulls and ends from the reprocessing process are or will be returned to the Netherlands and stored at COVRA.
In July 2006 new French legislation[2] entered into force, which prescribes that a return-scheme for the radioactive waste shall be formalised at the moment the spent fuel is sent

[2] LOI no 2006-739 du 28 juin 2006 de programme relative à la gestion durable des matières et déchets radioactifs. See http://admi.net/jo/20060629/ECOX0600036L.html.

to France. This condition also applies to the spent fuel that should be sent to France under the current contract between the operator of the Borssele NPP and AREVA. As a consequence a (new) bilateral agreement between the governments of the Netherlands and France had to be concluded. The new agreement entered into force in July 2010. The transports have been resumed, the first shipment of 21 fuel elements was sent to France in June 2011. During the period between 2006 and June 2011 all spent fuel had to be stored at the fuel pool of the Borssele NPP, which capacity was used to its maximum. The resumption of the transports to La Hague will bring the fuel pool inventory of the NPP Borssele back to normal in the nearby future.

The Borssele NPP has no licence to store radioactive waste; they have a licence to store spent fuel in order to reduce residual heat. In the Netherlands all radioactive waste has to be stored on one place at the COVRA. The producer has to pay and the government takes over the responsibility.

Under previous contracts all the plutonium extracted from reprocessed spent fuel of the Borssele NPP has been sold for reuse in MOX fuel for NPPs. Reprocessed uranium is also reused in fresh fuel. The plutonium made available under the current contract will also be reused in NPPs. The Borssele NPP intends to use MOX fuel. A licence for this was granted in June 2011.

All spent fuel from the Dodewaard NPP has been removed from the site. In 2003, the last batch of spent fuel from the reactor was transferred to Sellafield (UK) for reprocessing. The separated uranium from the Dodewaard NPP has been sold to a European NPP. The separated plutonium will finally be sold to AREVA or INS/SI. The first batch has been sold to AREVA. The remaining waste returned from Sellafield to the Netherlands in April 2010, and shipped to COVRA for long-term storage.

Spent fuel from the research reactors

Spent fuel from research reactors is stored in the spent fuel pools, prior to being shipped to COVRA for long-term storage. Usually a cooling period of five years is applied before the spent fuel is transferred to COVRA. Periodic transports are arranged to ensure that the pool always has sufficient storage capacity available to accommodate all elements present in the reactor core.

Since May 2006 the HFR only uses low enriched uranium (LEU). This is in line with the worldwide move to abandon the use of high enriched uranium (HEU) for non-proliferation reasons. The last HEU fuel elements from the HFR were transported to COVRA in March 2011.

The consumption of fuel in the LFR was very low. The original fuel elements were still in use till the shut-down of the reactor in 2010. The LFR is not discussed further in this report.

In Delft at the HOR some spent fuel is stored in the spent fuel pool as well. In 1998 a conversion of HEU fuel to LEU fuel was started. With the last HEU fuel element removed from the core on 10 January 2005 the conversion was completed. The last HEU fuel elements from the HOR were shipped to COVRA in May 2011.

32.1 (iii) Radioactive waste management policy

The Dutch policy on radioactive waste management is based on a report that was presented to parliament by the Government in 1984. This report covered two items. The first concerned the long-term interim storage of all radioactive waste generated in the Netherlands, and the second concerned the Government research strategy for eventually permanent disposal of the waste.

The report led to the establishment of the COVRA in Borsele, and to the launch of a research programme on disposal of radioactive waste. Pending the outcome of research on disposal, and assurance of political and public acceptance, it was decided to construct an engineered surface-storage facility with sufficient capacity for all the radioactive waste generated in a period of at least 100 years.
By doing so the government keeps control over all the radioactive waste generated in the Netherlands, whereas in the mean time research into the best permanent solution can be done without pressure of time.

Long-term storage

The policy in the Netherlands is that all hazardous and radioactive waste must be isolated, controlled and monitored. In principle this can be achieved by storage in buildings and institutional control. It can also be achieved by shallow land burial and maintenance of a system of long-term institutional control, or by deep geologic disposal, for which institutional control is likely to be discontinued at some moment. For the options mentioned, the degree of institutional control is the highest for storage in buildings and the lowest for deep disposal. When containment is required over periods of time longer than the existence of present society can be foreseen, doubt may be raised on the capacity of society to fulfil the control requirement.

The Netherlands has a very high groundwater level, and under these circumstances shallow land burial is not acceptable for the permanent burial of low- and intermediate-level waste (LILW) and of course not for high level waste as well. Furthermore, as the Netherlands is a coastal state and the possible effects of sea level rising on the long term are largely unknown, an additional uncertainty factor would be introduced. As a consequence deep geologic disposal will be required for all waste categories as a final solution under the assumption that such a disposal is the preferred management option.

Also it should be realized that the cumulative waste volume that is actually in storage right now, is about twenty thousand m^3. For such a small volume it is not economically feasible to construct a deep geologic disposal facility at this moment. The waste volume collected in a period of 100 years was judged as large enough to make a disposal facility in the future viable. This disposal facility is intended to dispose of all types of radioactive waste, ranging from LILW to heat-generating high-level waste (HLW) since this is the only way to make a deep underground disposal facility economically feasible.

For the interim period considered, storage in buildings will be required. This creates at least five positive effects:

- There is a period of 100 years available to allow the money in the capital growth fund to grow to the desired level. This brings the financial burden for today's waste, that the generator has to pay, to an acceptable level;
- In the period of 100 years the heat-generating HLW will cool down to a situation where cooling is no longer required;
- A substantial volume of the waste will decay to a non-radioactive level in 100 years and has not to be stored in a deep underground disposal;
- In the mean time research into the best permanent solution can be done without pressure of time. And in 100 years from now new techniques or management options can become available;
- During the next 100 years an international or regional solution may become available. For most countries the total volume of radioactive waste is small. Co-operation creates financial benefits, could result in a higher safety standard and a more reliable control.

Consequently, it was concluded in the policy report of 1984 that a dedicated solution for the Netherlands is to store all radioactive waste at one place, to take over by the government the responsibility for the waste in return of a sufficient payment by the producer of the waste in order to keep control over all the radioactive waste generated in the Netherlands. Therefore the government decided to build at one location buildings specially designed for the storage of radioactive waste, to store the waste in those buildings for a period of at least 100 years and to prepare financially, technically and socially a deep disposal during this period in such a way, that it can really be implemented during the storage period. Of course at that time society will have the freedom of choice between a continuation of the storage for another 100 years, to realise the final disposal, or to use new techniques or management options that may become available during the period of interim storage.

Transparency of nuclear activities and communication to the public are the cornerstones of the chosen solution: to build confidence in the regulator and the safety of radioactive waste management; to enable a dialogue among stakeholders and/or public debate on the final disposal. Details about the communication policy are given in Annex 5.

Disposal of radioactive waste

The geological conditions in the Netherlands are in principle favourable from the perspective of disposal of radioactive waste. In the northern part of the country there are deep lying, large salt formations with a good potential as disposal site. Clay formations are ubiquitous at varying depth in the whole country. Extensions of the Boom clay, which qualifies as potentially suitable host rock for a repository in Belgium, also abounds in the south west of the Netherlands (see Figures 1 and 2).

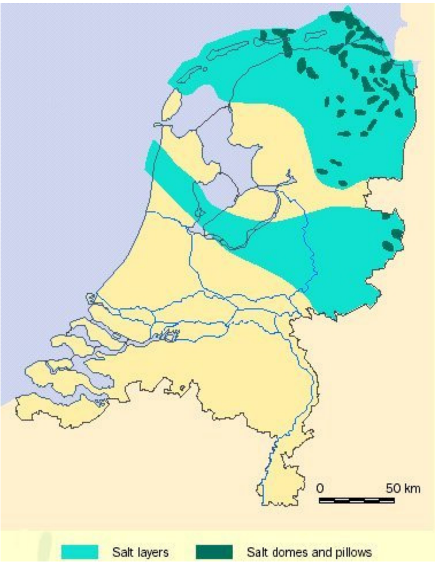


Figure 1. Distribution of salt formations

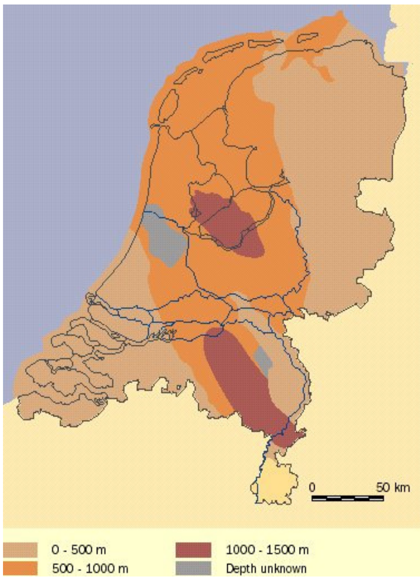


Figure 2. Distribution and depth of the Boom Clay

In 1993 a preliminary radioactive waste disposal research programme was completed, and it was concluded that there are no safety-related factors that would prevent the deep underground disposal of radioactive waste in salt. However, the level of public acceptance of underground waste disposal remained low. Progress of the disposal programme was stalled by lack of approval for site investigations in salt formations that are considered suitable for this purpose and, hence, the prospect of a waste disposal facility being available within the next few decades was remote.

In 1993 the government adopted, and presented to parliament, a position paper on the long-term underground disposal of radioactive and other highly toxic wastes. This forms the basis for further development of a national radioactive waste management disposal policy. The new policy requires that any underground disposal facility be designed in such a way that each step of the process is reversible. This means that retrieval of waste, if deemed necessary for whatever reason, would still be possible for decades up to several centuries after closing the repository, leaving the possibility to future generations to apply other management techniques, if available.

The reasons for introducing this concept of retrievability originated from considerations of sustainable development. Waste is considered a non-sustainable commodity whose generation should be prevented. If prevention is not possible, the preferred option is to reuse and/or recycle it. If this in turn is not practical, disposal of the waste in a retrievable way will enable future generations to make their own decisions about its eventual management. This could include the application of more sustainable management options if such technologies become available. The retrievable emplacement of the waste in the deep underground would ensure a fail-safe situation in case of neglect or social disruption.

Although waste retrievability allows future generations to make their own choices, it is dependent upon the technical ability and preparedness of society to keep the facility accessible for inspection and monitoring over a long period. It also entails a greater risk of exposure to radiation and requires long-term arrangements for maintenance, data-management, monitoring and supervision. Furthermore, provision of retrievability in disposal in the deep underground is likely to make the construction and operation more complex and costly.

In 1995 the so-called Commission Disposal Radioactive Waste (CORA) research programme was initiated as a continuation of former research, aiming at demonstrating the technical feasibility of a retrievable underground repository in salt and clay formations. In 2001 the programme was concluded. The main conclusions were:

- retrieval of radioactive waste from repositories in salt and clay is technically feasible. The disposal concept envisages the construction of short, horizontal disposal cells each containing one HLW canister;
- safety criteria can be met. Even in a situation of neglect, the maximum radiation dose that an individual can incur remains far below 10 μSv/year;
- structural adjustments to the repository design are required to maintain accessibility. This applies particularly to a repository in clay, which needs additional support to prevent borehole convergence and eventual collapse of the disposal drifts;
- costs are higher than those for a non-retrievable repository, mainly due to maintenance of accessibility of the disposal drifts.

Although it was not included in the terms of reference, the CORA programme also addressed social aspects in a scoping study of local environmental organisations. In particular, it considered the ethical aspects of long-term storage of radioactive waste versus retrievable disposal. The results may not be representative of the views of a broader public, including other institutions with social or ideological objectives, but some preliminary conclusions could be drawn. The following statements reflected the position of many environmental groups:

- radioactive waste management is strongly associated with the negative image of nuclear power amongst those groups. As such, underground disposal is rejected on ethical grounds since nuclear power is considered unethical. And a solution for radioactive waste could revitalise the use of nuclear power;

- permanent control by the government on dedicated surface facilities is considered as the least harmful management option, although the possibility of social instability is recognised as a liability for which no solution can be provided;
- while it is clear that widely different views exist between stakeholders, this exchange of views can be considered as the start of a dialogue, which is a prerequisite for any solution.

Because the Netherlands has adopted the strategy of storage in dedicated surface facilities for at least 100 years, there is no immediate urgency to select a specific disposal site. However, further research is required to resolve outstanding issues, to preserve the expertise and knowledge, and to be prepared for site selection in case of any change to the current timetable, arising by way of future European directives, for example. The CORA committee recommended validation of some of the results of safety studies, under field conditions, and co-operation with other countries, particularly on joint projects in underground laboratories, is foreseen in this context. As regards other technical aspects, it was recommended that attention should be given to the requirements for monitoring of retrievable repositories. Non-technical aspects also need to be addressed.

After some years of delay, in september 2009 the third national research program on radioactive waste, OPERA started. COVRA has been charged to conduct this 10 million euro research program while the costs are divided between the nuclear industry and the government. The goal of OPERA is to evaluate the existing safety and feasibility studies in a so-called safety case. The current considerations with regard to the safety of a repository for radioactive waste were made more than ten to twenty years ago and a reevaluation in the light of current knowledge was considered necessary. The results of OPERA are expected around 2016.

Together with a core group of six other European countries, the Netherlands have representatives in the ERDO (European repository development organisation) working group. The working group investigates the feasibility of establishing a formal, joint waste management organisation in Europe that can work on a multinational solution parallel to the national programmes. In parallel with OPERA, from which results are expected around 2016, the government will develop a national programme for management of spent fuel and radioactive waste, 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. This national program is expected around 2014 due to the Directive on the management of spent fuel and radioactive waste (Council Directive 2011/70/Euratom) and will be based on the existing and projected national inventory of radioactive waste and spent fuel. The national program will include:

- the overall objectives of the Dutch national policy of spent fuel and radioactive waste management;
- the significant major milestones, clear timeframes and responsibilities for the implementation and the achievement of these milestones in light of the overarching objectives of the national programme;
- an inventory of all spent fuel and radioactive wastes and estimates of future quantities, including those from decommissioning of nuclear installations and cyclotrons, clearly indicating the present location and the amount of the radioactive waste and spent fuel in accordance with appropriate classification of the radioactive waste;
- the concepts or plans and technical solutions for spent fuel and radioactive waste management from generation to disposal;

- the concepts and 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 preserve knowledge of that facility awaiting the complete decommissioning of the installation;
- the research, development and demonstration activities that are needed in order to implement solutions for the management of spent fuel and radioactive waste;
- the responsibility for the implementation of the national programme and the key performance indicators to monitor progress in the implementation;
- an assessment of the national programme costs, the underlying basis and hypotheses for that assessment, which must include a profile over time;
- the financing scheme(s) in force;
- a transparent policy or process as described in the paragraph below.

Since increasing public awareness could lead to challenges regarding the acceptance for radioactive waste disposal, it is realized that the public should be given the necessary opportunities to participate effectively in the process of decision-making on spent fuel and radioactive waste management in accordance with the national legislation and international obligations. It is also important to ensure that necessary information on the management of spent fuel and radioactive waste is made available to workers in the nuclear and related industry and to the general public. Information will 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, as layed down in national legislation or international obligations. This transparant process will also be more specified in the national programme to be published around 2014.

32.1 (iv) Radioactive waste management practices

Storage facilities

All radioactive waste produced in the Netherlands is managed by COVRA, except for radioactive waste with a half-life less than 100 days, which is allowed to decay at the sites where it is being generated. Transferral of the radioactive waste to COVRA includes transferral of the property and liabilities. The fact that COVRA takes full title of the waste is reflected in the Transfer document and laid down in the General Conditions of COVRA. COVRA operates its facilities at one single site in an industrial area in Borsele in the South-West of the country. Details about the storage facilities are given in Annex 2.

Low- and intermediate-level waste

LILW arises from activities with radioisotopes - in among others - industry, research institutes and hospitals. It includes lightly contaminated materials, such as tissues, plastic -, metal - or glass objects, or cloth. In addition, drums with waste in cement, originating from nuclear power plants, and delivered in a conditioned form to COVRA contribute to the growing amount of LILW at COVRA. In 2010 about 356 m^3 of conditioned LILW was added to the inventory, which amounted to a total of 9,854 m^3 at the end of 2010. Without correction for decay this corresponded to a total of 2076 TBq. The radioactivity is dominated by the radionuclides Co-60, H-3 and Cs-137.

As mentioned earlier, a substantial volume of the waste will decay to a non-radioactive level in 100 years. To keep track of the actual level, the radioactive content of each package is recorded in a database. Thus, the expected date at which the radioactivity has decayed below the clearance levels can be calculated. In the Netherlands the clearance levels are numerically equivalent to the exemption levels. These exemption levels have been laid down in the Euratom Basic Safety Standards [1]. Exceptions are Ra-226, Ra-228, and Co-60. The clearance levels of these radionuclides, that are applied in the Netherlands (1 Bq/g), differ from the basic safety standards (10 Bq/g).

(TE)NORM and depleted U

Waste from ores – and other raw materials – generated in processing industries sometimes have natural radioactivity concentrations far in excess of the exemption levels as specified in Table 1 of the Euratom Basic Safety Standards [1]. In case the exemption levels are exceeded by a factor of 10 in the Netherlands a licence is required. Below this factor 10 exceeding level – but above the exemption levels – a notification to the competent authority is sufficient. Furthermore, the legislation for Naturally Occurring Radioactive Material (NORM) and/or Technically Enhanced Naturally Occurring Radioactive Material (TENORM) allows a (TE)NORM generating industry – under certain conditions - to mix up naturally occurring radioactive material with other materials for recycling purposes as long as this activity does not result in an increased risk to man and environment. Mixing up NORM with the solitary aim of dilution is not allowed, only for recycling purposes.

(TE)NORM includes depleted uranium originating from the uranium enrichment facility of URENCO. The tails that remain after the enrichment process are not considered as waste as long as they are available for re-enrichment. If URENCO decides that re-enrichment is not economically feasible, the tails are converted to solid uranium oxide in France and stored at the COVRA site. The uranium oxide is stored in standardized 3 m^3 containers (DV-70) in a custom-built modular storage building. One storage module with a storage capacity of 650 containers became operational in 2004, two more in 2008 and in 2010 the construction of modules 4, 5 and 6 was started. At the end of 2010, a total of 1590 containers was kept in storage in the depleted uranium storage building (VOG).

(TE)NORM also includes waste from phosphor production with an activity between 500 and 4000 Bq/gram dominated by polonium-, bismuth- and lead- isotopes. Depending on the initial activity the material will decay to exemption/clearance levels within 100 to 150 years. So, after such a foreseen storage at COVRA as radioactive waste, the material can be disposed of as conventional waste. The waste is stored in large freight containers in a modular building specifically built for this purpose. At the end of 2010 a total of 178 containers was kept in storage in the container storage building (COG).

The quantities of NORM waste stored on other sites than COVRA are not recorded at a central level. A large quantity of this waste has radioactivity concentrations below the exemption levels, as specified in Annex 1 of the Radiation Protection Decree [2]. As far as possible this waste is reused as additives for the preparation of building materials, e.g. for road construction. Other waste, particularly mixed waste, containing both radioactive material and other hazardous material is destined to be disposed of in repositories for chemical waste. Consequently, the quantities of NORM kept in storage may vary considerably from year to year.

NORM materials with radioactivity concentrations in excess of the exemption limits are also stored at sites of raw materials processing industries. The quantities are estimated to add up to about 50,000 tonnes. It is important to note that these stored NORM materials are not considered waste. It concerns for instance bulk materials for which future use is foreseen, like uranium or thorium bearing ores or zirconium oxides. Generally speaking, the activity concentrations of these materials are above the exemption limits, but below ten times the exemption limits, which implies that a notification to the authorities is sufficient. If the activity concentrations exceed ten times the exemption levels, a licence is required.

In case NORM material is declared as waste, and the activity concentration exceeds the exemption levels ten times or more, it is sent to COVRA. Examples of this kind of waste are Po- and Pb-bearing waste from high temperature phosphorus production. In case NORM is declared as waste, and the activity concentration levels are less than ten times the exemption levels, it can be disposed of at two dedicated disposal sites for hazardous materials.

High-level waste

The HLW at COVRA consists partly of heat-generating waste (vitrified waste from reprocessed spent fuel from the NPPs in Borssele and Dodewaard, conditioned spent fuel from the research reactors and spent uranium targets from molybdenum production) and partly of non-heat-generating waste (such as hulls and ends from fuel assemblies and waste from nuclear research and radio-isotope production).

Because of the long-term storage requirement, the design of the high-level waste treatment and storage building (HABOG) includes as many passive safety features as possible. In addition, precautions are taken to prevent degradation of the waste packages. The heat-generating waste is stored in an inert noble gas atmosphere and cooled by natural convection. In the design of the building all accidents with a frequency of occurrence larger than once per million years were taken into account. The design must be such that these accidents do not cause radiological damage to the environment.

The non-heat-generating waste is, remotely controlled, stacked in well-shielded storage areas. The heat-generating waste such as the vitrified residues is put into vertical storage wells cooled by natural ventilation. The HABOG storage facility is in full operation since 2003. At the end of 2010, a total of 51.7 m^3 HLW and spent fuel (SF) was kept in storage.

The spent fuel elements of the research reactors are delivered to COVRA in a cask containing a basket with circa 33 elements. Inside COVRA the basket with elements is removed from the cask and placed in a steel canister, which is welded tight and filled with an inert gas (helium). These sealed canisters are placed in wells, in the same way as the vitrified residues. The wells are filled with another inert gas (argon) to prevent corrosion of canisters with spent fuel elements or vitrified waste. Details of the HABOG design are presented in the text under article 7 (i).

There still is an amount of historical high-level waste present in the WSF building at the Research Location Petten. This waste, resulting from four decades of nuclear research at that facility, exists of fuel material residues (spent uranium targets and irradiated fuel) and fission and activation products. Currently, the low level 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 are under investigation.

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

Radioactive waste is defined as: a radioactive material for which no further use, reuse, or recycling is foreseen and which will not be discharged [2].

As stated before, most of the radioactive waste is collected and managed by COVRA. Long-term storage of all radioactive waste in buildings has been chosen as the preferred national policy. Disposal in suitable geological formations is envisaged in due time. Consequently, classification of the waste is based on practical criteria both derived from the need to limit exposures during the prolonged storage period and from the final disposal route.

Roughly there are three waste categories, namely LILW, HLW (non-heat-generating) and HLW (heat-generating).

No distinction is made between short-lived and long-lived LILW as defined by the IAEA Safety Guide on Classification [3]. The reason is that shallow land burial is not applicable for the Netherlands. All categories of waste will be disposed of in a deep geologic repository in the future (due to the small amounts of radioactive waste, no separate disposal facilities for LILW and HLW are envisaged). The waste in the storage buildings for LILW is segregated according to the scheme in Table 1.

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

Table 1. Low-and intermediate-level waste classified by type of radioactivity

HLW, heat-generating, consists of the vitrified waste from reprocessing of spent fuel from the two nuclear power reactors in the Netherlands (Borssele and Dodewaard), the spent fuel of the two research reactors (Petten and Delft) and the spent uranium targets of the molybdenum production.

HLW, non-heat-generating, is mainly formed by the reprocessing waste other than the vitrified residues. It also includes waste from research on reactor fuel and some decommissioning waste. HLW, heat-generating, and HLW, non-heat-generating, are stored in separate compartments of the HABOG.

Section C

Scope of Application

Article 3. SCOPE OF APPLICATION

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

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

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

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

3.1 Spent fuel

Spent fuel from the nuclear power stations, which has been transferred to La Hague for reprocessing, will not be taken into account in the spent fuel inventory as long as it is at the reprocessing plant.

3.2 Radioactive waste

The Netherlands has decided that waste originating from naturally occurring radioactive materials in quantities or concentrations exceeding the exemption limits specified in the text to Article 12, shall be declared as radioactive waste under the scope of this Convention.

3.3 Military or defence programmes

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

Section D

Inventories and Lists

Article 32, paragraph 2

This report shall also include:

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

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

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

(iv) an inventory of radioactive waste that is subject to this Convention that:

(a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;

(b) has been disposed of; or

(c) has resulted from past practices.

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

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

32.2 (i) Spent fuel management facilities

In table 2, a list of the spent fuel management facilities subject to this Convention, their location and essential features is given.

Location	*Spent fuel storage facility*	*Features*
Borsele	Dry storage in vaults	COVRA facility for treatment and storage of HLW and spent fuel (SF) (HABOG)
Borssele	Fuel storage pool	Pool belongs to nuclear power station where SF is stored temporarily before shipment to La Hague for reprocessing
Petten	Fuel storage pool	Belongs to the HFR and LFR research reactors; SF is stored temporarily awaiting shipment to COVRA
	Dry storage in drums	WSF; historical SF samples from HFR irradiation experiments; stored in concrete-lined vaults. To be transferred to COVRA

Location	Spent fuel storage facility	Features
Delft	Fuel storage pond	Belongs to HOR research reactor; SF is stored temporarily awaiting shipment to COVRA

Table 2. Radioactive Waste Management Facilities

32.2 (ii) Inventory of spent fuel

Annex 4 gives the inventory of spent fuel held in storage at the various locations.

32.2 (iii) Radioactive waste management facilities

In table 3 a list of the radioactive waste management facilities subject to this convention is given. Only those radioactive waste management facilities are reported whose main purpose is radioactive waste management. This means that small-scale waste management departments of hospitals, research institutes or industries which store radioactive waste for decay 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 licence condition obliges licensees to limit their inventories by transferring their radioactive waste periodically to COVRA. This does not apply for waste with a half-life of less than 100 days, which is allowed to be stored for decay on site. NRG is not allowed to store new waste in the WSF; this waste has to be delivered to COVRA.

Location	Radioactive waste storage facility	Features
Borsele	Dry storage in vaults	COVRA facility for treatment and storage of HLW and SF (HABOG)
	Dry storage of LILW in conditioned form in drums	COVRA facilities for treatment and storage of LILW (AVG and LOG)
	Dry storage of NORM and (TE)NORM-waste in containers	COVRA container storage facility (COG)
	Dry storage of small containers of depleted uranium oxide.	COVRA facility for storage of U_3O_8; this waste may be retrieved and converted (VOG)
Petten	Dry storage of unconditioned waste in drums.	WSF; partly HLW from irradiation experiments; to be transferred to COVRA

Table 3. Radioactive Waste Management Facilities

32.2 (iv) Inventory of radioactive waste

Annex 3 gives the inventory of radioactive waste held in storage at the various locations.

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

In table 4 a list of nuclear facilities in the process of being decommissioned is given.

Facility	*Date of closure*	*State of decommissioning*
Dodewaard NPP	1997	Safe enclosure as of 01/07/2005
LFR	2010	Shut down, fuel removal is being planned. No application for dismantling yet.

Table 4. Nuclear facilities being decommissioned

Section E

Legislative and Regulatory System

Article 18. IMPLEMENTING MEASURES

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

18 Implementing measures

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

Article 19. LEGISLATIVE AND REGULATORY FRAMEWORK

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

2. This legislative and regulatory framework shall provide for:

(i) the establishment of applicable national safety requirements and regulations for radiation safety;

(ii) a system of licensing of spent fuel and radioactive waste management activities;

(iii) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence;

(iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting;

(v) the enforcement of applicable regulations and of the terms of the licences;

(vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.

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

19.1 Legislative and regulatory framework governing the safety of spent fuel and radioactive waste management

a. Overview of the legal framework

The following are the main laws to which nuclear installations are subject:

- the Nuclear Energy Act (Kew);

- the Environmental Protection Act (Wm);
- General Administrative Law Act (Awb).

The basic legislation governing nuclear activities is contained in the Nuclear Energy Act. It is a framework law, which sets out the basic rules on the application of nuclear technology and materials, makes provisions for radiation protection, designates the competent authorities and outlines their responsibilities. More detailed legislation is provided by associated decrees.

Several changes have been made to the Nuclear Energy Act since the third national report of the Netherlands. For this Convention the most important is the introduction of new regulation concerning financial provisions for the costs of the decommissioning of nuclear installations (see Article 26).

A second important change is the establishment of a single authority regarding licensing under the Nuclear Energy Act. Licences for nuclear facilities, practices and work activities are granted by the minister of Economic Affairs, Agriculture and Innovation (EL&I), the competent authority as defined by the Nuclear Energy Act. For legislative issues (like e.g. future changes to the Nuclear Energy Act) the minister of EL&I shares its authority with other relevant ministers (see Articles 19.2 and 20).

With regard to nuclear energy, the Act considers (Article 15b):

- 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.

A number of decrees and ordinances have also been issued, containing additional regulation and these continue to be updated in the light of ongoing developments. The most important of these in relation to the safety aspects of nuclear installations and radioactive materials include:

- the Nuclear Installations, Fissionable Materials and Ores Decree (Bkse)
- the Radiation Protection Decree (Bs).
- the Transport of Fissionable Materials, Ores, and radioactive Substances Decree (Bvser).
- the Radioactive Scrap Detection Decree

The Nuclear Installations, Fissionable Materials and Ores Decree regulates all activities (including licensing) that involve fissionable materials and nuclear installations. The Radiation Protection Decree regulates the protection of the public and workers against the hazards of all ionising radiation. It also establishes a licensing system for the use of radioactive materials and radiation emitting devices, and prescribes general rules for their use. For NORM this is further elaborated in the ordinance Natural Sources of Ionising radiation (NABIS). This ordinance establishes a reporting system and protective measures for workers and environment. For high active sources, it is elaborated in the ordinance High-activity sealed sources and orphan sources. The ordinance (in compliance with Directive 2003/122/Euratom) establishes a registration system for high active sealed sources and ensures that license holders have financial reservations to cover treatment and disposal of used high-activity sources

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. The Radioactive Scrap Detection Decree stipulates that the larger metal recycling companies shall install detection portals to monitor scrap activity levels, and shall have financial reservations to cover possible undue responsibilities.

The Nuclear Energy Act and the above mentioned decrees are fully in compliance with the relevant Euratom Directive laying down the basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation and the Council Directive 2009/71/Euratom, establishing a Community framework for the nuclear safety of nuclear installations, and – at least partially – Council Directive 2011/70/Euratom, establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste.

The **Environmental Protection Act**, in conjunction with the Environmental Impact Assessment Decree, stipulates (in compliance with EU Council Directive 97/11/EC; see also the section on Article 8) that an Environmental Impact Assessment must be presented when an application is submitted for a licence for a nuclear installation.

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 and regulates both conventional and non-conventional environmental issues.

The **General Administrative Law Act** sets out the procedure for obtaining a licence, and also describes the role played by the general public in this procedure (i.e. objections and appeals).

For additional information see also the text under Article 4 (iv).

b. Main elements of the Acts and Decrees

b.1 Nuclear Energy Act (Kew)

Within the framework of the Nuclear Energy Act, fissionable materials are defined as materials containing up to a certain percentage of uranium, plutonium or thorium (i.e. 0.1% uranium or plutonium and 3% thorium by weight). Ores are defined as raw materials containing at least 0.1% uranium or 3% thorium and are used for purposes of fission or breeding. All other materials are defined as radioactive materials.

As far as nuclear installations are concerned, the Nuclear Energy Act covers three distinct areas relating to the handling of fissionable materials and ores:

- (a) registration,
- (b) transport and management of such materials;
- (c) the operation of sites at which these materials are stored, used or processed.

Ad a) 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.

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

Ad c) Licences are also required for construction, commissioning, operating, modifying or decommissioning nuclear installations (Section 15b), as well as for nuclear driven ships (Section 15c). To date, the latter category has not been of any practical significance.

Under item (c), the Nuclear Energy Act distinguishes between construction licences and operating licences. In theory, a licence to build a plant may be issued separately from any licence to actually operate it. However, the construction of a nuclear power plant involves much more than simply building work. Account must be taken of all activities to be conducted in the plant. This means that the government needs to decide whether the location, design and construction of the plant are such as to afford sufficient protection from any danger, damage or nuisance associated with the activities that are to be conducted there. In practice, therefore, the procedure for issuing a licence to operate a NPP will be of limited scope, unless major differences have arisen between the beginning and the completion of construction work. For example, there may be a considerable difference between the Preliminary Safety Analysis Report (which provides the basis for the construction licence) and the Final Safety Analysis Report (for the operating licence). Views on matters of environmental protection may also have changed over the intervening period.

Amendments to a licence will be needed where modifications of a plant invalidate the earlier description of it. In the case of very minor modifications, the licensee may make use of a special provision in the Nuclear Energy Act (Article 17) that allows such modifications to be made with a minor licence amendment. The licensee still needs to submit an application for a license describing the intended modification, including the consequences of the modification for the public and the environment but the procedure is more simple and shorter. This instrument can only be used if the consequences of the modification for the public and the environment are within the limits of the licence in force and no environmental impact assessment is needed. The license is published and open to appeal.

The Bkse sets out additional regulations in relation to a number of areas, including the licence application procedure and associated requirements. Applicants are required to supply the following information:

- 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 plant, including the equipment to be used in it, the mode of operation of the plant 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 plant'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 plant, specifying the maximum quantities of the various fissionable materials that will be present in the plant 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 plant 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.

The Radiation protection decree (Bs) regulates all general radiation protection issues for nuclear and non-nuclear installations, fissionable materials and radioactive materials, including the licensing. For more details about waste management and radiation safety requirements, please refer to section 19.2 (i).

b.2 Environmental Protection Act (Wm)

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 EIA. In certain circumstances, an EIA is also required if an existing plant is modified. More specifically, it is required in situations involving:

- a change in the type, quantity or enrichment of the fuel used;
- an increase in the release of radioactive effluents;
- an increase in the on-site storage of spent fuel;
- decommissioning;
- any change in the conceptual safety design of the plant that is not covered by the description of the design in the safety analysis report.

The Environmental Protection Act states that an independent Commission for Environmental Impact Assessments must be established and its advice can be sought whenever it is decided that an environmental impact assessment needs to be submitted by a person or body applying for a licence. The regulations based on this Act stipulate the type of activities for which such assessments are required.

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.

b.3 General Administrative Act (Awb)

Notice must be given, both in the Government Gazette and in the national and local press, of the publication of a draft decision to award a licence 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. All members of the public are free to lodge written objections to the draft decision and a hearing is to be held under the terms of the General Administrative Act. Any objections made to the draft version of the decision are taken into account in the final version. Anybody who has objected to the draft decision is free to appeal to the Council of State (the highest administrative court in the Netherlands) against the decision by which the licence is eventually granted, amended or withdrawn. If the appellant asks the court at the same time for provisional relief (i.e. a suspension of the licence), the Decree (i.e. the licence) will not take effect until the court has reached a decision on the request for suspension.

19.2 (i) National safety requirements and regulations for radiation safety

a. General requirements

The Nuclear Energy Act, together with the Radiation Protection Decree [2], provides for a system of general goal oriented rules and regulations. The Radiation Protection Decree also regulates general radioactive waste requirements, and prescribes that radioactive material for which no further use is foreseen can be declared as radioactive waste. Besides this, it stipulates that an authorized user of radioactive material is allowed to dispose of radioactive material without a licence in only a limited number of ways:

if 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 is 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 licence for this material;

if declared as waste:

- by transfer to a recognised waste management organisation. COVRA is the only recognized organisation for the collection, treatment and storage of radioactive waste [4];
- by transfer to another designated organisation for the collection of radioactive waste.

For all practical purposes, licensees for applications of radioactive materials are required to deliver their radioactive waste or fissionable materials for which no further use is foreseen or spent fuel which is not destined for reprocessing, to COVRA. The underlying philosophy 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. Therefore most requirements are established in the licence of COVRA and few specific rules exist for spent fuel and radioactive waste management facilities.

b. Nuclear Safety Rules

The Nuclear Installations, Fissionable Materials and Ores Decree (Article 20) provides the basis for a system of more detailed safety regulations concerning the design, operation and quality assurance of nuclear facilities. These regulations are referred to as the Nuclear Safety Rules (NVRs). The NVRs are based on the Requirements and Safety Guides in the IAEA Safety Standards Series. NVRs on design and operation of NPPs have been implemented in the licences for the Borssele NPP and the research reactors. This allows the regulatory body to enforce the NVRs. The regulatory body uses the NVRs as the basis for review of the degree of compliance with the licence conditions by the operator. A NVR on Quality Assurance is implemented in the Quality Assurance Nuclear Power Plants Ordinance [21]. In the light of a possible new NPP, the NVRs are now being reviewed.

c. Radiation Safety Requirements

As has been outlined in the text under Article 19.1, the operations in the spent fuel and radioactive waste management facilities of COVRA are essentially governed by two decrees for the safety aspects:

- the Nuclear Installations, Fissionable Materials and Ores Decree;
- the Radiation Protection Decree [2] (Bs).

These Decrees set the criteria for:

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

Standard operation

A maximum total individual dose of 1 mSv in any year for the consequences of normal operation of all sources emitting ionising radiation (i.e. NPPs, isotope laboratories, sealed sources, X-ray machines etc.), excluding natural background and medical exposures.

For a single source (for instance a waste management facility), the maximum individual dose has been set at 0.1 mSv per year. As a first optimisation goal, a dose level of 0.04 mSv per year has been set for a single source in accordance with the ALARA principle.

An employer of a facility where workers can be exposed to ionising radiation is required to classify persons as radiation worker in one of the categories A or B. Category A workers are likely to receive doses greater than three-tenths of the dose limit (6 mSv per year for whole body exposure). Category B workers are likely to be exposed during their work to radiation greater than the dose limit for the population at large (1 mSv per year for whole body exposure), but less than 6 mSv per year.

Design base accidents

The risks due to accidents for which protection is included in the design of the facility, i.e. the design base accidents, should be lower than the values given in table 5.

Frequency of occurrence (F)	***Maximum permissible effective dose***	
	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

Table 5. Design base accidents for nuclear facilities

Non-compliance with the values in the table is a reason for refusing a licence.

Incidents and accidents

In accordance with the probabilistic acceptance criteria for individual mortality risk and societal risk as laid down in the Nuclear Installations, Fissionable Materials and Ores Decree (Bkse), 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 risk from 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.

d. WENRA Reference levels

Another issue which may become important in the future is the development and adoption of the Western European Nuclear Regulators' Association's (WENRA) Reference Levels, harmonising reference levels for nuclear safety, the safe management of spent fuel, and radioactive waste and for decommissioning. These reference levels will be based on a selection of the most important IAEA-requirements.

In the framework of this Convention especially the reference levels for storage of radioactive waste and spent fuel and for decommissioning are relevant. The Netherlands participates in the WENRA Reactor Harmonisation Working Group and the Working Group on Waste and Decommissioning.

19.2 (ii) A system of licensing

As was discussed in the section on Article 19.1 of the Convention, the Nuclear Energy Act stipulates (in Article 15, sub b) that a licence must be obtained for construction, commissioning, operating, modifying or decommissioning a nuclear facility. Similarly, the Nuclear Energy Act also states (in Article 15, sub a) that a licence is required for importing, exporting, possessing and disposing of fissionable material.

In addition, for the construction or major modification of a nuclear facility, a Building Permit is needed. This is governed by other laws and decrees, for which the local municipal authorities are the competent bodies.

Under Article 29 of the Nuclear Energy Act, a licence is required for the preparation, transport, possession, import and disposal of radioactive material in a number of cases that are identified in the Radiation Protection Decree.

The procedures to obtain a licence 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 applies, everybody may express his or her view. The regulatory body 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, he can go to court.

In the case of very minor modifications, the licensee may make use of a special provision in the Act (Article 17) that allows such modifications to be made with a minor licence amendment. The licensee needs to submit a report describing the intended modification. This instrument can only be used if the consequences of the modification for the public and the environment are within the limits of the licence in force. The notification is published and open to appeal.

As was mentioned in the section on Article 19.1, the above mentioned licences are granted by the Minister of EL&I, the competent authority as defined by the Nuclear Energy Act.

Article 15b of the Nuclear Energy Act enumerates the interests for the protection of which a licence may be refused (listed above in the section on Article 19.1, sub a). The licence itself lists the restrictions and conditions imposed to take account of these interests. The licence conditions may include an obligation to satisfy further requirements, related to the subject of the licence condition, as set by the competent regulatory body.

The regulatory body conducts regular reviews to establish whether the restrictions and conditions under which a licence has been granted are still sufficient to protect the public and the environment, taking account of any developments in safety that have taken place in the meantime. Should one of these reviews indicate that, given the developments, the level of protection can and should be improved; the regulatory body will amend the restrictions and conditions accordingly. It should be noted that this is not the same as the periodic safety evaluations which the licensee is required to perform.

19.2 (iii) Prohibition to operate a facility without a licence

Article 15, paragraph 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 licence.

19.2 (iv) Institutional control, regulatory inspection and documentation and reporting

General

Article 58 of the Nuclear Energy Act states that the Minister responsible for licensing procedures should entrust designated officials with the task of performing assessment, inspection and enforcement. The Decree on Supervision identifies the bodies that have responsibilities in this connection, being the Department of Nuclear Safety, Security and Safeguards (KFD) of the VROM Inspection (VI) of the Ministry of IenM. Although the inspectorate acts independently from the Ministry of EL&I, the Minister of EL&I remains politically responsible for the activities of the KFD.

At the Ministry of EL&I, the Directorate Energy and Sustainability (ED) is responsible for assessing whether the radiological safety and security objectives have been met. It should be noted that this directorate is responsible for policymaking and licensing, and does not perform inspections. ED has also responsibility for the implementation of international regulations and guidelines in the national legislation and for any other adjustments of the regulations deemed necessary.

With regard to nuclear fuel cycle installations and NPPs in particular, almost all inspection tasks are carried out by the KFD, which possesses the technical expertise needed for the inspection of nuclear safety, radiation protection, security and safeguards. Further information is given in the section on Article 20 of the Convention.

Regulatory assessment

The regulatory assessment process is as follows. The regulatory body reviews and assesses the documentation submitted by the applicant. This may include the EIA Report and Safety Report with underlying safety analyses submitted within the context of a licence renewal or modification request, proposals for design changes, changes to Technical Specifications, etc.

The KFD assesses whether the NVRs (i.e. requirements and guidelines for nuclear safety and environment), requirements and guidelines for security and regulation for non-nuclear environment protection have been met and whether the assessments (methods and input data) have been prepared according to the state of the art etc. ED assesses the waste and radiation safety aspects of spent fuel or radioactive waste management facilities.

Regulatory inspections

The function of regulatory inspections is:

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

All inspections with regard to nuclear safety, nuclear security, radiological protection of personnel and of the environment around nuclear sites, security and safeguards, including transportation of fresh and spent nuclear fuel and related radioactive waste to and from nuclear installations are carried out by the KFD.

To check that the licensee is acting in compliance with the Nuclear Energy Act, the licence and the associated safety analysis report, there is a system of inspections, audits, assessment of operational reports, and evaluation of operational occurrences and incidents. Inspection activities are supplemented by international missions and a special arrangement with the Belgian inspection authority, which participates frequently in Dutch inspections. An important piece of information for inspection is the safety evaluation report, conducted at 2-5 years periods. In this report the licensee presents its self-assessment of all the relevant technical, organisational, personnel and administrative matters.

Every ten years a major assessment of the accomplishments in the area of safety and radiation protection is performed by the staff of the spent fuel and radioactive waste management facility and compared with new developments.

The management of inspection is supported by a yearly planning, the reporting of the inspections and the follow-up actions. On an annual or quarterly basis, dependent on the type of facility, a meeting between facility management and KFD management is held devoted to inspections and inspection findings, during which any necessary remedial actions are established and the progress made with their execution discussed.

19.2 (v) The enforcement of applicable regulations and of the terms of the licences

As indicated in the section on Article 19.2 (iv), a special decree was issued, known as the Decree on Supervision on Inspection and Enforcement of the Nuclear Energy Act. This deals with the inspection and enforcement of the regulations and the terms of licences. An extended series of articles has been published covering all aspects for which supervision is required, from public health to security and financial liability. The decree also specifies the responsible authorities.

Should there be any serious shortcoming in the actual operation of a nuclear installation, the Minister of EL&I is empowered under Article 37b of the Nuclear Energy Act to take all such measures as deemed necessary, including shutting down the nuclear installation. Written enforcement procedures have been published describing the action to be taken if this article of the Act needs to be applied. Special investigators have been appointed to prepare an official report for the public prosecutor, should the need occur.

Article 19.1 of the Nuclear Energy Act empowers the regulatory body to modify, add or revoke restrictions and conditions in the licence in order to protect the interests on which the licence is based. Article 20a of the Act designates the authority that is empowered to withdraw the licence, if this is required in order to protect these interests.

Article 15aa of the Nuclear Energy Act empowers the regulatory body to force the licensee to co-operate in a process of total revision and update of the licence. This action is indicated if for instance comprehensive modifications are proposed or when after a number of years the licence is less clear (or outdated) due to a large number of changes during that time.

19.2 (vi) A clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.

The constituent parts of the Regulatory Body, which have a function in one or more steps in spent fuel and radioactive waste management, are listed in the table below together with their respective responsibilities.

Ministry	***Regulatory body***	***Responsibility***	***Specific step in SF and radioactive waste management***
Ministry of Economic Affairs, Agriculture and Innovation (EL&I)	Directorate of Energy and Sustainability (ED)	• Setting policies, developing regulations and issuing licences; • Making technical assessments in a limited number of areas; • Developing security guidelines; • Policy on security of energy supply.	• all
Ministry of Infrastructure and the Environment (I&M)	Inspectorate/ Department of Nuclear Safety, Security and Safeguards (KFD)	• Making technical assessments for all issues related to nuclear facilities; • Performing inspections (both on nuclear and non-nuclear aspects) and enforcement in nuclear facilities; • Carrying out tasks in the area of security, physical protection and safeguards	• all
Ministry of Infrastructure and the	Inspectorate/ Department on Emergency	• Preparing and co-ordinating actions in case of emergencies.	• all

Ministry	Regulatory body	Responsibility	Specific step in SF and radioactive waste management
Environment (I&M)	Response (CM)		
Ministry of Social Affairs and Employment (SZW)	Directorate for Safety and Health at Work	• Occupational safety related to nuclear power generation and other applications of radiation.	• all

Table 6. Allocation of responsibilities

19.3 Regulation of radioactive materials as radioactive waste.

The radioactive waste policy follows closely the approach chosen for the management of conventional waste. Conventional waste is considered to include other hazardous waste, but also household refuse. This approach is based on the following series of hierarchical principles:

- In principle, the generation of waste is undesirable from the point of view of sustainable development (integrated life-cycle management). Waste is the result of an imperfect utilization of materials in the networks of interconnected processes. Consequently, the generation of waste should be prevented. Realising that most processes have already been optimised in previous decades, although often for economic reasons and as individual processes, it is more realistic to state that generation of waste should be minimised. As radioactive waste is concerned, the Radiation Protection Decree requires the holder of a licence for radioactive materials to minimize the generation of radioactive waste as far as reasonably possible. The preferred use of radioactive materials with short decay-times fits within this policy.
- If it is not possible to further reduce the amount of waste in a process, attempts should be directed to return the waste into the process by product reuse or by materials reuse (recycling). In the case of radioactive materials, the Radiation Protection Decree stipulates that the holder of a licence for radioactive material shall reuse sources, or materials of these sources.
- If reuse or recycling cannot be achieved, or if it can only be achieved under adverse environmental conditions, incineration should be considered in order to benefit from the heat of the combustion process (recovery).
- Disposal is the last resort in case all previous options have been exhausted. For highly toxic waste such as high-level radioactive waste it is advocated that such waste be stored until more advanced processing technologies become available. In the case of radioactive waste, the Netherlands has adopted a policy based on centralised pre-disposal storage for a period of at least 100 years at COVRA. All associated costs are born by the generators of the waste. Recently, a requirement was added to the Bkse-decree making the generator of the waste formally responsible to arrange sufficient storage capacity at COVRA, which in practice means that the generator of the waste will have to pay COVRA for creating storage capacity.
- Long-term disposal must be arranged for existing waste and for future waste if arising of this waste cannot be prevented. The disposal facility

should be constructed in such a way that the waste is not only retrievable but that in principle the whole disposal process can be reversed. This requirement is imposed firstly with the aim to maintain control over the waste and secondly to ensure that the waste remains accessible for purposes of re-entering it into the cycle when such an opportunity arises provided that this can be done in an environmentally responsible manner.

By adhering to these principles, and thus minimising the amount of waste while ensuring that the waste which cannot be processed, is managed in an environmentally sound way the objectives of this Convention are complied with.

Furthermore the Netherlands has interpreted the scope of this Convention in the most extensive manner by declaring waste containing natural radionuclides to fall under the requirements of the Convention. Doing this ensures that these wastes are managed properly, with due respect to the potential hazards that such waste can pose to exposed groups of persons.

Article 20. REGULATORY BODY

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

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

20.1 Regulatory framework

General

Following the formation of the new government a reshuffle of responsibilities and a reorganisation of tasks among several ministries took place. Relevant for this convention is that a.o. the ministries of Housing, Spatial Planning and Environment (VROM) and of Economic Affairs (EZ) were eliminated and that the new ministries of Economic Affairs, Agriculture and Innovation (EL&I) and of Infrastructure and Environment (IenM) were formed. The responsibility for all tasks of the regulatory body lies now with the minister of EL&I, whereas formerly the minister of VROM was responsible. Activities regarding licensing, coordination, contribution to legislative activities and policy development on nuclear safety and radiation protection have been moved from the former ministry of VROM to the ministry of EL&I. The activities for inspection and assessment of licensee's compliance with licensing conditions has been moved from the former ministry of VROM to the inspection of the ministry of I&M; KFD. Under the responsibility of the Minister of EL&I the KFD carries out its activities independently.

As discussed in the section on Article 19, the Minister of EL&I is responsible for licensing, assessment and inspection of nuclear installations. The various organizations within the ministries which are charged with these tasks, and the legal basis on which they operate, have already been discussed in the section on Article 19.2 (ii and iii):

- Ministry of Economic Affairs, Agriculture and Innovation (EL&I) (see also Figure 3)
    - Directorate-General for Energy, Telecommunication and Competition (DGETM)
        - Directorate for Energy and Sustainability (ED)

- Ministry of Infrastructure and the Environment (I&M) (see also Figure 3)
    - Inspectorate-General (VI)
        - Department of Nuclear Safety, Security and Safeguards (KFD)

- Ministry of Social Affairs and Employment (SZW)
    - Directorate-General for Labour and Social Security
        - Directorate Health and Safety at Work

The minister of EL&I has overall responsibility for legislation concerning the Nuclear Energy Act, for licensing and for ensuring that the current legislation is being adequately maintained. It is also responsible for the technical safety considerations on which the decision to grant or reject an application for a licence is based. These considerations are mainly based on assessments and inspections by the KFD, which advises the licensing body (ED) on licensing conditions and requirements, including those relating to effluent discharge, environmental protection and security & safeguards.

The KFD has the supervision over the radiological safety of workers in nuclear installations. Policy development and the regulation for the protection of workers, however, is the responsibility of ministry of SZW.

The ministry of EL&I is responsible for formulating the conditions attached to the licence concerning the safety and the (radiation) protection of the workers and the public and the environment.

All supervision tasks for the nuclear installations and radioactive materials (including disused sealed sources and waste) in the Netherlands have been integrated in the KFD, including those for nuclear security and safeguards.

Figure 3 illustrates the current organisation of within the regulatory body.

Regulatory Body

According to the Nuclear Energy Act, the regulatory body of the Netherlands exists of different organisations. The directorate for Energy and Sustainability of EL&I is responsible for the policy and legislation on radiation protection, nuclear safety and nuclear security and all licensing. The KFD of the inspectorate of IenM covers the task of surveillance. The minister of EL&I remains politically responsible for the KFD. The Directorate Health and Safety at Work within the ministry SZW is responsible for the legal aspects of radiation protection of workers.

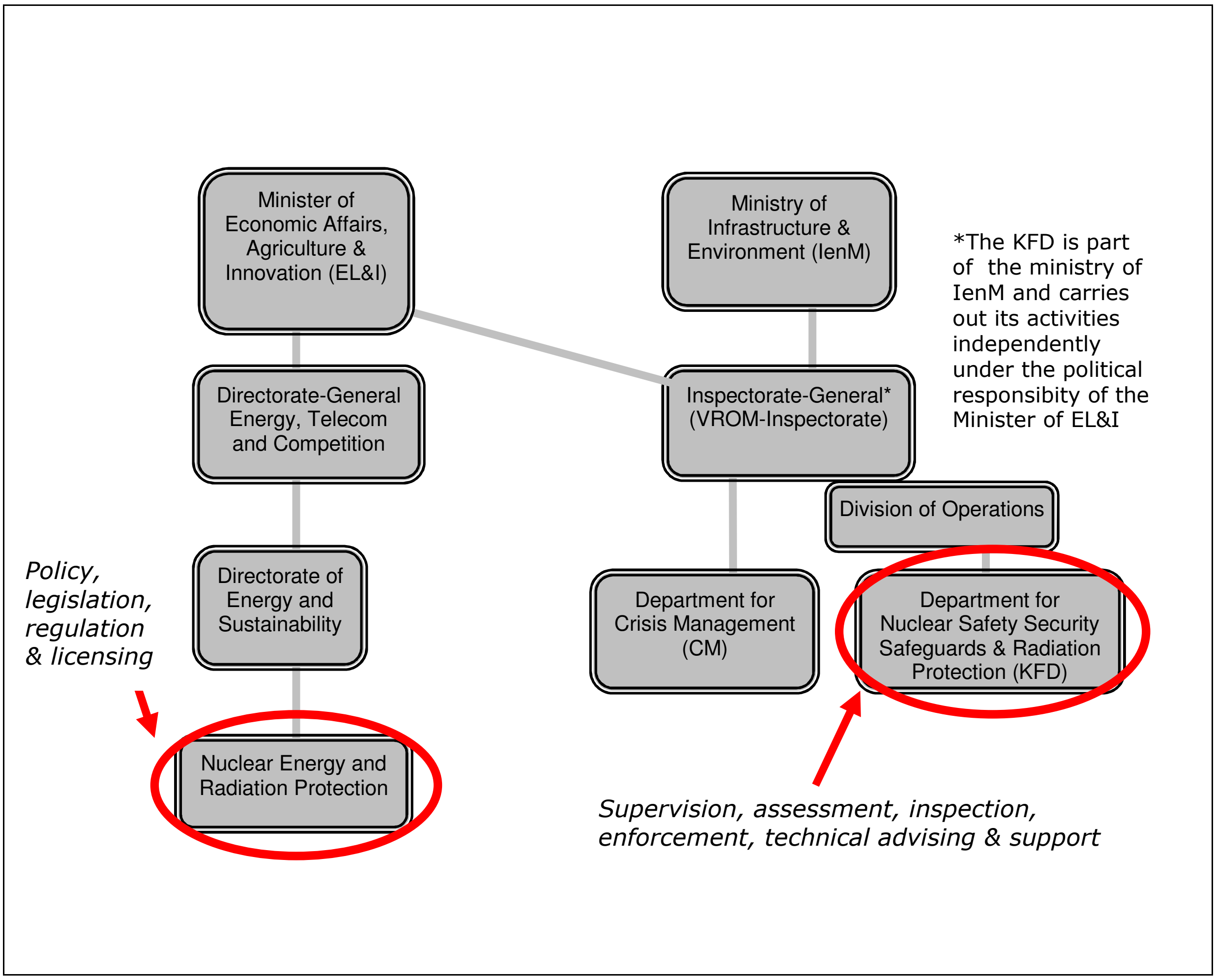


Figure 3. Nuclear safety and radiation protection within the regulatory body

Directorate for Energy and Sustainability (ED)

ED is responsible for policy development and legislation in the field of radiation protection and nuclear safety, particularly in relation to the public and the environment. The subjects of nuclear security and safeguards are included. ED is also responsible for licensing of nuclear installations, radioactive waste & decommissioning and nuclear transports in general (all procedural aspects), as well as for all aspects of radiation protection and external safety.

The expertise of ED spans disciplines like radiation protection, nuclear safety, risk assessment, security and safeguards, and legal and licensing aspects. Via ED an annual contribution is provided to support the work of the National Institute for Public Health and the Environment (RIVM). RIVM provides scientific support to EL&I.

The total professional staff of ED, assigned to nuclear, waste, radiation and transport safety, including legal support and management is currently about 20 full time staff equivalents (fte). KFD supports ED with technical safety assessments and safety status information. Implementation of the Dutch policy is outsourced to the Agentschap NL; a service organisation that executes programmes and regulations for many ministries and other governmental organisations.

Department of Nuclear Safety, Security and Safeguards (KFD)

The KFD encompasses all major reactor safety, radiation protection, security and safeguards and emergency preparedness disciplines. For areas in which its competence is not sufficient or where a specific in-depth analysis is needed, the KFD has a budget at its disposal for contracting external specialists. This is one of the basic policies of the KFD: that the core disciplines should be available in-house, while the remaining work is subcontracted to third parties or technical support organizations (TSO's).

The core disciplines are:

- mechanical engineering;
- materials science and technology;
- reactor technology (including reactor physics and thermal hydraulics);
- electrical engineering;
- instrumentation and control;
- radiation protection (workers and members of the public);
- probabilistic safety assessment and severe accidents;
- quality assurance;
- nuclear safety auditing and inspecting;
- process technology;
- security and safeguards;
- human factors and organisation.

The current KFD professional formation is about 41 full-time staff equivalents, including three managers. This is 18 fte more than three years ago. Although the ministries, including the inspectorates have to reduce staff, the capacity of KFD is protected.

20.2 Independence of regulatory functions

In 2011 the regulatory body was reorganised. The authority regarding licensing under the Nuclear Energy Act is moved from the ministry of VROM to the newly created ministry of EL&I. The ministry of EL&I manages the energy policy and the policy on nuclear safety of the Netherlands. In the recent past there were no incentives to increase the share of nuclear power in the domestic electricity production. However, recently some private initiatives have emerged, aiming to build NPPs in the Netherlands. Therefore the Nuclear Energy Act dossier was moved to the newly formed ministry of EL&I.

On the basis of the Nuclear Energy Act the KFD inspects and assesses the licensee's compliance with licensing conditions. The activities for inspection and assessment of licensee's compliance with licensing conditions has been moved from the former ministry of VROM to the ministry of IenM, The KFD is retained as an entity and the KFD retains its name. Under the responsibility of the Minister of EL&I the KFD carries out its activities independently. Through this arrangement the conditions as described in Article 20.2 of this Convention concerning effective separation are fully satisfied.

Section F

Other General Safety Provisions

Article 21. RESPONSIBILITY OF THE LICENCE HOLDER

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

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

21.1 Prime responsibility for Safety

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

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

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

At the moment radioactive material is classified as waste, a number of additional requirements apply. The most important requirement is that the waste shall be transferred to COVRA as soon as reasonably possible. Upon transferral of the waste to COVRA, all liabilities, including the responsibility for safety, are transferred to COVRA.

21.2 Responsibility of Contracting Party if there is no licence holder or other responsible party

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 KFD has been empowered to impound such material and have it transferred it to designated institutes, which are equipped and licensed to manage these materials.

The institutes which have been designated by a special decree [6] are: NRG in Petten and COVRA in Borsele for fissionable materials. The same institutes as well as the RIVM in Bilthoven have been designated for radioactive materials.

Article 22. HUMAN AND FINANCIAL RESOURCES

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

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

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

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

22 (i) Qualified Staff

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

COVRA has implemented a Personnel Qualification Plan (as part of a more generic quality management system) in which clear details of the responsibilities, authority interfaces and lines of communication, requisite level of expertise, and the requirements for training and education are laid down. A training plan ensures that an adequate number of staff, with relevant expertise and appropriately trained is always available. Any major organisational changes, e.g. at management level, must be reported to the authorities.

22 (ii) Adequate financial resources

One of the basic principles governing radioactive waste management and also adhered to in the Netherlands 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.

As regards the management of spent fuel and other high-level waste, the utilities and the operators of research reactors agreed to jointly build a facility for treatment and long-term storage of SF and HLW at the COVRA site. This building (HABOG) was commissioned in 2003 and is now receiving vitrified and other high-level waste from reprocessing plants as well as spent fuel and other high-level waste from the research reactors. Both the construction costs and the operating costs are borne by the generators of the spent fuel and the high-level waste respectively.

In the frame of transfer of ownership of COVRA from the utilities and ECN to the State, the utilities decided to discharge themselves from any further responsibility for management of the radioactive waste. They made a down payment to COVRA covering the discounted costs for operation and maintenance of the HABOG during the envisaged operational period (~100 years). The other customers of the HABOG pay their share of operational costs by annual instalments.

For LILW there are fixed tariffs for specified categories of radioactive waste which take into account all management costs including disposal after some 100 years of interim storage. Once the transfer of the waste has been accomplished the customer is exempted from further responsibility for the waste. No surcharges can be made to make up for exploitation losses by COVRA and no waste can be returned to the customers. While the tariffs are annually adjusted with the price index, every five years the tariff structure is evaluated with the aim to reconsider the need for any structural adjustment. However, the utmost restraint is exercised to any proposal for an increase of the tariffs, in order to prevent the temptation of environmentally irresponsible behaviour with the waste by the customer. In the previous period COVRA suffered substantial and structural exploitation losses for the management of LILW which can be partly attributed to a successful implementation of national waste separation and reduction policies. Financial support as a combination of a subsidy and a loan granted by the government, aimed to ensure that COVRA will have a neutral financial result over the period up to 2015.

In 1986 a study was conducted with the aim to estimate the costs for the construction and operation of a repository for radioactive waste in salt formations in the deep underground. It is envisaged that all radioactive waste, LILW and HLW, will be placed in this repository. The total cost was estimated at 1230 Meur of which 820 Meur for the disposal of HLW (1986 price level). These cost estimates formed the basis for the establishment of financial provisions by the operators of nuclear facilities and have been taken into account in the calculation of the discounted costs as mentioned before. A real interest rate of 3.5% and a discounting period of 130 years were used in the calculations for disposal of HLW. This sum was disbursed to COVRA in the framework of the transfer of ownership of COVRA to the State and put in a separate fund which is managed by COVRA. The money is stored at an account at the Ministry of Finance and guaranteed by the state. Every 5 years since, the basis for the cost estimate has been re-assessed. In case of inadequate fund growth the fees for waste are adjusted.

For LILW a separate procedure is followed: COVRA raises a surcharge for waste disposal on the fees of generators of radioactive waste. This sum is added to the fund. Out of the total amount of money estimated to be needed for the construction and operation of a disposal facility, one third has to be covered by the surcharge on LILW. The other part has to be covered by the HLW and SF.

The adequacy of financial resources for decommissioning is addressed under Article 26 of the Convention.

22 (iii) Institutional controls

The national disposal research programme OPERA (see section B) will address the issue of institutional controls and make proposals on the types of institutional control necessary, taking into account the prolonged retrievability of the waste from the repository. It is, however, not expected that the recommended institutional controls will lead to significantly different cost estimates.

Article 23. QUALITY ASSURANCE

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

23 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 result, the IAEA SS QA Series No. 50-C-Q was chosen to provide the basis for the QA programme in the Netherlands. Although the IAEA-NUSS QA Safety Series are primarily set up for NPPs, some of these are applied to the COVRA facilities for the storage of spent fuel and radioactive waste. In particular, the adapted version of the IAEA Code for the Safety of Nuclear Power Plants [7] is used as source material for the QA programme of COVRA. Since this Code is specific for NPPs, provisions from the industrial standards NEN-ISO 9000 – 9004 have also been implemented. The IAEA SS QA Series No. 50-C-Q will be replaced by IAEA GS-R-3 "The management system for facilities and activities". This process is completed at the NPP Borssele. COVRA is still in the conversion process.

Regulations

The QA system of COVRA is part of the operating licence and hence is binding for the licensee. Those parts of the QA programme 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 KFD.

Specific points in the QA system

The core of the QA system is the Quality Manual. This Manual describes procedures for the following issues:

- Acceptance criteria for radioactive waste and storage procedures;
- Document controls;
- Emergency response measures;
- Procedures for security;
- Procurement control;
- Design control for new and modified installations;
- Management of inspections and tests.

With regard to the acceptance criteria for vitrified waste it is worth to mention that the specifications were drawn by the reprocessing facilities and approved by the operators of the NPPs and the Regulatory Body. These specifications were used – among other things as input for design and licensing of COVRA's HLW facility. These specifications include guaranteed parameters for contamination and radiation levels, heat load and chemical composition. Before shipment from the reprocessing site to COVRA, all relevant data and product files are provided and checked, compliance with transport regulation is assured, and the canisters are witnessed by COVRA and the NPP operator. Upon arrival at the COVRA site a second check is performed.

Article 24. OPERATIONAL RADIATION PROTECTION

1. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:

(i) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;

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

(iii) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.

2. Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:

(i) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and

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

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

24.1 (i) ALARA

As has been stated before in the response to Article 19, the basic legislation on nuclear activities in the Netherlands is the Nuclear Energy Act. A number of decrees have also been issued, containing more detailed regulations based on the provisions of the Act. The most important decrees for the safety aspects of nuclear facilities and the radiation protection of the workers and the public are:

- the Nuclear Installations, Fissionable Materials and Ores Decree (Bkse);
- the Radiation Protection Decree (Bs).

The above-mentioned Decrees are fully in compliance with the Euratom Directive 96/29/Euratom laying down the basic safety standards for the protection of the health of workers and of the general public against the dangers arising from ionising radiation.

The Bkse requires the licensee of a nuclear facility to take adequate measures for the protection of people, animals, plants and property. Article 31 of the Bkse states that a licence must contain requirements aimed at preventing the exposure and contamination of people, animals, plants and property as far as possible. If exposure or contamination is unavoidable, the level must be as low as is reasonably achievable (ALARA). The number of people exposed must be limited as much as possible, and the licensee must act in accordance with the individual effective dose limits.

The Bkse also states that these activities must be carried out by or under the responsibility of a person with sufficient expertise, subject to the judgement of the regulatory body. This expert should occupy a post in the organisation such that he or she is able to advise the management of the facility in an adequate way and to intervene directly if he or she considers this to be necessary.

Written procedures must be available to ensure that the radiological protection measures which have to be taken are effective and that the above-mentioned expert is properly informed. Full details of these conditions are given in the Radiation Protection Decree (Bs), which also lays down more specific requirements on the protection of people and the environment from radiation. Throughout the Bs the concept of ALARA is used and it is required to be applied to all exposures and discharges as well as to disposal of radioactive waste.

The above requirements also apply for the holder of a licence for practices with radioactive material.

24.1 (ii) Dose limits

Protection of the workers

In conformity with the Euratom Basic Safety Standards the aforementioned Radiation Protection Decree (Bs) stipulates a limit of 20 mSv per year as the maximum individual effective dose for radiation workers.

An employer of a spent fuel or a radioactive waste facility is required to classify persons as radiation worker in one of the categories A or B. Category A workers are likely to receive doses greater than three-tenths of the dose limit (6 mSv per year for whole body exposure). Category B workers are likely to be exposed during their work to radiation greater than the dose limit for the population at large (1 mSv per year for whole body exposure), but less than 6 mSv per year.

Article 90 of the Bs requires that the employer records doses incurred by each exposed employee using personal dosimetry. As regards personal dosimetry no distinction is made between Category A and B workers. Only approved dosimetry services are allowed to provide dosimeters, to assess the received dose and to manage the dose records of exposed individuals.

Dose summaries of all dosimetry services are made available to the National Dose Registration and Information System (NDRIS). NDRIS has been established in 1989 by the Ministry of Social Affairs and Employment and had as main objective to preserve dosimetric data for the period required by the Euratom Basic Safety Standards [1] as well as to bring together all data from all registered radiation workers, including those of foreign workers from abroad whose data are identified through the radiation passport.

Apart from a valid radiation passport, no special work permits are necessary for radiation workers. According to the directive 90/641/Euratom, Dutch legislation obliges a licence holder who hires a radiological worker to ask for the radiation passport, and to respect the annual dose constraints of 20 mSv for A workers and 6 mSv for B workers. The KFD is responsible for surveillance. There are no special ALARA review programmes for workers expected to exceed the 6 mSv dose constraint. However, some licence holders have the policy not to hire workers with more than 10 mSv in their radiological passport. In practice, the number of workers with a dose higher than 5 mSv is very low, as is shown in table 7.

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

- personal data
- social security number
- dosimetric data
- branch of industry (e.g. hospitals, nuclear industry)
- job category (e.g. veterinary X-ray diagnostics, radioactive waste treatment)

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

In Table 7 the dose distribution of workers in the nuclear industry, covering a period of 10 years, is given. It clearly shows a consistently low exposure to radiation.

Dose Category (mSV)	***0.0-1.0***	***1.0-5.0***	***5.0-20.0***	***>20.0***	***Total***	***>1.0***	***>5.0***	***>20.0***
		(frequency)					***(%)***	
Year								
2001	1230	225	7	0	1462	15.9	0.48	0.00
2002	1151	143	3	0	1297	11.3	0.23	0.00
2003	1244	154	4	0	1402	11.3	0.29	0.00
2004	1260	280	32	0	1572	19.8	2.04	0.00
2005	1273	109	7	0	1389	8.4	0.50	0.00
2006	1218	254	23	0	1495	18.5	1.54	0.00
2007	1457	133	11	0	1601	9.0	0.69	0.00
2008	1505	149	2	0	1656	9.1	0.12	0.00
2009	1503	119	8	0	1630	7.8	0.49	0.00
2010	1487	222	19	0	1728	13.9	1.10	0.00

Table 7. Dosimetric data in the nuclear industry

The licensee of the COVRA facility has taken measures to ensure that radiation doses for the most exposed workers remain well under the dose limit. The design of the installations and the work procedures are aimed to maintain a dose constraint of 6 mSv for the individual dose. In 2010 the highest individual dose recorded for the 43 radiation workers was 2.14 mSv. The collective dose for these persons was about 31 millimanSv in the same year. In the last decade the occupational exposures have shown little variance from the values mentioned.

In order to comply with the set targets, the outside area, the buildings and the working spaces are divided in three colour-marked zones according to the scheme in Table 8. The white zone comprises the non-controlled area. For purposes of radiation protection there are no access restrictions. Under normal circumstances there is no contamination with radioactivity in this zone. If it occurs anyway it is due to an incident and consequently temporary in nature. In this case access restrictions apply until the contamination has been removed and the area has been cleared by the Radiation Protection Department.

Radiation levels can be enhanced temporarily in the neighbourhood of vehicles carrying radioactive cargo. The green and red zones constitute the guarded and controlled zones. These zones are situated exclusively within buildings and are not accessible without permission of the Radiation Protection Department. In the green zone the length of stay for radiation workers is unlimited. The working procedures for the other zones are laid down in written instructions.

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

Table 8. Operational zones used to control individual exposures

At the HFR measures to protect the workers are mainly determined by the day-to-day operations around the reactor pool. This work consists mainly of loading and unloading of experiments and isotope production facilities. The following measures are taken to ensure that workers are properly protected:

- From the viewpoint of radiological protection the reactor hall is declared a controlled area. This means that access is limited to those individuals who have the right to enter, with appropriate protective clothing and a dosimeter.
- Around the spent fuel and reactor pool (3rd level) new protective clothing, shoes and gloves are mandatory.
- The dose rate arising from radioactive material in the pool water is the main source of radiation to workers. This dose rate is kept as low as reasonably achievable by filters through which the pool water is circulated. Regularly the water is replenished with clean water, since a few cubic meters of water are lost weekly by evaporation.
- The number of workers present around the pool is kept as low as practicable, which is partly achieved by appointing one of the operators as radiation protection officer.

The result of these measures is an annual effective dose to workers not exceeding 10 mSv. These doses include the dose incurred during handling operations with spent fuel. Each reactor cycle of about 27 days is followed by a short maintenance period during which the reactor vessel is completely unloaded. Most fuel elements are put back in the reactor, but a few elements are stored as waste. In contrast to the situation at NPPs, the dose during these fuel operations is lower that during the normal work.

Similar criteria apply to the HOR research reactor in Delft.

Protection of the public

In article 48 of the Bs a source limit amounting to one tenth of the annual effective dose limit for the public (1 mSv) has been set for any practice or facility, to be measured or calculated at the border of the facility. The reason for this is that an individual licensee cannot be held responsible for the exposure caused by other practices or facilities.

Therefore, a tenth of the cumulative dose limit of 1 mSv is allocated to every individual licensee as a source limit. This is based on the assumption that, by applying these source limits, it is very unlikely that for an individual member of the public the 1 mSv limit will be exceeded to exposure by all sources together in a single year.

On top of the source limit a dose constraint of 0.4 is applied as a first optimisation goal. Consequently the target dose is set at 0.04 mSv/year. The target dose is defined as an Actual Individual Dose, which includes correction factors for low population areas with reduced exposure times such as parkings, motorways, etc.

At specific locations at the site boundaries of COVRA and the HFR thermo luminescent detectors are installed that are read out every quarter year. The results of these measurements are corrected for background radiation (measured elsewhere on the site) and multiplied by the fixed factor related to the maximum period of time any person might conceivably be present at the site boundary

At COVRA the equivalent dose rate at the boundaries of the establishment is as low as reasonably achievable (ALARA), but not higher than a fraction of the dose limit for the public. Both the licensee (COVRA) and an independent institute (RIVM) monitor the radiation levels at the border of the establishment continuously. In 2010 the ambient dose due to the activities at COVRA was below 0.002 mSv/y. This is approximately four percent of the limit accorded to COVRA in the operating licence.

At the HFR research reactor in Petten the radiological protection of the public other than arising from discharges (see the text under 24.2) is achieved by controlling the cumulative radiation dose at the site boundary. The main source of radiation is the radioactive content of the heat exchanger building that is located outside the reactor building. The resulting dose has always been lower than 0.002 mSv in any year since the beginning of these measurements in 1984. Usually the limit for this annual dose is set at 0.04 mSv (see also above and section 19.2 (i)).

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

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

- Category 1. Standard operation
- Category 2. Incidents
  This category describes events, having an irregular frequency of occurrence (about once a year) such as failure of the electrical supply for a short period;
- Category 3. Accidents
  In this category all accidents are included which could occur during the operational life of the facility, such as a fire in the installations, a drop of a package with radioactive contents, or failure of the electrical supply during substantial periods. The frequency of occurrence is in the range of 10^{-1} to 10^{-2} per annum.
- Category 4. Extreme accidents
  These are accidents which, without mitigating measures, could have an impact on the environment. Some of these events have been taken into consideration in the design of the buildings and of the installations. The frequency of occurrence is in the range of 10^{-2} to 10^{-6} per annum

External events from category 4 which have been considered in the consequence analysis are the following:

- Flooding of the buildings
- Earthquakes
- Hurricanes
- Gas cloud explosions
- Release of toxic and/or corrosive substances
- Crashing aircraft (military aircraft)
- External fire

Only the storage building for HLW (HABOG) has been designed to withstand the events mentioned before.

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

The consequences of the design base accidents of category 4 for the HABOG have also been assessed for the other buildings (treatment and storage buildings for LILW) and have been found to be acceptable: for each accident scenario the risk was lower than 10^{-8}/y. Also the cumulative risk was found to be lower than 10^{-8}/y. Internal fires in the treatment facility for LILW constitute the accident scenario with relatively the highest risk.

The measures taken to prevent unplanned and uncontrolled releases from HFR are similar to any other working nuclear installation. The main feature in this respect is the containment building. This structure will prevent any uncontrolled discharge of radioactive material into the environment during normal operations and design base accidents.

Severe accidents initiated by outside events have been considered as beyond design base accidents. These initiating events are the same as mentioned for COVRA. It has been shown that the chance of incurring fatal radiation injury for any individual outside the perimeter fence from any of these events is smaller than 10^{-8} per year. The risk is not determined by the presence of spent fuel, but by the shorter-lived fission products produced by the working reactor.

24.2 Radioactive discharges

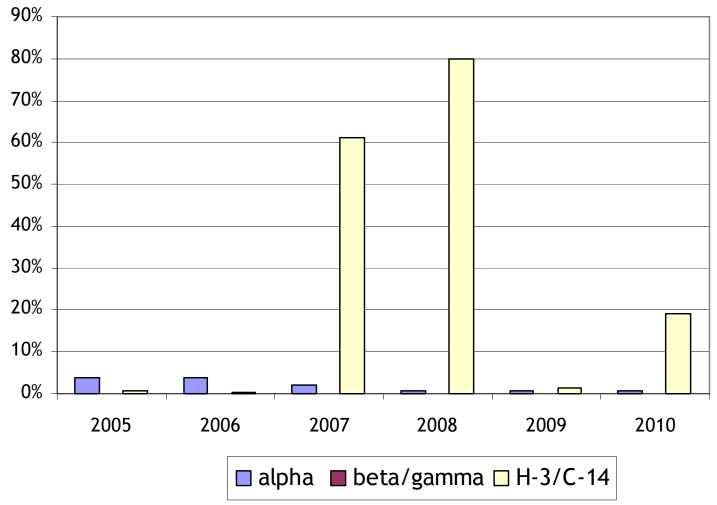
Discharges from COVRA

Both atmospheric and liquid discharges of radionuclides are restricted by requirements in the operating licence of COVRA. In Table 9 below the annual discharge limits for different categories of radionuclides are represented. For the derivation of the authorized discharge limits the annual dose limits for the population are the determining factor. In the second place a source limit of one tenth of the annual dose limit will be applied to a single facility. In the third place the operator is required to make a proposal for the discharge limits by applying ALARA, using both specific design options and optimised operational procedures, to the satisfaction of the regulatory body.

The actual emissions of radionuclides are generally a fraction of the limits specified in the licence, as demonstrated in the diagram in Figures 4a and 4b.

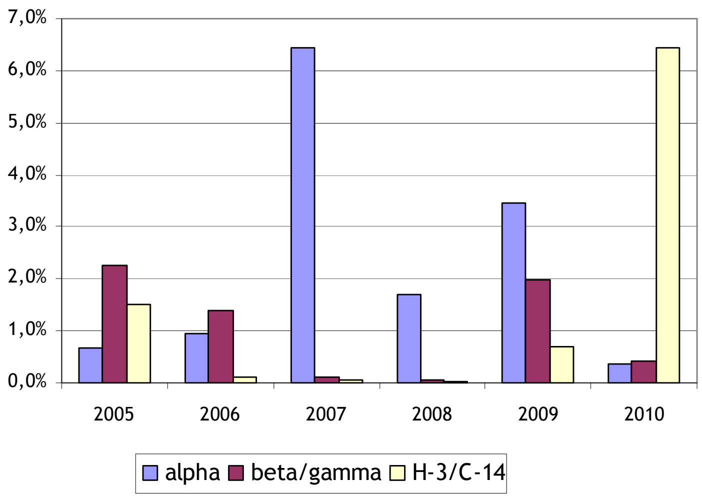
	Annual discharges	
Category	Air borne	Liquid
Alpha	1 MBq	80 MBq
Beta/gamma	50 GBq	200 GBq
Tritium/C-14	1 TBq	2 TBq

Table 9. Authorized discharges at COVRA



emissions to air

Figure 4a. Emissions of radionuclides to the air as a percentage of the annual limit (source COVRA)[3].



emissions to water

Figure 4b. Emissions of radionuclides to water as a percentage of the annual limit (source COVRA).

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

Discharges from the HFR

The regular discharges of HFR are mainly determined by Ar-41 with a half life of 110 minutes. This radionuclide is formed only during the active operation of the reactor, and therefore is not the result of the storage of spent fuel. Also tritium is present in the emissions and rarely small traces of I-131 are detected in the HFR stack. Since 2005 the limit is set at a discharge of 66.6 TBq for the sum of these nuclides. The actual total discharges are presented in the following Table 10:

Year	2003	2004	2005	2006	2007	2008	2009	2010
Discharge (TBq)	7.4	8.2	5.6	4.6	4.6	3.3	4.6	2.6

Table 10. Airborne emissions from the HFR.

The discharges from the Borssele NPP are included in the fifth national report to the Convention on Nuclear Safety.

24.3 Unplanned or Uncontrolled Releases

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

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

Article 25. EMERGENCY PREPAREDNESS

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

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

25 Emergency Preparedness

25.1 Emergency plans

On-site emergency provisions

Although the Nuclear Energy Act does not demand any on-site emergency response plan, the operation licences of spent fuel and radioactive waste management facilities stipulate that a plan should be established and maintained. In the following the situation of the facilities of COVRA are used as an example.

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

The emergency plan has three principal goals:

- to ensure that the operating organisation of the facility is prepared for any on-site emergency situation;
- to mitigate as much as possible the effects on the operating personnel of the facility and on the environment in the vicinity of the plant;
- to advise the relevant government bodies as effective as possible on emergency actions that should be carried out.

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

- procedures for abnormal situations (incidents); and
- procedures for emergency situations, i.e. the symptom-based emergency procedures or "function-restoration procedures" that are applicable to design basis and beyond-design basis accidents.

COVRA has implemented on-site procedures for abnormal events as required by the operating licence. The procedures include the establishment of radiation levels at the border of the facility, which if exceeded, must be notified to the regulatory body.

More specific, incidents or accidents with spent fuel or radioactive waste, which could cause emissions of radioactive material or an increase of the radiation level at any point at the fence of the facility by more than 200 nSv per hour, or cases involving missing drums of radioactive waste, must always be notified to the regulatory body.

Off-site emergency provisions

Chapter VI of the Nuclear Energy Act describes the organisation and co-ordination of response to accidents with nuclear facilities by national and local authorities. A distinction is made between facilities where accidents could potentially have an impact on the whole country (category A objects) and facilities where this is less likely and consequences are assumed to be restricted to the immediate surroundings of the facility (category B-objects). Facilities classified in category A typically include nuclear power stations. The COVRA facility is classified as a type B-object. However, in practice the national government will be involved in the emergency response because of the exclusive availability of nuclear expertise. Chapter VI of the Nuclear Energy Act also sets out the competences and the dependencies of the authorities that are responsible, *inter alia*, for the preparation and the organisation of measures in response to emergencies. Under Article 40 of the Act, the central government carries the bulk of the responsibility, both for the preparatory work as for actually dealing with any emergency that may arise in practice. The operational structure of the system for dealing with nuclear accidents is set out in the National Nuclear Emergency Plan (NPK). The NPK-organisation consists of the following groups:

- A national Warning Point (NWP) at the ministry of Infrastructure and Environment (VROM-Inspectorate) to which all nuclear incidents and accidents (and other environmental incidents) are reported. This centre is staffed and accessible 24 hours a day. The NWP is part of the departmental crisis coordination centre of the environmental department of the ministry of Infrastructure and Environment.
- A policy team at the National Crisis Centre (NCC) of the ministry of the Security and Justice. This team decides on the countermeasures to be

taken to mitigate the consequences of the accident. It is composed of ministers and senior civil servants, and chaired by the minister of Economic Affairs, Agriculture and Innovation or the minister of Security and Justice.

- The National Nuclear Assessment Team (EPA-n). This team advises the policy team whenever there is a real threat of an off-site emergency in a nuclear installation or a radioactive release (in the Netherlands or in a neighbouring country). The team consists of a front-office, where an emergency situation is analysed and advice on measures is drafted, and back-offices for radiological, and medical information. The back-office for radiological information provides projected dose data on the basis of dispersion calculations and monitoring data concerning the environment, drinking water and foodstuffs. It is located within the National Institute for Public Health and the Environment (RIVM). RIVM operates the national radiological monitoring network (NMR) and in addition monitoring vans. It also collects data from other institutes. Alongside the radiological experts, the nuclear regulatory body (KFD) has an important role in assessing the status of the relevant nuclear installation, the accident prognoses and the potential source term. In addition KFD inspectors go to the accident site to support the emergency organisation.
- The National Information Centre is located within the ministry of Security and Justice. This centre is responsible for the coordination of information to be supplied to the public, the press, other national and international authorities and specific target groups, such as farmers.

Under Article 41 of the Act, the local authorities also have a role to play in making contingency plans for emergencies. The mayors of municipalities likely to be affected by accidents involving nuclear power plants located either within their boundaries or in their vicinity (including those across national borders) have drawn up emergency contingency plans in consultation with representatives of central government. These plans are obligatory under Article 7 of the Disasters and Major Accidents Act, and encompass all measures that need to be taken at both local and regional levels. Exercises are also held at regular intervals.

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

Intervention levels and measures

For purposes of emergency planning, the following generic intervention levels and measures are observed:

<u>Direct intervention</u>	(Projected Dose)
Direct evacuation:	1000 mSv H_{eff} or 5000 mSv H_{th} (2 days)
Early evacuation:	200 mSv H_{eff} (2 days)
Late evacuation:	50-250 mSv (first year dose)
Relocation/return:	50-250 mSv (first 50 years after return)
Iodine prophylaxis:	100 mSv (child); adult 1000 mSv (2 days)
Sheltering:	10 mSv H_{eff} (2 days)

Indirect intervention

Grazing prohibition:	5000 Bq I-131 per m^2
Milk(products), drinking water etc.:	500 Bq/l I, 1000 Bq/l Cs, 125 Bq/l Sr, 20 Bq/l alpha emitters.

The intervention measures and levels have been established by the regulatory body following discussions with national experts in the relevant fields. International expertise and guidelines were also taken into account. There was no direct involvement of other stakeholders because the protection of the public in case of possible emergencies is a primary responsibility of national government. There are also derived intervention levels for foodstuffs, based on the appropriate EU regulations.

While awaiting harmonisation directives from the European Commission, the intervention levels for early evacuation, Iodine prophylaxis and for sheltering have been lowered, to match or to come closer to the levels in neighbouring countries.

Emergency exercises

Integrated exercises (i.e. involving both the plant staff and the authorities) have proved a useful way of improving the effectiveness of the licensee's emergency plan and organisation and the emergency organisation of the authorities. After a period in which exercises focused mainly on specific aspects of safety procedures and handling within the facility or exercising parts of the relevant organisations, integrated exercises are now being held on a more regular basis (national full scale every five years).

In addition to the regular schedule of exercises, special attention is to be paid to implementing the results of the NPK revitalisation process. A National full scale Exercise has been held on May 25th 2005. The next exercise is foreseen in 2011. In preparation for this exercise, which involved the Borssele NPP, training and several smaller exercises have been conducted to test the new arrangements and resources. The emphasis in the next full-scale exercise will be focused on performance of the National Nuclear Assessment and Advisory Team ("EPA-n"), information and communication between the NPP and the government and between the different layers of government structure in the Netherlands (e.g. municipality of Borsele, safety region, national government etc.).

25.2 International aspects

The new (draft) National Nuclear Emergency Plan of the Netherlands, preparing for off-site emergency, deals with nuclear and radiological activities including several NPPs located close to the borders, whose off-site emergency-response planning zones cover Dutch territory.

It is recognized that the bilateral response measures do not completely match at different sides of national borders. Examples are reference accidents for NPPs and intervention levels, especially for iodine prophylaxis. This could lead to different zones for countermeasures on both sides of the border. This situation is difficult to explain to the public. Several initiatives are ongoing to harmonize or tune intervention levels and countermeasures with active participation of the Netherlands.

In March 2008 the Dutch policy regarding intervention levels and reference scenario's has been updated. Compatibility with border-countries is improved, although slight differences due to national circumstances remain. The regional Nuclear Emergency plans for the NPPs Borssele and Doel will be updated to implement the new policy (expected to be finished in 2011).

The provision of information to the authorities in neighbouring countries is the subject of a Memorandum of Understanding that has been signed with Germany and Belgium.

Similar Memoranda of Understanding with Belgium and the UK are under development. The exchange of technical data (such as monitoring data and modelling results) takes place on a regular basis between the Netherlands and Germany. With Belgium, the same approach is in preparation. International information exchange in case of a nuclear or radiological accident or incident with transboundary effects is also regulated by the Convention on Early Notification as well as the Convention on Assistance and the Euratom-directive 87/600 ECURIE).

Article 26. DECOMMISSIONING

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

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

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

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

(iv) records of information important to decommissioning are kept.

26. Decommissioning

In table 11 is presented which nuclear facilities in the Netherlands are in operation or have been shut down.

Name of facility	***Type***	***Power***	***Status***	***Date of closure***
Borssele	NPP	515 MW_e	Operational	2033
Dodewaard	NPP	60 MW_e	Shut down	1997
High Flux Reactor (HFR), Petten	Research reactor	45 MW_{th}	Operational	N.a.
Low Flux Reactor (LFR), Petten	Research reactor	30 kW_{th}	Shut down	2010
Hoger Onderwijs Reactor (HOR)	Research reactor	2 MW_{th}	Operational	N.a.
Urenco	Uranium enrichment	N.a.	Operational	N.a.
COVRA	Waste treatment and storage facility	N.a.	Operational	N.a.

Table 11. Status of nuclear facilities

The Dodewaard NPP and the LFR are the only nuclear facilities that are in a state of decommissioning. The Dodewaard NPP was shut down in 1997 after 28 years of operation. It is now in a state of safe enclosure. The LFR was shut down in 2010.

National policy

In principle the operator is responsible for all aspects of decommissioning. According to new legislation, in force since April 2011, a nuclear facility shall be decommissioned directly after finale shut down[4]. Decommissioning implies the implementation of all administrative and technical measures that are necessary to remove the facility in a safe manner, and to create an end state of 'green field'. Therefore, during the operational phase, the licensee is required to develop a decommissioning plan, describing all the necessary measures to safely reach the end state of decommissioning, including the management of radioactive waste, record keeping, etc. This decommissioning plan shall be periodically updated every five years, and shall be approved by the authorities. The decommissioning plan finally becomes part of the decommissioning licence.

During decommissioning, the licensee is required to store records of the decommissioning, the release of material, and the release of the site. At the end of decommissioning, the licensee can apply for withdrawal of the licence, after presenting an end report to the authorities proving that the decommissioning was completed. After withdrawal of the licence, records will be stored at COVRA.

The new legislation also requires the licensee to make available adequate financial resources for decommissioning at the moment that these are required. Therefore, the licensee will have to calculate the costs of all the activities described in the decommissioning plan, and provide for a financial provision offering sufficient security that all costs are covered at the envisaged start of decommissioning. The licensee is free to choose the form of the financial provision: however, it shall be approved by the authorities.

In May 2002 a licence was granted to GKN, the operator of the NPP Dodewaard, to bring and keep the plant in a safe enclosure until 2045. One of the requirements in the licence for safe enclosure is to keep a record system of the inventory of all radioactive materials and components, which have become contaminated or activated during operation, and to update it every five years. In July 2005 the stage of safe enclosure was achieved. Another requirement in the license is that the licensee shall commence dismantling in 2045. The licensee will have to apply for a dismantling licence in due time. In the case that the licensee would consider to commence dismantling activities earlier than 2045, he will have to apply for a new licence, substituting the current safe enclosure licence.

For the nuclear power station in Borssele the government has reached an agreement with the operator on immediate dismantling after closure (scheduled in 2033). There are no plans yet for the decommissioning of the other nuclear facilities.

26 (i) Qualified staff and financial resources

Qualified staff

The NPP Dodewaard is exempted from the requirement of direct decommissioning, and is scheduled to be in safe enclosure for a period of 40 years, starting from the year 2005. The licence requires the operator to appoint a radiological expert for this period, who is responsible for all radiation protection issues. These responsibilities include:

- To asses the results of routine monitoring procedures on locations where external radiation levels and/or contamination levels are likely to be encountered.
- To be immediately available for any information request regarding radiation protection by the regulatory body.
- To take appropriate action in case of unplanned events.

[4] The NPP Dodewaard, brought into state of safe enclosure in 2005, is excluded from this requirement.

- To ensure that radiation monitoring equipment is well maintained or replaced in case of dysfunction.
- To ensure that radioactive waste is managed in accordance with relevant safety standards [5] and is transferred at regular intervals to COVRA.
- To report periodically to the regulatory body on radiation protection matters and general site conditions.

Financial resources

There has been a general understanding that the "polluter pays principle" applies. Consequently, the operators of the NPPs had made financial reservations for decommissioning on a voluntary basis. The decommissioning funds are managed by the utilities.

The latest revision of the Nuclear Energy Act introduced a set of legal provisions requiring the licensee to set up a financial provision for decommissioning. At the moment of writing this report, the licensees are preparing their financial provisions, and are discussing them with the authorities. For further details is referred to section 26.

The aim is to transfer the ownership of the Dodewaard NPP to COVRA, contingent on an agreement on the estimated costs of dismantling increased with a supplement to cover uncertainties in the estimates due to the long period of safe enclosure. The former ministry of VROM, COVRA and GKN - the current owner of the NPP – finished a study on these costs and uncertainties in 2010.

26 (ii) Operational radiation protection

The provisions with respect to radiation protection as set out in article 24 apply generically to decommissioning. In the specific case of the Dodewaard NPP, liquid emissions of radioactive material are not permitted, while airborne* emissions of radioactivity will (per year) be restricted to:

aerosols .... : 1 GBq

tritium as HTO ....: 2 TBq

carbon-14 ....: 50 GBq

Since January 2011 the release of carbon-14 is no longer measured as the plant has become free of carbon-14. All actual releases are less as 1% of these limits.

Radioactive waste management

COVRA is responsible for the treatment and storage of all kinds of radioactive waste. This comprises also the waste associated with the dismantling of a nuclear facility. Storage is conceived to take place on one single location, for a period of at least 100 years.

According to the Dodewaard licence, any radioactive waste arising during the period of safe enclosure will be kept in a dedicated and controlled area and managed according to applicable safety standards [4]. Waste quantities will be recorded and the records be kept at least during the full decommissioning period. Regularly, but at least within 2 years after packaging, this waste will be transferred to COVRA.

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* No liquid discharges are allowed during the safe enclosure period.

26 (iii) Emergency preparedness

The provisions set out under article 25 apply generically.

26 (iv) Record keeping

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

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

Besides that relevant records are kept at the plant itself and at the Gelders Archief, a state controlled archive.

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

In the case of the Borssele NPP, preservation of knowledge is less complicated, as the NPP will be dismantled directly after shut down. Furthermore, Dutch legislation requires that the operator keeps record and documentation during operation.

Section G

Safety of Spent Fuel Management

ARTICLE 4. GENERAL SAFETY REQUIREMENTS

Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management, individuals, society and the environment are adequately protected against radiological hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

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

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

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

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

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

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

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

4 (i) Criticality and removal of residual heat

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

a) At the site of the nuclear power station;

b) At the sites of the research reactors;

c) In the storage facility for High-Level Waste of the Central Organisation for Radioactive Waste (COVRA)

d) At the sites of the reprocessing plant in France.

e) In spent fuel management facilities in the US for research reactor fuel returned under prevailing contracts.

Ad a) The Netherlands has two Nuclear Power Plants (NPPs), a 515 MWe PWR in Borssele, which is in operation, and a 60 MWe BWR in Dodewaard which has been shut down in 1997 and is now in a stage of safe enclosure. All spent fuel has been removed from the Dodewaard plant and transferred to the UK for reprocessing. The last transport of spent fuel from Dodewaard was carried out in April 2003 and the resulting reprocessing waste was returned to the Netherlands in 2010; for that reason, the following information is limited to the practices at the Borssele plant. Details on how the

Netherlands ensures adequate protection against criticality and residual heat are described in the documents mentioned under Art. 32.2 (ii) in Section B.

Ad b) The design of the fuel pools of the HFR at the Research Location Petten and the HOR of the Reactor Institute Delft comply with the provisions in NVR publication 2.1.10, adapted from IAEA Safety Series No. 50-SG-D10. This design ensures the removal of residual heat from the spent fuel, while the design of the fuel storage racks ensures control of criticality.

Ad c) The HABOG facility of COVRA is designed to store spent fuel from the research reactors, vitrified waste from reprocessing and other high-level waste from reprocessing, decommissioning, research activities or molybdenum production. In November 2003 the first spent fuel of the HFR reactor was stored, followed in 2004 by vitrified waste from reprocessing in France and by spent fuel elements from the HOR. At the end of 2010, 168 vitrified glass canisters, 88 compacted hulls and ends canisters, 24 spent fuel containers from the HOR in Delft and the HFR in Petten as well as 4 containers with spent uranium targets from molybdenum production were kept in storage. Details of the HABOG design are presented in the text under article 7 (i).

Ad d) All of the spent fuel of Dodewaard NPP and most of the spent fuel from Borssele NPP has been transferred to the reprocessing plants in the UK and in France respectively and has been reprocessed in previous years. Depending on the reprocessors' operating schedule, some quantity is temporarily stored in the reprocessors' storage pools pending shearing. It is being managed under the prevailing regulatory systems in France. The radioactive residues from reprocessing activities will in due time be returned to the Netherlands and stored in the HABOG facility at COVRA. All HLW of Dodewaard NPP was returned to the Netherlands in April 2010.

Ad e) Under the "Off-site Fuels Policy", which expired in 1988 for HEU fuel, the United States accepted foreign research reactor fuel. Consequently, up to that year the research reactors in the Netherlands sent their spent fuel back to the US. Also in later years occasional shipments with spent nuclear fuel to the US have taken place. This fuel will not be returned to the Netherlands.

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

4 (ii) Minimization of Radioactive Waste

In the Netherlands, minimization of the generation of radioactive waste is achieved in different ways. First of all, and in accordance with the Basic Safety Standards, Dutch regulation requires that the use of radioactive material shall be justified; meaning that it shall be used only if there is no reasonable non-radioactive alternative available. Furthermore, according to Article 36 of the Dutch Radiation Protection Decree, a licensee in possession of radioactive material is obliged to minimise the generation of radioactive waste. The licensee is in principle free to choose its measures to achieve this. An example of such a measure is the preferred use of radionuclides with short decay times, allowing for a rapid decay below the exemption levels.

In the case of materials (not declared as waste) containing radionuclides of natural origin with activity concentrations below ten times the exemption levels, Dutch legislation provides the option to reuse these materials as far as reasonably practical. These materials can for instance be mixed with conventional bulk materials for the use in public works and infrastructure. For further information about this refer to section 32.1 (iv).

Regarding management of spent fuel, the choice whether or not to reprocess spent fuel is left to the operator. In the beginning of the nuclear era in the Netherlands the operators of the two NPPs Dodewaard and Borssele decided in favour of reprocessing for economic reasons. Uranium prices were relatively high and it was considered that the reprocessed uranium and plutonium could be reused either in fast breeder reactors or as MOX in the more conventional light water reactors. Reuse of resource materials is definitely a way to reduce the amount of waste if not in an absolute sense, then at least relative to the electric output of the process. For a variety of reasons, but principally the low price of uranium ore, fast breeder reactors have not yet been deployed commercially. Reuse of uranium from reprocessing facilities, although not fully competitive with fresh uranium, occurs on a limited scale. The reuse of plutonium as MOX fuel in light water reactors is accepted as a method to reduce the plutonium stocks.

On February 11, 2011, the current 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 licensee of a nuclear power plant to evaluate their spent fuel management strategy every 10 years. The government decided to continue the existing policy on reprocessing, allowing the licensee to decide on this. However, this policy will be evaluated every 20 years.

The operator of the Borssele NPP has arranged for the recycling of its reprocessing products (uranium, plutonium), and has been granted a licence 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 a fuel fabricating company for fabricating MOX fuel. Plutonium stored at Sellafield will be sold to a fuel fabricating company for fabricating MOX fuel as well.

4 (iii) Interdependencies in spent fuel management

The basic steps in spent fuel management are not fundamentally different from those in radioactive waste management. For radioactive waste management the steps identified and internationally agreed upon are pre-treatment, treatment, conditioning, storage and disposal [8] (see scheme of Figure 5 below).

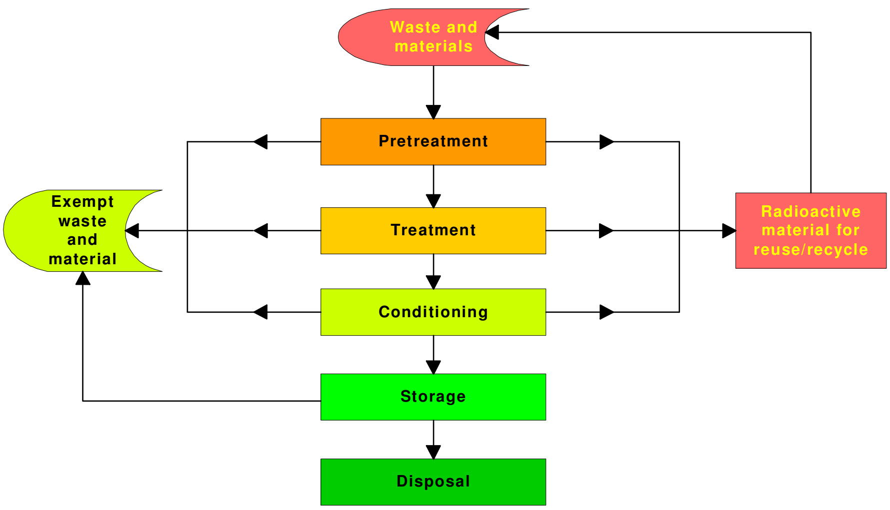

Figure 5. Basic steps in Radioactive Waste Management

For spent fuel management pre-treatment should be taken as temporary storage with the aim of cooling down in the storage pool at the reactor site. Treatment is to be understood as reprocessing, while conditioning and (temporary) storage of spent fuel are steps aimed to keep the extracted resource material in a suitable condition for reuse in case this is the preferred option. The latter two management steps are so far occurring at the reprocessing plants. The policy of reprocessing is consistent with the Netherlands' decision to store the residues above ground for an interim period of 100 years.

Reprocessing residues are produced in packages that facilitate their long-term storage without significant maintenance. The fuel from the non-power reactors is also packed in sealed canisters consistent with maintenance-free storage.

So far no decisions have been taken that would foreclose any of the available management options.

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

Radiation protection of workers

The basic legislation on nuclear activities in the Netherlands is the Nuclear Energy Act. A number of decrees have been issued, containing detailed regulations based on the provisions of the Act. The most important decrees for the safety aspects of nuclear installations and the radiation protection of the workers and the public are:

- the Nuclear Installations, Fissionable Materials and Ores Decree (Bkse); and
- the Radiation Protection Decree (Bs).

The above mentioned decrees are fully in compliance with the Euratom Directive 96/29/Euratom laying down the basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation.

The Bkse requires the licensee of a nuclear installation to take adequate measures for the protection of people, animals, plants and property. Article 31 of the Bkse states that a licence must contain requirements aimed at preventing the exposure and contamination of people, animals, plants and property as much as possible. If exposure or contamination is unavoidable, the level must be as low as is reasonably achievable. The number of people exposed must be limited as much as possible, and the licensee must act in accordance with the individual effective dose limits.

The Bkse also states that these activities must be carried out by or under the responsibility of a person with sufficient expertise, subject to the judgement of the regulatory body*. This expert should occupy a post in the organisation such that he or she is able to advise the management in an adequate way and to intervene directly if he or she considers this to be necessary.

Written procedures must be available to ensure that the radiological protection measures that have to be taken are effective and to ensure that the above-mentioned expert is properly informed. Full details of these conditions are given in the Radiation Protection Decree (Bs), which also lays down more specific requirements on the protection of people and the environment from radiation.

In conformity with the Euratom basic safety standards the aforementioned Radiation Protection Decree stipulates a limit of 20 mSv per year as the maximum individual effective dose for radiological workers.

At the Borssele NPP an individual dose limit of 3 mSv per year has been set as an average long-term objective for radiological workers. This objective serves as an internal target within the context of meeting ALARA requirements. At the other sites in the Netherlands where spent fuel is managed similar operational dose constraints have been adopted.

* A description of the composition and the functions of the Regulatory Body is given in the text under Article 20.

Radiation Protection of the Public and the Environment

As prescribed in the operating licence of spent fuel management facilities, all discharges of radioactive effluents must be monitored, quantified and documented. The licensee must report the relevant data on discharges and radiological exposure to the regulatory body. On behalf of the regulatory body, the National Institute for Public Health and the Environment (RIVM) regularly checks the measurements of the quantities and composition of discharges. The licensee is also required to set up and maintain an adequate off-site monitoring programme. This programme normally includes measurements of radiological exposures and possible contamination of grass and milk in the vicinity of the installation. The results are reported to - and regularly checked by - the regulatory body. Under Article 36 of the Euratom treaty, the discharge data must be submitted to the European Commission each year.

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

4 (v) Biological, chemical and other hazards

Since at the NPPs no other activities are being undertaken than transferral of fuel assemblies from the reactor core to the storage pool and in a later stage transport from the NPPs to the reprocessing plants in certified and accident proof packages, chemical or other hazards are not considered to be a significant issue in spent fuel management.

At the HFR in Petten and the RID in Delft fuel assemblies are also transferred directly from the reactor core to the storage pool. After a cooling period of five years these are transported to COVRA in certified and accident proof packages. Therefore, chemical or other hazards are not considered to be a significant issue in the context of spent fuel management.

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

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

4 (vi) Impacts on future generations

Scenarios that could, in principle, lead to higher exposures of future generations than those, which are considered justifiable for the current generation are:

- Bad management of spent fuel, resulting in uncontrolled discharges into the environment at some time in the future;
- Prolonged authorized discharges of long-lived radionuclides into air and water (e.g. estuaries or the sea). This could result in a gradual build-up of long-lived radionuclides in the atmosphere, causing humans to be exposed to ever increasing concentrations of radioactivity or to delayed exposure due to transportation and concentration mechanisms in food chains which become significant only after an equilibrium situation has been reached.

As stated before, the current policy in the Netherlands with regard to spent fuel management of the NPPs is not to use the full capacity of the storage pools for on site storage of spent fuel. As required by a pertinent condition in the operation licences of the nuclear facilities, regular transports of spent fuel from the NPPs to the reprocessing plants are carried out to ensure that this favourable situation is being maintained.

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

As regards the authorized discharges from the management of spent fuel it is noted that the application of the ALARA principle has a beneficial effect on the actual discharges. All spent fuel management facilities have succeeded in keeping their discharges far below the limits authorized by the regulatory body. This in turn ensures that future generations are not less protected than the current generation under the internationally endorsed radiation protection criteria and standards (see also text under Art. 4 (iv).

4 (vii) Undue burdens on future generations

The strategy of the government of the Netherlands with respect to spent fuel management is founded on the principle that the generation which is responsible for the arising of a hazardous commodity such as spent fuel is in the best position to provide for good management now and to offer possible and sustainable solutions for the future.

For spent fuel from the NPPs the decision has been taken to subject it to reprocessing with the aim to recover resource material from it and to immobilize the fission products into a stable glass matrix of High-level Waste (HLW). The intermediate-level reprocessing residues will also be packed in such a way, that long-term safe and maintenance-free handling is possible. Consequently, it is envisaged that future generations will not have to be concerned with the management of spent fuel from the NPPs. The “burden” for future generations is limited to execution of the final disposal for the HLW, which according to prevailing expert views is already in a suitable condition for disposal. Alternatively, if other options become available in the future, it would be the execution of these other, and presumably preferred, options.

Spent fuel from the research reactors will be conditioned, packaged and subsequently stored in the HABOG facility at COVRA. The care for that material will be passed on to the next generation. However, not only the burden of this care will be passed on to the next generation, but also financial resources and technical knowledge required setting favourable conditions for the good management of the spent fuel.

Article 5. EXISTING FACILITIES

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

5 Existing facilities

The operator of the Borssele NPP has chosen for the option of reprocessing of its spent fuel. Some spent fuel is kept in short-term storage in the spent fuel pool at the Borssele reactor site, waiting for transport to the reprocessing facility, as a new bilateral agreement had to be concluded between France and the Netherlands. Now this agreement has been concluded in July 2010 new transports are scheduled for the coming years. The management of spent fuel of the Borssele NPP that is sent for reprocessing in France is exercised under the authority of the French government.

The only other spent fuel management facility is the HABOG facility, managed by COVRA. This facility is designed to store conditioned spent fuel from the research reactors and has been commissioned in 2003. In this case an upgrade of the safety of this facility is not applicable. However, under the operating licence there is a condition to evaluate every five years the actual safety level, the operational experience and the developments in general regarding the safety of this spent fuel management facility. The first evaluation has been completed at the end of 2009 and the recommendations were implemented by July 2011.

ARTICLE 6. SITING OF PROPOSED FACILITIES

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:

(i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;

(ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment;

(iii) to make information on the safety of such a facility available to members of the public;

(iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

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

6.1 (i) Evaluation of site-relevant factors

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

6.1 (ii) to (iv) Impact of facility and providing information about it.

The HABOG facility of COVRA is the only facility for the long-term storage of spent fuel and high-level radioactive waste in the Netherlands. The storage pools at the research and power reactor sites are not intended for long-term storage and are consequently not considered in this report.

The site selection procedure for COVRA followed two separate routes. For a selection of potentially suitable locations a commission of high-ranking officials from the domain of public administration was established. The first step in the procedure was the formulation of selection criteria for the facility. The selection criteria for candidate sites for the

COVRA facility were mainly based on considerations of adequate infrastructure and the site had to be situated at an industrialised area. As a matter of fact many sites comply with these rather general criteria. Twelve of these were selected by the commission as being suitable in principle. None of the investigated sites had features that were thought to be prohibitive for the planned activity. For the selection of the preferred sites the co-operation of the local authorities was sought. In order to facilitate the negotiations with the local authorities a site-independent Environmental Impact Assessment (EIA) was performed (see below). As expected, this demonstrated essentially the absence of any adverse effect on the environment. However, this conclusion did not lead to an offer from local administrators. Although there are in principle legal procedures for overruling a refusal by a local or regional authority to accept a potentially suitable storage or disposal site, as a rule the consensus model is followed for the allocation of a site. In practice this limits the number of available sites to just a few, since most municipalities consider the presence of a radioactive waste management facility as undesirable. Consequently, the preferred sites are basically selected on the basis of willingness of local authorities to co-operate in the establishment of such a facility. Eventually, only two municipalities were willing to accommodate a facility for storage of spent fuel and radioactive waste. COVRA expressed a preference for the present location in the Sloe industrial area in the south-west part of the country close to the NPP Borssele.

As mentioned earlier, the second route towards the selection of a site was an assessment of the possible environmental effects from a spent fuel and waste storage facility for a generic site. The Environmental Impact Statement was published in 1985. The EIS was re-written for the specific location in the Sloe area and submitted as part of the licence application to the competent authority. This location-dependent Environmental Impact Assessment (EIA) was performed by considering three operational alternatives (the proposed facility, a facility with maximum volume reduction and a facility with a maximum reduction of handling operations). Both the EIS and the licence application were made available to the public for comment. International notification is required in relation to any plan for the disposal of radioactive waste, according to a procedure established in Article 37 of the Euratom Treaty.

Since spent fuel management facilities can in principle give rise to discharges of radioactive material and hence could possibly affect other countries, information of such a plan is provided to the European Commission, which will have an assessment made by experts.

A scheme with the comprehensive step-wise decision-making process for an EIA is presented in the text under article 8.

6.2 Siting in accordance with general safety requirements

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

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

ARTICLE 7. DESIGN AND CONSTRUCTION OF FACILITIES

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

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

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

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

7 (i) Limitation of possible radiological impacts

Spent fuel from the research reactors is stored in the HABOG facility at COVRA. HABOG was commissioned in 2003. A schematic cross-section of the HABOG facility is presented in Figure 6.

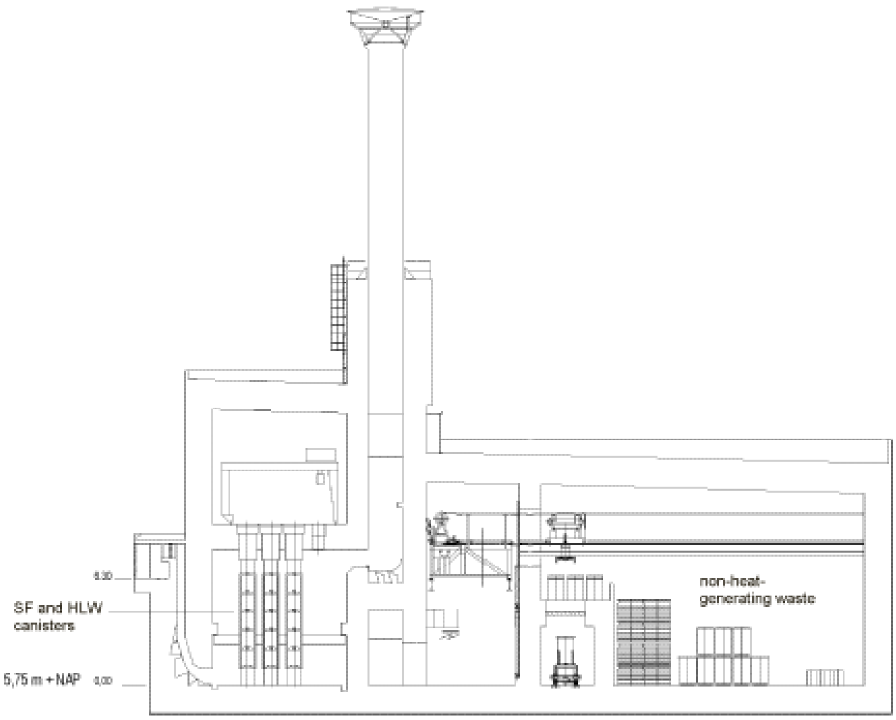

Figure 6. Cross-section of the HABOG facility

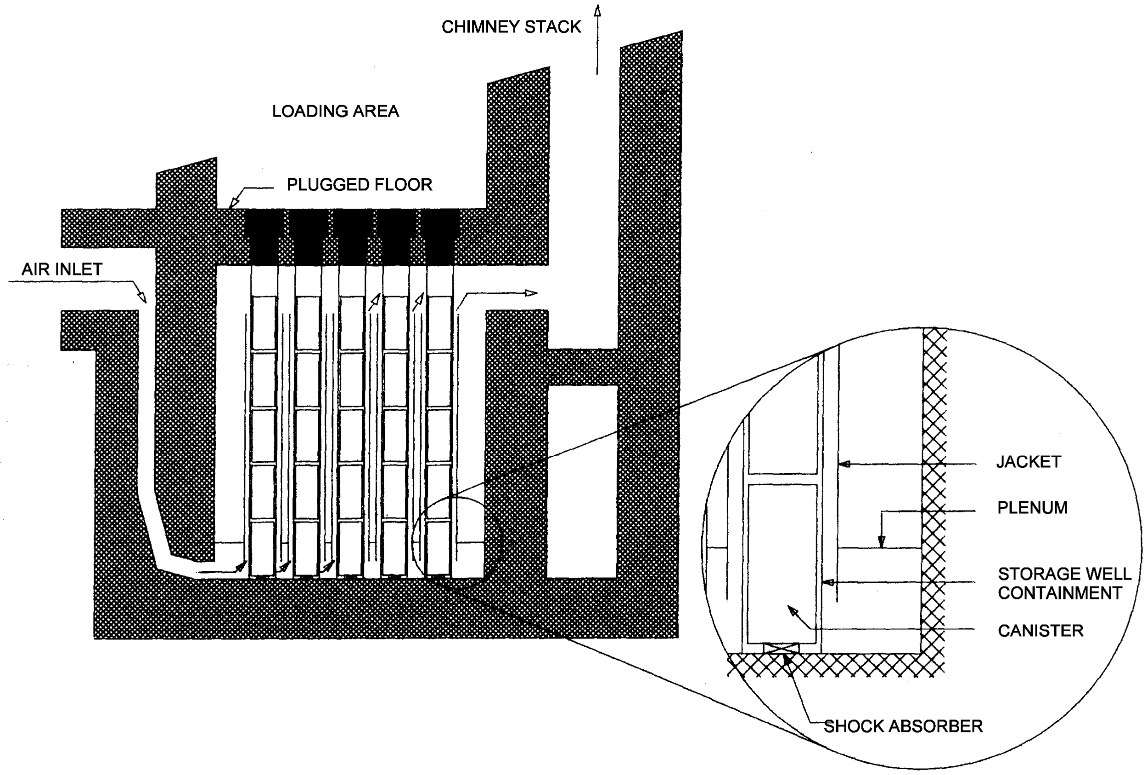

Figure 7. Storage wells for SF and HLW in the HABOG

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. A schematic diagram of the storage compartment for SF and vitrified HLW is represented in Figure 7.

The leading principles of operational safety in the management of spent fuel (and radioactive waste) are the following:

- Isolation
- Control
- 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

- Assurance of a condition of sub-criticality of the spent fuel and targets by application of neutron absorbers and by a suitable geometry of the spent fuel and targets.
- Assurance of adequate cooling of heat-generating HLW.
- Possibility to move spent fuel and targets or HLW from the storage wells with a view to repackaging, relocating to another storage compartment or removal from the facility.

Monitoring

- Monitoring the containment of the storage wells, the temperature of the wells, the shielding capacity and the emissions by inspections and/or measurements.

These 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. 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 under pressure. The air flow through the building is directed from areas with no contamination towards areas with a potentially higher contamination. Both incoming and outgoing air is monitored and filtered.

7 (ii) Conceptual plans and provisions for decommissioning

The spent fuel and HLW storage facility HABOG is designed for a storage period of at least 100 years. Since the technologies are likely to change considerably in this period, no firm plans for decommissioning have been made. Moreover, the facility is designed and operated with the objective to prevent contamination. The SF and waste packages accepted in the building have to be free of (non-fixed) contamination (IAEA Safety Requirements No. TS-R-1). The places in the HABOG which may be contaminated with radioactive material due to handling of SF/HLW are limited. The finishing of all surfaces in places where radioactive material is being handled is carried out in such a way that any radioactive contamination can be easily removed. Consequently, it is unlikely that major structures and components of the building become contaminated. Keeping the buildings clean forms an integral part of the operations, which prevents or limits the build-up and spreading of any contamination. By regularly conducting contamination measurements, any contamination is timely detected and removed. Finally, the consequences of any contamination are limited by compartmentalisation.

7 (iii) Technologies incorporated in the design and construction

One of the most conspicuous features in the design of the HABOG facility is the application of natural convection for the control of the temperature of the SF and HLW canisters. The choice was made in favour of a system of natural convection because of its inherent safety characteristics: cooling is ensured under conditions of loss of electric power and it is insensitive to human errors. It is a reliable cooling method, which is common practice these days. Much experience with this system has been gathered in France.

ARTICLE 8. ASSESSMENT OF SAFETY OF FACILITIES

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

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

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

8 (i) Safety Assessment

A licence for a spent fuel 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 with the international state of the art. Also the applicable parts of the IAEA codes on Design, Operation and Quality Assurance for NPPs must be covered or incorporated in the Safety Report (SR), which is submitted to the regulatory body. 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 licence but before construction the licensee drafts and submits to the regulatory body 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 SR and the international state of the art.

After construction and commissioning of the spent fuel management facility the licensee submits the SAR with a description of the as built-facility and the results of the commissioning to the regulatory body 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 licence. 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.

The regulatory body closely followed the HABOG project. 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 regulatory body for approval. Other documents are submitted for information only.

8 (ii) Updated assessments before operation

In the Environmental Impact Assessment Decree [9], 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 is always mandatory in the cases indicated in Table 12:

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 12. Situations in which an EIA is required

The Regulatory Body is competent for both the safety assessment and the environmental impact assessment.

The facilities at COVRA meet the descriptions under the entries *a* and *d* and an EIA had to be conducted. As reported in the text under Article 6.1 the first EIS was published in 1985. The most recent EIS was carried out in 1995 as a consequence of an envisaged modification in the design of the facility for the storage of SF and HLW. This again was the result of a reassessment of the estimated quantities of SF and radioactive waste to be stored due to the cancellation of expansion plans in the nuclear energy programme. This eventually led to a choice for the current design of the HABOG.

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

With a view to monitor whether the predicted favourable outcome of these statements could be confirmed in practice an evaluation was made of the health and environmental effects in 1995 after 3 years of operation of the facility for low- and intermediate-level radioactive waste.

It appeared that the impact to the environment was even lower than assumed in the EIS, because all emissions of radioactive materials and chemical hazardous materials – both airborne and waterborne – remained far below the limits authorized in the operating licence. The annual reports of COVRA on releases and radiation levels at the fence of the facility show that the favourable situation in 2005, 2006 and 2007 also continued in 2008, 2009 and 2010.

ARTICLE 9. OPERATION OF FACILITIES

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

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

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

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

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

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

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

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

9 (i) Licence to operate

After the commissioning of the SF/HLW storage building COVRA submitted the report with the description of the as built-facility and the results of the commissioning to the regulatory body for approval. This document demonstrated full compliance with the licence and the SR. During the first operational phase, when the storage building is accepting its SF and HLW, the regulatory body closely followed the safety of the installation by inspections and assessment of the licensee’s periodic operation reports.

For the long-term storage phase a licence 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 basic review shall be conducted once every ten years. The latter may involve a review of the facility 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 licences are required for building, taking into operation and operating a nuclear installation. In the specific case of a spent fuel and radioactive waste management facility these licences are usually granted by one ministerial decision. The issue of a licence is conditional on a favourable outcome of the review of the safety assessment of the facility by the KFD of the Ministry of IenM and on a favourable outcome of the EIA.

A safety assessment for the operation of a spent fuel management facility is made by the operator of the facility as part of the application for a licence 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 Regulatory Body that the situation as built is in accordance with the technical specifications and that the safety requirements can be met.

9 (ii) Operational limits and conditions

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

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

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

Examples of such licence conditions include:

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

9 (iv) Engineering and technical support

During the active period of COVRA waste will be accepted and actively stored in the facility. From the moment that no more waste is generated or returned from reprocessing facilities, the HABOG facility will be in its passive phase (design basis ~100 years). Only maintenance and control will take place. After 2130 a final disposal route should become operational.

The money needed for maintenance during this passive period (as well as for the disposal) has been paid in advance and was calculated as discounted value. The money is put in a capital growth fund, managed by COVRA. Because money is available support can be purchased.

The specific policy in the Netherlands requires long-term planning for COVRA's activities. Initially, for the HABOG facility an active operating phase was foreseen until and including 2014 (the originally anticipated closure date of the Borssele NPP). However, as the operational life of the NPP at Borssele has been extended to 2033, and thus more HLW will be generated, this date has to be reconsidered.

9 (v) Reporting of incidents significant to safety

According to the licence conditions the operator is required to report events that have an impact on the safe operation of the facility to the Regulatory Body. The operator is also required to make arrangements for responding adequately to incidents and accidents. The Regulatory Body has approved this arrangement.

9 (vi) Programmes to collect and analyse relevant operating experience

The conditions attached to the operating licence stipulate that both operating experience from the licensee organisation and information obtained from other organisations involved in the management of spent fuel and/or radioactive waste is collected and analysed. This requirement applies both to normal operating experience and to incidents or accidents.

9 (vii) Decommissioning plans

Following the new decommissioning legislation, a (very) preliminary decommissioning plan has recently been made by COVRA and sent to the authorities for approval. The waste stored in the HABOG-facility is delivered in a conditioned form, packaged in stainless steel canisters, in principle not requiring any further treatment or repackaging. The waste form is considered to be a condition that is suitable for disposal in due time. This ensures that radioactive contamination of the HABOG is highly unlikely. Decommissioning of the HABOG facility will not differ significantly from the demolition of any other robust building outside the nuclear sector.

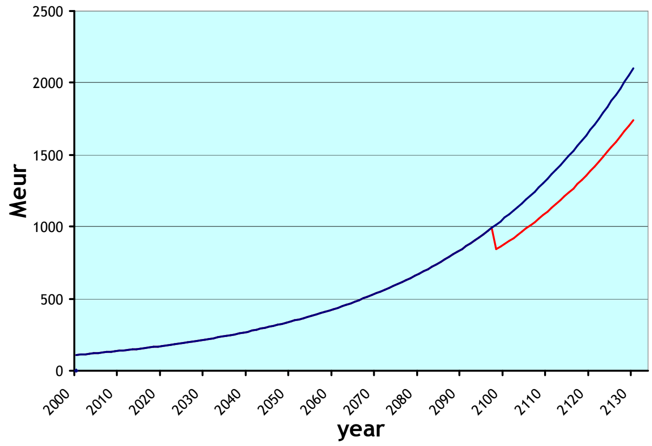

Figure 8. Growth of the radioactive waste management fund

The adjacent graph (Figure 8) is a reference line representing expected growth of the fund for future radioactive waste management. It shows that, if in 2100 money would be drawn from it for the construction of a replacement of the HABOG and other facilities (150 Meur), it would cause a delay of not more than several years (red line in graph). In that period the fund would grow to its original level.

ARTICLE 10. DISPOSAL OF SPENT FUEL

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

10 Disposal of spent fuel

No formal decision has been made regarding disposal of spent fuel. The spent fuel that originates from the research reactors will be stored at the HABOG-facility. In a later stage it will be decided whether the fissile material will be extracted for further use or whether it will be conditioned in a suitable form for disposal.

Section H

Safety of Radioactive Waste Management

ARTICLE 11. GENERAL SAFETY REQUIREMENTS

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

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

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

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

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

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

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

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

11 General safety requirements

See the text under Article 4.

ARTICLE 12. EXISTING FACILITIES AND PAST PRACTICES

Each Contracting Party shall in due course take the appropriate steps to review:

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

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

12 (i) Safety of facilities

The only existing radioactive waste management facility in the Netherlands is the COVRA waste treatment and storage facility at Borsele. It consists of an operational waste treatment and waste storage facility for low- and intermediate-level radioactive waste and a treatment and storage facility for HLW and SF (HABOG). On the premises of COVRA a building was also constructed for the storage of NORM waste, in cases where the regulatory exemption limits are exceeded. Another building is present for the storage of depleted uranium oxide from the Urenco enrichment plant in Almelo. The LILW facility is equipped with volume-reducing installations including a 1500 ton super compactor, an incinerator for liquid organic waste and an incinerator for animal carcasses. The LILW facility has now been in operation for more than 18 years. The whole waste management facility got a major regulatory overhaul in the framework of a revision of the licence for the construction and operation of the HABOG.

Under the operating licence of COVRA there is a condition to evaluate every five years the actual safety level, the operational experience and the developments in general regarding the safety of the whole COVRA facility, including the HABOG facility. All procedural, operational and administrative aspects are evaluated. The first evaluation has been completed at the end of 2009 and the recommendations were implemented by July 2011.

For the intermediate- and high-level waste present in the Waste Storage Facility at the research location Petten, several options for conditioning, repacking and transport to COVRA are under investigation. The waste has to be handled in a dedicated hot cell facility before it can be transferred to the COVRA. It is intended that all the waste has to be transferred from Petten to COVRA before 2020.

12 (ii) Past practices

1,765 drums (January 2011) with historical waste are still stored at the NRG Waste Storage Facility at Petten. This waste, resulting from four decades of nuclear research at that location, exists of high active waste containing fuel material residues and some highly active waste not including fuel material (fission and activation products). The waste is stored in metal drums placed inside concrete-lined pipes.

In the course of a two-year campaign between 1999 and 2001 the waste was inspected and levels of activity were determined. The inspection revealed evidence of corrosion in drums containing highly active mixed waste, due to the presence of PVC. Prior to the inspection campaign, the potential implications of packaging highly active waste together with PVC were unknown. This practice now no longer occurs.

It is intended that those drums containing PVC, about 300 in total, will be sorted, repacked, and prepared for storage at COVRA using a dedicated hot cell facility at the Petten site. All other containers will also be treated, repacked and shipped to COVRA. It is intended that all historical waste from the Waste Storage Facility at Petten will have been removed before 2020.

The owner of this historical waste, the ECN, will have to pay for all management costs, including the commissioning, operation and decommissioning of the necessary hot cell facility at the Petten site, where the waste will be conditioned and repacked before transportation to COVRA. Operational costs for storage will be paid annually and the costs for the passive storage period as well as for final disposal will be paid in 2015.

ARTICLE 13. SITING OF PROPOSED FACILITIES

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:

(i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;

(ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;

(iii) to make information on the safety of such a facility available to members of the public;

(iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.

13 Siting of proposed facilities

See text under Article 6.

ARTICLE 14. DESIGN AND CONSTRUCTION OF FACILITIES

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

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

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;

(iii) at the design stage, technical provisions for the closure of a disposal facility are prepared;

(iv) the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

14 (i) Limitation of possible radiological impacts

In the text under Article 7 a description was given of the building and installations for the treatment and storage of SF and HLW.

A description of the facilities for the treatment and storage of Low- and Intermediate Level Waste (LILW) of COVRA is given below.

Normal operation

Treatment of LILW occurs in a special building, the waste processing building (AVG). Drums of waste collected from licensees from all over the country are sorted with respect to type and/or processing method to be applied. The following categories are distinguished:

Vials containing scintillation liquid

The vials are crushed. The liquid is collected and, if possible, separated in an organic and an inorganic part. The organic liquid is burned in an incinerator, the aqueous liquid is treated and the resulting radioactive residues are solidified and conditioned. The solid components are super compacted and conditioned in concrete.

Liquid waste

Unless their composition is exactly known liquids are considered as mixtures of organic and inorganic components. Further treatment takes place in the water treatment system where as far as possible the dissolved radioactive material is deposited with chemical agents or by electrochemistry. Usually the radioactivity concentrates in the deposit and can be separated by filtration. The purified aqueous liquid is then almost free of contamination and can be discharged within the authorized limits. The radioactive residue is dried and compacted in the same way as other solid waste. Organic constituents of the waste water can also be removed through biological route. Liquids that cannot be treated in the water treatment system are incinerated.

Animal carcasses

Carcasses of laboratory animals, which are contaminated with radioactivity, are burned in a dedicated incinerator. The ashes are collected, super compacted and immobilised in concrete.

Compactable waste

Most of the volume of radioactive waste collected by COVRA is solid compactable waste. Its volume is reduced by compacting the waste-containing drums with a 1500 tonnes super compactor. The compacted drums are transferred to drums with a larger diameter and consolidated with concrete. The conditioned waste is transferred to the storage building.

Sources and other waste

Used sealed radioactive sources are mixed with cement and stored in drums. Other radioactive waste consisting of large sized components is first pre-compressed, or sheared and cut to fit the compacting drums. Again conditioning for long-term storage is done with cement grout and concrete.

Storage buildings (LOG, COG and VOG)

The buildings for the storage of conditioned radioactive waste (LOG) are robust concrete buildings with floors capable of carrying the heavy load of drums stacked in 9 layers (see also Annex 3). The moisture content in the air of the LOG is controlled to prevent condensation and thus corrosion of the metal surfaces of the stored drums.

In the COG building 20-ft containers with large volumes of (TE)NORM from the phosphor producing industry are stored. The building is constructed of lightweight materials in view of the relatively low radiation levels of the waste. Again, air humidity is controlled in order to prevent corrosion

In the VOG building depleted uranium from the uranium enrichment plant in the form of uranium oxide (U_3O_8) is stored in containers of ca 3 m^3. A concrete structure is needed in order to obtain the required shielding. Air humidity control is standard here as well.

Accidents and Incidents

The buildings for treatment and storage of LILW are designed to withstand small mishaps during normal operation and internal accidents such as fire and drops of a radioactive waste container during handling (see also the text under Article 24.1.(iii)). The treatment building (AVG) is also designed to withstand the forces of a hurricane.

These buildings are not designed to provide protection against more severe accidents such as:

- Flooding of the buildings
- Earthquakes
- Gas cloud explosions
- Release of toxic and/or corrosive substances
- Crashing aircraft (military aircraft)
- External fire

However, an analysis of the consequences of beyond design accidents has demonstrated that not only the probability of occurrence but also the radiological impact is limited. The unconditional risk of such accidents has been assessed as lower than 10^{-8}.

14 (ii) Conceptual plans and provisions for decommissioning

See the text under Articles 7 (ii) and 9 (vii).

14 (iii) Closure of disposal facilities

In 1993 the government adopted a position paper [10] on the long-term underground disposal of radioactive and other highly toxic wastes. This position paper was presented to parliament, and forms the basis for the further development of the national radioactive waste management policy: any underground disposal facility to be constructed shall be designed in such a way that each single step in the process can be reversed. The consequence of this position is that retrieval of the waste, if deemed necessary for whatever reason, is always possible.

The overriding reasons for introducing the concept of retrievability were derived from considerations of sustainable development. Waste is considered a non-sustainable commodity and its arising should be prevented. If prevention is not possible, the reuse and/or recycling of this waste is the preferred option. By disposing of the waste in a retrievable way, its eventual management will be passed on to future generations which will thus be enabled to make their own decisions. This could include the application of more sustainable management options if such technologies become available. The emplacement of the waste in the deep underground would ensure a fail-safe situation in case of negligence or social disruption.

Retrievability of the waste allows future generations to make their own choices, but is dependent on the technical ability and preparedness of the society to keep the facility accessible during a long period for inspection and monitoring. It also entails a greater risk of exposure to radiation and requires a long-term organisational effort involving maintenance, data management, monitoring and supervision. In particular in the case of disposal in the deep underground, retrievability will make the construction and operation more complex and requires additional costs.

There might be some conflict between the requirement of retrievability and the requirement to prepare technical provisions for closing a disposal facility. While retrievability demands accessibility of the waste in a repository for a prolonged period – until adequate assurance has been obtained that there are no adverse effects associated with underground disposal, or that no more advanced processing methods for the waste have become available – safety requires that the repository is closed as soon as all the waste is emplaced, in order to create an effective barrier from the biosphere. In practice the feasibility of keeping a geological repository accessible for retrieval purposes is restricted to a maximum of a couple of hundred years, depending on the type of host rock [11]. While borehole convergence due to plastic deformation of the host rock is rather limited for granite, repositories in salt and clay, without any supportive measures of the galleries, tend to close around the emplaced waste. Basically in safety studies this plastic behaviour of salt and clay has been advocated as a safety asset because of an enhancement of the containment function of the repository and a facilitation of the heat dissipation to the rock formation. Consequently, the retrieval period should be limited to a realistic length of time. In the Netherlands only salt and clay are available as possible host rock for an underground disposal facility.

A progressive, step-wise closure procedure of the repository is the most likely approach to reconcile both objectives.

Since the Netherlands has adopted the strategy of long-term storage (at least 100 years, see also Appendix 2) in dedicated buildings at the surface, there is no immediate urgency to resolve this matter in the next decade.

14 (iv) Technologies incorporated in the design and construction

For the HABOG see the text under Article 7 (iii). As regards the buildings for the treatment and storage of LILW much experience has been acquired by comparable waste management activities at the previous location in Petten.

ARTICLE 15. ASSESSMENT OF SAFETY OF FACILITIES

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

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

(ii) in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;

(iii) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

15 (i)-(iii) Assessment of Safety

There are no plans yet for the construction of a disposal facility. For the other entries see the text under Article 8.

ARTICLE 16. OPERATION OF FACILITIES

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

(i) the licence to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;

(v) procedures for characterization and segregation of radioactive waste are applied;

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

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

(viii) decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;

(ix) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

16 (i) Licence to operate

See text under 9 (i).

16 (ii) Operational limits and conditions

See text under 9 (ii).

16 (iii) Operation, maintenance, monitoring, inspection and testing

See text under Article 9 (iii); there are no plans for the construction of a disposal facility.

16 (iv) Engineering and technical support

See text under 9 (iv).

16 (v) Characterization and segregation of radioactive waste.

The radionuclide content of the waste delivered to COVRA is declared and assured by the waste producer. For the LILW four categories are distinguished:

- alpha contaminated waste
- beta/gamma contaminated waste from nuclear power plants
- beta/gamma contaminated waste from producers other than nuclear power plants with a half life longer than 15 years
- beta/gamma contaminated waste from producers other than nuclear power plants with a half life shorter than 15 years

During treatment and conditioning the categories are kept separate.

The price of radioactive waste is a financial incentive to segregate at the production point as much as possible radioactive and non-radioactive materials.

As transferral of the waste to COVRA includes transferral of all liabilities, COVRA performs dose rate measurements before transport on site (there is a relation between dose rate and waste tariff). Furthermore, before processing the waste, random sampling of liquid waste is carried out. In the case that during conditioning the characteristics of the waste turn out to deviate from those provided by the waste producer, COVRA may have to apply for additional processing steps. According to COVRA's accepting conditions, the waste producer will then be charged for all additional costs, creating an incentive for providing the correct data.

16 (vi) Reporting of incidents significant to safety

See text under 9 (v).

16 (vii) Programmes to collect and analyse relevant operating experience

See text under 9 (vi).

16 (viii) Decommissioning plans

See text under 9 (vii).

16 (ix) Closure of a disposal facility

There are no plans for the construction of a disposal facility. Disposal is foreseen more than 100 years from now. The money needed to construct such a facility in the future is gathered in a capital growth fund.

ARTICLE 17. INSTITUTIONAL MEASURES AFTER CLOSURE

Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

(i) records of the location, design and inventory of that facility required by the regulatory body are preserved;

(ii) active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and

(iii) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

17 Institutional measures after closure

This article is not applicable, since there are no plans yet for the construction of a disposal facility.

Section I

Transboundary Movement

ARTICLE 27.TRANSBOUNDARY MOVEMENT

1. Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments.

In so doing:

(i) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

(ii) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;

(iii) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

(iv) a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement;

(v) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

2. A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

3. Nothing in this Convention prejudices or affects:

(i) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;

(ii) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;

(iii) the right of a Contracting Party to export its spent fuel for reprocessing;

(iv) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

27 Transboundary movement

The Netherlands, as a member state of the European Union, has implemented in its national legislation [12] Council Directive nr. 2006/117/Euratom [13]. This directive sets out similar requirements as the ones specified in paragraphs (i)-(v) of this article 27.

Under these regulations imports and exports of radioactive waste require a licence to be issued by the regulatory body (EL&I/ED). Licence applications for a transboundary shipment of radioactive waste should be made to the regulatory body using the standard document laid down in Council Directive nr. 2006/117.

Spent fuel destined for reprocessing is not considered as radioactive waste. However, with a view to the large quantities of radioactive material involved in such transports, these shipments are now also part of Directive 2006/117/Euratom. A licence based on the international transport regulations is also required, covering aspects such as import or export from the country, package approval certificates and physical protection measures.

Paragraph 2 of this article derives from the Antarctic treaty to which the Netherlands is a Contracting Party.

As regards paragraph 3 of this article, the Netherlands has implemented the international agreements on the transport of radioactive materials for the different modes of transport as released by ICAO (air transport), IMO (sea transport), ADR (road transport) and RID (rail transport) and ADNR (transport over inland waterways). The provisions in these agreements are not affected by the Joint Convention [14],[15],[16],[17],[18].

Section J

Disused Sealed Sources

ARTICLE 28. DISUSED SEALED SOURCES

1. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.

2. A Contracting Party shall allow for reentry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

28 Disused sealed sources

All import, manufacturing, transfer, storage, use, export and disposal of radioactive sources with a radioactivity content in excess of the exemption limits, specified in Annex I of the Euratom Basic Safety Standards [1] and implemented in the national Radiation Protection Decree, is subject to availability of a licence. A licence will only be issued if a qualified expert is available who is knowledgeable with respect to the hazards of ionizing radiation. Persons are considered qualified to use a radioactive source if they have completed a radiation protection course of a level commensurate with the hazard of the source and successfully passed an exam.

If a sealed source is declared disused, transfer of the source may occur in two different ways: either transfer to another legal or natural person who is in possession of a valid licence for that source or – if no further use is foreseen – transfer to the recognized organization for radioactive waste management (COVRA). COVRA takes title of the spent sealed sources, after which they are treated as appropriate, conditioned and kept in storage. Sources, as any other LILW, are destined for disposal in an underground repository in due time. In both cases the licensee is required to keep record of the changes in his/her licence. Regular inspections by the official inspection services ensure that individual sources can be tracked during their whole useful life by following the chain of records.

In articles 22 and 33 of the Nuclear Energy Act a mechanism is put in place in which orphan sources, for example lost sources, should be notified to the mayor of the municipality or the city where the sources are found. Subsequently one of the competent inspection services is alerted, which is authorized to impound such source and have it transferred to one of three appointed institutes, which are equipped to store the source. However, most orphan sources are found during routine radiation monitoring of scrap material with portal monitors at scrap yards.

Since 2002 large metal recycling companies are obliged to detect all incoming loads of metal scrap on enhanced radiation levels with portal detectors [19]. The purpose is to monitor all scrap at least one time in the Netherlands. In this way it should be prevented that an orphan source reaches a foundry and is melted.

There are no radiation monitors at points of entry at the borders of the Netherlands to detect orphan sources. However, since 2005 in total 40 portal monitors have been installed at container terminals in the Rotterdam harbour. These monitors were installed on the basis of a Mutual Declaration of Principles between the Netherlands and the United States of America to monitor containers for the purpose of detecting and interdicting illicit trafficking of nuclear and other radioactive material. In airports handheld radiation monitors are available.

Orphan sources are not frequently found in the Netherlands. If such an event occurs it is recorded as an incident or accident. In principle this information is retrievable by searching the annual reports on incidents or unusual events issued by the VROM inspection. Experience shows that practically all events involving orphan sources occur during routine monitoring of scrap material in scrap yards. The more serious incidents, which have a potential of exposing people, are included in the INES database. In 2006 and 2007 a total of three occurrences with a rating of 2 were reported, involving a container with ladies handbags with buckles containing Co-60 and two cases of Cs-137 sources in scrap containers.

With a view to enable reuse or recycling of sources the preferred option for management of spent sealed sources in the Netherlands is return to the manufacturer. This option is usually available when sources are replaced by this manufacturer. However, if, after discontinuation of a practice, sealed sources cannot be returned to the manufacturer, they should be considered as radioactive waste and be delivered to the recognized radioactive waste management organisation (COVRA).

Council Directive 2006/117/Euratom[13] on transboundary shipments of radioactive waste facilitates return of spent sealed sources to the manufacturer by excluding such shipments from the scope of application of the directive.

Council Directive 2003/122/Euratom[20] aims to further restrict exposure of the population to ionizing radiation from high activity sealed sources, including orphan sources. The Directive requires that each high activity sealed source is licensed, that it is uniquely identified with a number embossed or stamped on the source and that countries keep a registry of all licence holders and sources. It further provides for financial arrangements to ensure that the costs for management of disused sources are covered, in cases where no owner can be identified. The provisions of this Directive are fully implemented in the Radiation Protection Decree [2].

Section K

Planned Activities to Improve Safety

Maintenance of nuclear competence at COVRA

A concern at the third Review Conference was the identification of the difficulty to maintain nuclear competence for a period of at least 100 years, since Dutch radioactive waste policy is based on the concept of long-term interim storage. It was noted that the continuity of knowledge during this storage period may require that expertise will have to be hired outside the country. Another point is to ensure the preservation of the information on the stored waste and its history for a period of at least 100 years.

Ensuring the availability of qualified staff through the years is always a challenge in countries with a small nuclear programme. As COVRA is the only organisation in the Netherlands licensed to manage and store radioactive waste and spent fuel, it will have to preserve at least a minimum of qualified staff for the foreseen storage period of 100 years. Additional expertise could be hired from abroad.

The preservation of information on the stored waste and its history is ensured by technical means: all data are preserved in a double archive, using both digital as well as conventional paper data storage. A distinction is made between the short-term archives (<15 years) and the long-term archives (>15 years). For the long-term archive additional measures are taken. The digital information is stored in two different buildings and a procedure exists to update this information at regular intervals. Paper information carriers are printed on certified durable paper and ink and stored in a conditioned room.

Maintenance of nuclear competence at regulatory body

During the third Review Conference a continuous challenge was identified in maintaining and refreshing the regulatory expertise. The regulatory body is faced with challenges regarding staffing, since the activities in the nuclear sectors of the Netherlands are increasing. The extension of the operating life of the Borssele NPP and the current plans for nuclear new-build of NRG, Delta and ERH, face the regulatory body with major challenges like providing adequate number of government staff with sufficient expertise to oversee the licensing procedures. Anticipating increasing workload, the number of staff is being increased. Financial constraints after the global financial crisis force the government to cut the budgets of its ministries, posing an extra challenge to the proper performance of its regulatory tasks.

The following measures have been taken to meet the challenges:

- Anticipating increasing workload requests within the ministry of EL&I for the allowance to expand the financial and human resources of KFD en ED were granted. In the first half of 2011 the financial budget was increased and budget was reserved to increase the total amount of staff at ED with at least 15 fte.
- The budget for providing external international technical safety support to the KFD will increase in the years 2010-2020.

The current ED organisation at this moment is about 20 fte, but this is about to expand in the nearby future. The current KFD professional formation expanded to 41 full-time staff equivalents, including three managers. This is 18 fte more than three years ago. The introduction of new people in the existing organisations is a challenging task. Education and training will require careful planning.

Section L

Annexes

Annex 1 **Conditions for new build Nuclear Power Plants in the Netherlands**

Annex 2 **Storage of Radioactive Waste in the Netherlands**

Annex 3 **Inventory of Radioactive Waste from the Country Waste Profile Report 2007 for the Netherlands**

Annex 4 **Inventory of Spent Fuel**

Annex 5 **Communication policy**

Annex 6 **References**

Annex 1

Conditions for new build Nuclear Power Plants in the Netherlands

Unofficial English translation
"Conditions for new build Nuclear Power Plants in the Netherlands"
This document is a translation of the document: "Randvoorwaarden voor de bouw van nieuwe kerncentrales"
ETM/ED / 11015856, d.d. 11-02-2011

Ministry of Economic Affairs, Agriculture and Innovation

The President of the House of Representatives

of the States General

Binnenhof 4

2513 AA The Hague

Date:

Re: Conditions for the construction of new nuclear power plants

The Coalition Agreement states that licensing applications to build one or more new nuclear power plants will be granted, provided they satisfy the requirements. The purpose of this letter is to notify you of the principal conditions for the establishment of new nuclear power plants (i.e. nuclear power reactors used to generate electricity). The letter provides a comprehensive overview of the main conditions, some of which are already in force. My objective is to clarify matters for all parties involved, including the general public, local government authorities and the companies currently developing plans for the construction of nuclear power plants. Over the coming period, I intend to apply and further specify these conditions within the framework of the relevant procedures for imposed land-use plans and for licensing, amending the necessary legislations and drawing up any other plans mentioned in this letter.

Nuclear power in the context of broader energy policy

The government aims for affordable, secure energy supplies while striking the best possible balance between sustainability and growth. This means producing sustainable energy competitively and providing the scope for nuclear power. Industry and knowledge institutions will continue to cooperate in developing new, cost-effective energy technologies. We are thus aiming to move towards a low-carbon economy via short-term efficiency and longer-term innovation.

Nuclear power is clean. Its use will lead to a reduction in CO2 emissions and it is therefore a logical transitional measure as we move towards a sustainable energy economy. Through the diversification of technologies, fuel and supply routes, new nuclear power plants will help to increase security of energy supply.
The establishment of one or more new nuclear power plants will generate high-level

employment opportunities and knowledge. It will also boost nuclear research and education, especially at research institutes and universities.

International context

Worldwide, 441 nuclear power plants are currently in operation, with a total capacity of 376 GW[1].There is a strong, discernible trend towards expansion, especially in Asia, the United States and some Arab oil-producing states. Within the European Union, nuclear power currently plays a substantial role in power generation, accounting for around one third of the market. A total of four nuclear power plants are currently under construction in Finland, France and Slovakia. Bulgaria, the Czech Republic, France, Poland, Romania and the United Kingdom have plans for the establishment of a total of between 15 and 20 new nuclear power plants, while various countries – including Germany and Sweden – have postponed or cancelled plans to phase them out.

Role of government

The electricity market has been liberalised and the government will not itself invest in new power generation facilities. Instead, it will set conditions and leave it to the private sector to decide whether or not to invest in nuclear power. Applications for licences to build one or more new nuclear power plants will be granted provided they satisfy these conditions. To speed up and streamline the decision-making process, major energy projects, such as the construction of nuclear power plants, are subject to the regulations for central government coordination. This means that I am responsible, with the Minister of Infrastructure and the Environment, for the incorporation of large-scale energy infrastructure projects in the relevant land-use plans. Under the coordination regulation for the Central Government, I am also responsible for the coordination of all the necessary licensing procedures for a new nuclear power plant, as well as for the licence under the Nuclear Energy Act. My aim will be to complete all the necessary licensing procedures within the present government’s term in office. Applications must therefore be made swiftly. Since it would be undesirable to change the rules in the course of the process, I am eager to act now, thus before the licence applications are submitted, and provide a clear statement of the main conditions that the government intends to impose.

Further details of these conditions and any necessary legislation will follow soon. I aim to complete this process by the end of 2011. Due care and nuclear safety will, of course, be the prime considerations.

Status of initiatives for new nuclear power plants

Two concrete initiatives for new nuclear power plants at Borssele are currently on the table. DELTA submitted a notification of intent in June 2009 and the guidelines for the environmental impact assessment (EIA) were established a year later (June 2010). DELTA expects the EIA to be completed by the end of 2011 and intends to submit its application for a licence under the Nuclear Energy Act in early 2012.

Energy Resources Holding (ERH) completed a notification of intent in September 2010. The public participation procedure has been completed and, in late 2010, the Netherlands Commission for Environmental Assessment delivered its advisory report on the scope and level of detail of the EIA. The EIA guidelines are to be established in the near future. ERH expects its licence application under the Nuclear Energy Act to be submitted to the competent authority, together with the EIA, in 2012. Both companies expect to be in a position to commence construction in around 2015 and to start delivering power to the grid in 2019/2020.

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[1] World Nuclear Association (17 December 2010), www.world-nuclear.org/info/reactors.html.

Outline of main conditions

The main conditions for the establishment of new nuclear power plants are listed below. They concern, in the following order, nuclear safety, radioactive waste, decommissioning, uranium, non-proliferation, security and anti-terrorism measures, the knowledge infrastructure, spatial planning, public perceptions, procedural aspects and certain other issues. This letter draws on the results of previous work[2].

1. Nuclear power plants: types, characteristics, safety and the environment

Since the first nuclear reactors became commercially viable in the 1950s, considerable technological advances have been achieved. The 1960s saw the construction of a host of second-generation reactors. Efforts then focused on the development of market-ripe third-generation reactors. These represent a further evolutionary advance and improvement on earlier, tried-and-tested technologies (particularly in the safety field), having benefited from many years' worldwide experience in terms of operation and design. Third-generation reactors currently represent state-of-the-art technology and are now available on the market. They are very safe. The risk of incidents is very slight and many measures have been taken to limit the impact of any events that do occur. Two third-generation pressurised water reactors are currently being built in Finland and France. Outside the European Union, third-generation reactors of a different type – boiling water reactors – have been in service for over 10 years and a number of third-generation pressurised water reactors are under construction. By the time a third-generation reactor goes into operation in the Netherlands, therefore, operational experience will have been gained with them also within the European Union and operators in the Netherlands will be able to draw on this. Reactors that are still under development or at the experimental stage are undesirable because safety and reliability are inadequately safeguarded.

Conditions concerning the construction of new nuclear power plants:

1. The design of the new nuclear power plant must be based on state-of-the-art technology. At present, this means third-generation reactors. It does not, therefore, mean reactors that are still under development or at the experimental stage.
2. The new plant must at least satisfy the current technical requirements imposed by European and national legislation in the Netherlands, including nuclear safety regulations and it must have no unacceptable impact on the aquatic environment.
3. Under existing rules – both national and international – efforts have been made to minimise the risk of serious accidents. From the viewpoint of safety, the technical conditions for new nuclear power plants will be based on the latest insights. The following principles will at any rate apply:

   a) the risk of a core melt accident must be less than once in a million years;

   b) appropriate measures must be available to prevent core material escaping from the containment structure in the event of a core melt accident;

   c) accidents not involving core melt must have no radiological consequences off-site and must certainly not necessitate preventive measures such as evacuation or shelters;

   d) appropriate measures are available to ensure that in the event of a core melt accident protective measures will be required for no more than a limited area and a limited time. This means, for example, that evacuation must not be necessary beyond the immediate vicinity of the facility;

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[2] House of Representatives, Session 2006–2007, 30 000, no. 40 (Randvoorwaarden voor nieuwe kerncentrales) and House of Representatives, Session 2009-2010, 31510, no. 40 (Uitwerking kernenergiescenario's ten behoeve van besluitvorming door het volgende kabinet). For further information, see these letters and associated annexes.

e) the containment structure must be able to withstand great overpressure from inside and a commercial airliner crash from outside;

f) the nuclear power plant must have a long accident response time, so that if accidents occur the operators have time to decide whether and how to react;

g) the new nuclear power plant must meet all current regulations on matters such as conventional environmental protection, nature protection, radiation protection and nuclear safety.

4. The Nuclear Energy Act requires periodic reviews of plant safety in the light of current state-of-the-art technology. In the Netherlands, this means that facilities must be assessed in the light of the current state-of-the-art technology at least once every ten years, starting from the issue of the Nuclear Energy Act licence. These periodic assessments will include consideration of any improvements that may be deemed reasonably feasible. Account must also be taken of any important developments that occur while the plant is under construction[3]. Moreover, events occurring between periodic assessments, such as the discovery of shortcomings in other nuclear power plants of the same type, may necessitate extra reviews.
5. Consideration will be given to the feasibility and desirability of issuing fixed-term licences, and also of setting deadlines for the commencement of construction work following the issue of licences. Decisions on these matters will be taken in the very near future.

2. Radioactive waste

In 2002, the Netherlands decided[4] to store low, intermediate and high-level radioactive waste for a period of at least 100 years in purpose-designed buildings managed by the Netherlands' Central Organisation for Radioactive Waste (COVRA) in the province of Zeeland. Thereafter, the waste is to be disposed of in deep underground 'final repositories'. Based on the current state of science and technology, this method of geological disposal is the safest and most appropriate option for the long-term management of long-lived high-level radioactive waste[5], ensuring its long-term isolation from the human and natural environment.

With a view to possible future recycling and integrated chain management, the government took the position as long ago as 1993 that waste placed in final repositories must be retrievable also far into the future. It can then be brought back into the chain if appropriate recycling technologies are developed. Research by the Committee on Radioactive Waste Disposal (CORA) has shown that it is possible to dispose of high-level radioactive waste safely and retrievably in deep geological repositories[6]. That is why the Netherlands now envisages establishing such a retrievable disposal in the deep underground, probably in salt or clay layers.

Under a draft EURATOM Directive on the management of spent fuel and radioactive waste[7], Member States will be required to adopt national programmes stating how, in practice, they intend to construct and manage final repositories. Cooperation between Member States is not ruled out. Dutch nuclear power policy justifies expectations that the Dutch programme will be ready on time. By 2014, I shall produce a programme setting out the steps to be taken to achieve the final disposal of radioactive waste.

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[3] To cite a foreign example: following the events of 2001, the design of a nuclear power plant under construction in Finland was modified to enable it to withstand an aircraft crash.
[4] House of Representatives, Parliamentary Papers, Session 2002-2003, 28674, no. 1
[5] OECD-NEA Radioactive Waste Management Committee, Collective Statement on Moving Forward to Geological Disposal of Radioactive Waste, ISBN 978-92-64-99057-9, 2008
[6] Final report by the Committee on Radioactive Waste Disposal (CORA), Terugneembare berging, een begaanbaar pad?, letter of 21 February 2001 from the Minister of Economic Affairs (EZ01-107)
[7] Directive 2010/0306/Euratom, proposed by the European Commission on 2 November 2010.

The Dutch Research Programme on the Final Disposal of Radioactive Waste (OPERA 2009-2014) is now under way. The last Dutch studies on the feasibility and safety of the final disposal of radioactive waste date from between 10 and 20 years ago. OPERA is re-evaluating them. The government and industry are supporting this research on a voluntary basis. In view of the sensitivity of the issue of radioactive waste, future research will focus on both societal and technical factors. I will take the results of OPERA into account when deciding my position on the steps to be taken to achieve a final form of disposal for radioactive waste.

Until a few years ago, the choice between direct storage and reprocessing of spent fuel (known as the back-end strategy) was entirely in the hands of the nuclear power plant licence-holder. This is not now the case, since a convention is always needed with the country where reprocessing is to take place. The consent of the government and parliament is required for a convention and, therefore, for the decision to reprocess.

Various studies sent to the House of Representatives in recent years show that neither of these options is clearly preferable from the environmental, safety or non-proliferation point of view[8]. Technologies may eventually be developed for processing spent fuel to remove long-lived components by partitioning and then transmuting them in order to reduce the half-life of this form of nuclear waste. However, such technologies are not expected to be available on the market for some decades to come.

Conditions concerning radioactive waste:

1. The 'polluter pays' principle will continue to apply. Nuclear power plant licence-holders are responsible for both bearing the cost of waste management and providing storage facilities. In practice, this will mean, for example, that they will have to make arrangements with COVRA concerning storage capacity.
2. From the date on which the plant goes into service, nuclear power plant licence-holders will contribute to a fund financing research into the final disposal of radioactive waste. This fund will be cost-covering and will be managed by COVRA. It will be funded with higher COVRA charges for radioactive waste storage.
3. For the time being, it will be up to the nuclear power plant licence-holder to decide whether or not to reprocess spent fuel. If the licence-holder opts for reprocessing, the government will take action to conclude a covenent with the country in which reprocessing is to take place. The covenent will correspond to the length of the contract, subject to a maximum of around thirty years. The licence-holder will evaluate its back-end strategy every ten years. The State will do so every twenty years. Depending on the outcome of these evaluations, the licence-holder may be instructed to adopt a different back-end strategy. In that event, the government can be expected to set reasonable deadlines for compliance.

3. Decommissioning

Prior to the construction of any new nuclear power plant, there must be a clear strategy for decommissioning it and for funding the dismantlement operation. This is laid down in the recent amendments to the Nuclear Energy Act and the Nuclear Facilities, Fissile Material and Ores Decree[9].

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[8] Ontwikkelingen met betrekking tot eind verwerking van gebruikte splijtstof, NRG, April 2005, annexe to House of Representatives, Parliamentary Papers, Session 2004–2005, 30000, no. 5; Kerncentrale Borssele na 2013, Gevolgen van beëindiging of voortzetting van de bedrijfsvoering, ECN, November 2005, annexe to House of Representatives, Parliamentary Papers, Session 2005–2006, 30000, no. 18; Memorandum annexed to House of Representatives, Parliamentary Papers, Session 2006–2007, 30000, no. 40; Kernenergie & Randvoorwaarden, Een verkenning van mogelijke randvoorwaarden voor de kernenergiescenario's uit het Energierapport 2008, NRG, March 2010, annexe to House of Representatives, Parliamentary Papers, Session 2009-2010, 31510, no. 40.

[9] Bulletin of Acts and Decrees 2010, 18.

The licence-holder has long been responsible for the costs of decommissioning of the nuclear power plant. From 1 April this year, however, the licence-holder will be required to make advance financial provision for this, approved by the Minister of Economic Affairs, Agriculture and Innovation and the Minister of Finance. Before giving their approval, the Ministers will ensure that the financial arrangements made by the licence-holder provide a solid guarantee that the costs of decommissioning will be covered when the time comes.

Conditions concerning decommissioning:

1. Decommissioning must commence immediately after the nuclear power plant reaches the end of its normal operating life.
2. Decommissioning must be completed as soon as is reasonably possible.
3. The final aim of decommissioning will be to return the site to 'green field' status. This means that there must be no reason to limit its re-use in consequence of its past use as the site of a nuclear installation.
4. Would-be licence-holders for new nuclear power plants must present an initial decommissioning plan when applying for the licence. The decommissioning plan must be updated every 5 years, starting from the moment at which the plant goes into service.
5. Licence-holders will be responsible for the entire cost of decommissioning and dismantling nuclear power plants, and must have made advance financial provision for this, approved by the Minister of Economic Affairs, Agriculture and Innovation and the Minister of Finance.
6. The entire costs of decommissioning must be covered from the moment that fuel rods are loaded into the core of the new nuclear power plant. This can be achieved by means of insurance, a bank guarantee, collateral or some other arrangement providing equivalent guarantees.
7. A fund must be amassed by means of annual appropriations from profits made throughout the plant's operational life, so that money is available once decommissioning commence.
8. While the fund is being amassed, the difference between the amount of money available in it and the estimated cost of decommissioning must be covered by the guarantees referred to in point 6.
9. The arrangements made by the licence-holder for these financial guarantees must be based on an up-to-date decommissioning plan, and must be approved by the Minister of Economic Affairs, Agriculture and Innovation and the Minister of Finance.
10. There must be satisfactory, transparent arrangements for managing and scrutinising the decommissioning fund. The continuing availability of the financial resources must be guaranteed in the event of operator bankruptcy or transfer of the plant to third parties.

4. Uranium mining and fuel fabrication

Uranium is found in many places around the world but the concentrations vary. For this reason, uranium resources are not a fixed amount and to some extent determined by current market prices. In principle, global uranium resources are sufficient to fuel a substantial growth in nuclear power generation. However, shortages may occur because of the limited production capacity of existing uranium mines and the decline in production capacity from the dismantling of older nuclear weapons. In that event, a rise in the price of uranium may be expected, although this will have a limited impact on production costs, since the cost of fuel for nuclear power plants is estimated at 5 to 10% of total production costs, compared to over 50% for gas and around 30% for coal-fired power stations.

It is important to society to reduce the environmental impact of uranium mining and nuclear fuel fabrication. The main environmental issue relating to the mining and processing of uranium is the management of tailings and of mines themselves, both during operation and after closure. Local pollution is caused by emissions of radon gas to the air and discharges of heavy metals into water and soil. In principle, the reservoirs can be sealed effectively enough to reduce local pollution to levels equivalent to natural emissions of radon from the subsurface. Even so, environmental risks cannot be entirely excluded.

Uranium enrichment is a method of concentrating uranium for use as nuclear fuel. Enrichment can be achieved sustainably. Indeed, this is already being done, for example by URENCO in the Netherlands. To protect the environment, the remaining depleted uranium needs to be carefully managed, especially if it takes the form of uranium hexafluoride and is stored close to the enrichment factory.

I think it is important that operators of new nuclear power plants ensure, as an intrinsic part of corporate social responsibility, that the fuel to be used in their reactors is manufactured in a responsible manner. I am thinking in particular of the following factors. The front-end process (from the mining of the uranium through to the production of the fuel elements) should be transparent. In other words, the source of the uranium, the way it is processed and the way the fuel elements are produced should all be fully traceable. In addition, if the uranium is sourced from mining, the mining company should be at least ISO 14001 certified and should deal responsibly with the natural and human environment. Moreover, the preference in that case should be for in site leaching. If this is not feasible, open pit mining or underground mining are acceptable alternatives, provided that immediate and future pollution are kept to a minimum. However, recycling – for example, from the dismantling of nuclear weapons – is preferable to mining. Finally, I expect operators of new nuclear power plants relying on the enrichment of fissile material to manage the enrichment facilities, the depleted uranium and any other related waste products in an environmentally responsible manner. Because it is difficult to enact legislation in the Netherlands establishing and enforcing the relevant requirements, I will enter into consultations on these issues with those initiating new nuclear power plant projects.

5. Non-proliferation

Since certain fissile materials can be used to manufacture nuclear weapons and nuclear knowledge can also contribute to it, it is important for those operating nuclear facilities to prevent nuclear material and sensitive nuclear knowledge ever passing into the wrong hands, either accidentally or deliberately. Action to prevent the spread of such materials and knowledge is known as non-proliferation.

Non-proliferation is a guiding principle in international agreements. Under the EURATOM Treaty (1957) and the Nuclear Non-Proliferation Treaty (NPT, 1968), with its associated Safeguards Agreement and Additional Protocol, the Netherlands is obliged to place its nuclear activities under international supervision. Every nuclear facility falls automatically under the supervision of the EU (EURATOM) and the International Atomic Energy Agency in Vienna (IAEA) and its licence-holder is obliged to supply necessary information.

The aim of international supervision is to ensure that nuclear material is used for peaceful purposes only. One consequence for nuclear power plants is that regular joint inspections are conducted by the IAEA and EURATOM. Given the safety and security arrangements and the inspection regime, the risk of nuclear materials being diverted is extremely remote. The plutonium separated from spent nuclear fuel during its reprocessing is also subject to IAEA inspection and EURATOM oversight.

Compliance with the Nuclear Non-Proliferation Treaty, including the Safeguard Agreement and the Additional Protocol, provides substantial and effective safeguards in the Dutch situation. The operation of a new nuclear power plant in accordance with this regime is unlikely to create any particular new risk of proliferation.

Conditions concerning non-proliferation:

1. Before any new nuclear power plant is taken into service, comprehensive reports, as required under the prevailing treaties and agreements and in national legislation on non-proliferation, must be provided.
2. Once the nuclear power plant goes into operation, there must be full compliance with all the Netherlands' obligations under the prevailing treaties and agreements and in national legislation on non-proliferation.

6. Security and anti-terrorism measures

Since the events of 11 September 2001, anti-terrorism measures have been stepped up considerably at both international and national level. For example, national and international legislation on nuclear facilities and the transportation of nuclear materials has been modified and tightened up. Partly in that context, the amendment to the IAEA Convention on the Physical Protection of Nuclear Material[10] has recently been implemented through amendments to the Security of Nuclear Installations and Fissile Materials Order[11]. Security measures at the existing nuclear power plant at Borssele have been reviewed, improvements have been recommended and measures are being implemented. These measures will provide the basis for the integrated package of security arrangements required at any new nuclear power plant.

Current government security policy will also apply to any new nuclear power plant. Major features of this policy include identifying possible threats, making provision and taking measures at the design stage to prepare for them, and allocating responsibilities to the plant's own Internal Security Organisation (ISO) and a government External Security Organisation (ESO). Needless to say, effective coordination and harmonisation between these two organisations will be essential. The relevant security requirements are set out in the regulations governing the security of nuclear installations and fissile materials.

Conditions concerning security:

1. The design of the nuclear power plant must take account of facilities and measures realistically needed to maximise security, in combination with safety measures throughout the plant's period in service.
2. Before a nuclear power plant goes into service, it must satisfy the provisions of both the (amended) Convention on the Physical Protection of Nuclear Material and the relevant national and international legislation. The terms of the Convention are implemented in the Security of Nuclear Installations and Fissile Materials Order and elsewhere.
3. Security measures for nuclear installations and related government services must be geared to the latest threat scenarios, as specified in the Security of Nuclear Installations and Fissile Materials Order.
4. During the construction of nuclear power plants, adequate security measures must be taken to prevent deliberate disruption at the site.
5. In the development and design of nuclear power plants, adequate measures must be taken to enable the effective implementation of security and safety measures in the operational phase.

7. Knowledge infrastructure in the Netherlands and government organisation

If one or more new nuclear power plants are to be established, the public authorities and companies involved will need staff with sufficient knowledge and expertise. Government

[10] Dutch Treaty Series, 2006. No. 81.
[11] Dutch Government Gazette 2010, 19950

will need them for policy preparation, licensing and supervision, while the companies will need them for activities like the construction of the nuclear facility or facilities (including the qualification of Dutch supply companies) and the operation and maintenance of the plants. Facilities will also have to be available for sufficient fundamental and applied research on nuclear safety issues.

The Netherlands possesses a broad cluster of relevant nuclear institutions in the shape of the EPZ power producer (nuclear power plant), URENCO (uranium enrichment), COVRA (radioactive waste storage), NRG (fundamental and applied research and production of medical isotopes) and the Reactor Institute Delft (RID) (fundamental research and training). Internationally, the country is a major player in fields like the production of medical radioisotopes and uranium enrichment.

I want to maintain and strengthen this position. Incentives for research in the nuclear technology field will be continued. Wherever necessary and possible, Dutch knowledge and experience will be developed and disseminated internationally. The government will also take a positive attitude to the replacement of the Petten high flux reactor by a new reactor (Pallas) and will ensure that the necessary licensing conditions are ready in good time. It is up to NRG, as the initiating party, to present a watertight business case for the new reactor. New nuclear power plants will give a powerful boost to the nuclear knowledge infrastructure in the Netherlands.

Sufficient opportunities must be available to specialise. There is an international market for such specialists and Delft University of Technology has recently launched an MSc specialisation in Nuclear Science and Engineering. In Zeeland, a specialisation in nuclear technology has been created for students doing courses at secondary vocational and higher professional level. These are welcome developments. Together with the Minister of Education, Culture and Science, I will consider what complementary role the State can play. The Ministry of Economic Affairs, Agriculture and Innovation will continue to subsidise NRG research activities at Petten.

8. Spatial planning, sites for nuclear power plants

A policy is in place to safeguard sites designated for nuclear power facilities. This policy was first recorded in the government decision on sites for new nuclear power plants[12] and has been maintained ever since. It is currently enshrined in the Third National Structure Plan on Electricity Supply (SEV III)[13], which prohibits any developments that render building nuclear power plants impossible or that seriously impede their construction at the designated locations Borssele, Eemshaven and Maasvlakte I[14]. That remains the policy of this government.

The Delta and ERH initiatives both relate to the designated location Borssele. On my behalf and in consultation with the relevant subnational authorities, ARCADIS is now conducting an exploratory study of the spatial implications of the various energy-related and other proposals for the area around Borssele known as the Sloegebied. It will also consider whether there is room for one or more new nuclear power plants there. I will use the results of this study in deciding whether (and, if so, how) to produce an EIA-plan and an imposed central government land-use plan for the area. I will notify the House in due course. Factors in the planning decision will include cooling water (both inlet and outlet), population density, logistics for the supply of nuclear fuel and the removal of spent fuel and radioactive waste, and visual intrusion. I will also take account of the provisions of relevant IAEA Safety Documents, including the Site Evaluation for Nuclear Installations Safety Requirements, which address site-specific considerations like the risk of flooding.

[12] Parliamentary Papers II, Session 1985-1986, 18 830, nos. 46-47.
[13] Parliamentary Papers II, Session 2009–2010, 31 410, no. 16.
[14] The policy no longer applies, therefore, to the Westelijke Noordoostpolderdijk and Moerdijk locations listed in SEV II.

9. Public perceptions

In preparing the nuclear power scenarios, a survey was conducted of the Dutch public's perceptions of nuclear power[15]. The results show that the public find nuclear power a particularly thorny issue[16]. Their initial gut reaction is that nuclear power is dangerous, but necessary. The survey showed there is a need for debate about nuclear power in the context of the broader energy economy, but also that attitudes to it are closely connected to three key factors: fear, knowledge and trust.

The qualitative part of the survey revealed that the Dutch public's attitude to nuclear power could best be summed up as 'a necessary, but hopefully temporary, evil'. The vast majority of people are neither definitely pro nor definitely anti nuclear power. The researchers felt that the debate needed to focus more explicitly on facts and figures on the one hand and people's fears and concerns on the other hand.

People are particularly concerned about nuclear waste, the non-proliferation issue, and the safety of nuclear power plants. This is one of the reasons why investment in research on a solution for the radioactive waste issue and on the use of sustainable energy is regarded as important.

To promote public debate, it is extremely important for objective, transparent and accessible information to be available. I shall take action to ensure this is the case, making use of independent agencies to gather and disseminate it. Research on safe methods of final disposal of radioactive waste will continue. Nuclear power is a useful transitional technology as we move towards a sustainable energy economy.

Conditions concerning public perceptions:

1. Those initiating the establishment of new nuclear installations will be responsible for well-planned, transparent public communications strategies to ensure that the general public find their projects understandable and accessible.

10. Procedures

There are a number of procedures to be completed before work can start on the physical establishment and construction of a new nuclear power plant. These include a modification of the existing land-use plan by way of an imposed central government land-use plan, as well as licensing procedures under the Nuclear Energy Act, the Environmental Permitting (General Provisions) Act, the Water Act and others. A number of decisions (the imposed central government land-use plan and the main licences) also require an EIA report.

Under the Electricity Act 1998, the establishment of new nuclear power plants is by law subject to the regulations for the central government coordination of large-scale energy infrastructure projects. The imposed land-use plan will be adopted by the Minister of Economic Affairs, Agriculture and Innovation and the Minister of Infrastructure and the Environment.

To streamline the process, the regulations for the central government coordination of large-scale energy infrastructure projects include an 'implementation module'. This means that all (or, at any rate, many) of the necessary licences and exemptions can be prepared in a single coordinated procedure. Decisions continue in the first instance to be

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[15] House of Representatives, Session 2009-2010, 31510, no. 40.
[16] This was revealed, for example, by the quantitative part of the survey, where respondents were asked to rate the scenarios in terms of appeal, initial gut reaction, and final preference. The various results were as follows. The scenario with most general appeal was scenario 1a (no new nuclear power plants). After that, scenario 1b held most appeal (no new nuclear power plants, unless inherently safe), followed by scenario 2 (replace Borssele in 2033) and finally by scenario 3 (new nuclear power plant after 2020 – as well as replacing Borssele). Where gut reactions to each scenario were concerned, scenario 3 evoked the most anxiety. Scenario 1a was the one most frequently viewed as a sensible choice. The general feeling about scenario 1b was that the country couldn't wait that long. However, when respondents were asked to award ultimate preference to one of the scenarios, scenario 3 was the winner, followed by scenario 1b and scenario 1a, in that order. Scenario 2 was definitely the least popular.

the responsibility of the relevant subnational authorities, such as the province or municipality, and the central government coordinates the whole process. This means, for example, that responsibility for setting reasonable time limits for the granting of licences rests with me. The regulations also make it possible for the State ultimately to appropriate the licensing powers of another administrative authority, if that proves necessary. At this point, I assume that this will not be the case.

My aim is to ensure that the necessary decisions are taken and licenses issued within the present government's term in office. This is based on the assumption that the relevant applications will be submitted by the end of 2012 (as DELTA and ERH currently intend). The licences can then be awarded in early 2014, so that – depending on any appeal procedures – construction can start around 2014/2015. This can only be achieved, however, if the applications are submitted in time and if, in assessing them, substantial use (and suitable to my judgement) can be made of an approval or draft approval for a power plant issued by a Member State of the European Union, or by the United States of America or Canada.

The licence under the Nuclear Energy Act will be designed in such a way that the prescribed safety standards and other requirements can be carefully monitored and assessed at the various consecutive stages (construction, pre-operational testing and commissioning). The Nuclear Safety Service, (KFD) will have a major role to play and, like the other services involved, will need to be adequately equipped to do so. I will ensure that this is the case.

11. Other issues

Requirements for licence-holders

A nuclear power plant licence is awarded to a particular person. One of the reasons for this is the need to assess the trustworthiness of the applicant (or, in the case of a legal person, the members of its board), given the sometimes confidential nature of information and the involvement of proliferation-sensitive materials and knowledge. The safety of nuclear power plants is assured by legislation, supervision and inspection. Strictly speaking, supplementary requirements concerning the type of share ownership would add nothing to this. It is conceivable, however, that further agreements may be sought with licence applicants on specific matters such as national and regional employment opportunities.

Conditions concerning licence-holders will include the following:

1. Licence-holders must be trustworthy and knowledgable experts.
2. Licence-holders must have the organisation and expertise to be able to guarantee safe operation of plants.
3. Licence-holders must be responsible for guaranteeing the necessary financial and human resources to increase nuclear safety at their facilities[17].

Supporting measures and liability for accidents at nuclear power plants

As stated above, the liberalisation of the Dutch electricity market means that the State will not now invest in power generation. Grants or other financial support will not be provided for the construction of new power plants, whether nuclear or, for example, gas or coal-fired. And, in fact, the authors of the current initiatives have made no requests for any such assistance.

The liability of nuclear plant operators is established in the Paris Convention (1960) and the Brussels Convention (1963) supplementary to it. In the Netherlands, the terms of

[17] Based on the Nuclear Safety Directive (2009/71/EURATOM) and the recently amended Nuclear Energy Act.

these conventions are specified in the Nuclear Incidents (Third Party Liability) Act. New nuclear power plants will, of course, have to satisfy the requirements of that Act. This means that, in the event of a nuclear accident, the operator concerned will be liable for up to €340 million. Consequent to an amendment to the Act which has not yet entered into force, this sum is to rise to €700 million.

If the damage exceeds €340 million but is not above €485 million, there is an agreement under the Brussels Convention that the Member States will contribute set amounts to cover the cost. The Dutch contribution will be funded from the public purse.

If damage exceeds €485 million, there is a supplementary State guarantee up to a maximum of €2.3 billion[18]. This maximum will be increased to €3.2 billion. The licence-holder pays the State an annual premium for its guarantee. The size of the annual premium must adequately reflect the risk run by the State, and will be reviewed on an annual basis.

Costs

Accident management and security measures can be regarded to some extent as belonging to government's normal tasks (maintaining public order and ensuring individual safety) and prerogatives (the use of force). However, they may also include measures within the nuclear power plant itself (for example, in relation to the plant's security personnel, the installation of extra fences, surveillance apparatus etc.). The costs involved are currently shared on the basis of a breakdown of responsibilities. The financial arrangements will be reviewed to see whether there is any reason to change them.

The operators of nuclear facilities currently make a financial contribution towards the costs of licensing and supervision. The level of the contribution is laid down in the Nuclear Energy Act Contributions Decree. Since it has not been adjusted for the last 20 years, it now needs reviewing. The review will address, in particular, the funding of the licensing system, follow-up action and preventive and punitive enforcement measures. My aim is to take a decision on the review in mid-2011.

Conclusion

I plan to ensure that a decision can be taken on the current DELTA and ERH initiatives within the present government's term in office. However, safety and due care will be the prime considerations and this letter is a contribution to that. In the coming period, I shall proceed to specify and implement the conditions outlined in this letter.

Maxime Verhagen

Minister of Economic Affairs, Agriculture and Innovation

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[18] The changes in the amounts have not yet come into operation, however, because it has been agreed (Decision 2004/294/EC of the Council of the European Union, 8 March 2004 (PbEU L 97)) that the EU Member States party to the Paris Convention will all ratify the relevant Protocol simultaneously. Since some of the Member States concerned have still to amend their national legislation, the Protocols – and the amended Nuclear Incidents (Third Party Liability) Act - have not yet come into force.

Annex 2

Storage of Radioactive Waste in the Netherlands

Policy

Long-term storage of radioactive waste and spent nuclear fuel (SF) is an essential element of the policy to manage radioactive waste and SF in the Netherlands. This policy was established in the early eighties and has been fully implemented. Implementation of the policy is the task of COVRA N.V., the Central Organisation for Radioactive Waste.

In the Netherlands one nuclear power plant, two nuclear research centres, a uranium enrichment plant and a medical isotope production facility are in operation. In addition, there is a widespread use of radioactive materials in other areas and one nuclear power plant (Dodewaard, BWR, 50 MWe) is in the decommissioning phase of safe enclosure. The small nuclear power programme is foreseen to remain stable the next tens of years. The nuclear power plant Borsele is in operation since 1973 and is scheduled to remain operational until 2033. The SF of the two power reactors is reprocessed. For the SF of the research reactors reprocessing is not foreseen.

The policy to manage the limited amount of waste and SF is tailor-made to the country's needs and is a pragmatic and practical solution. The high groundwater level in the Netherlands disfavours the use of shallow land burial for short-lived radioactive waste, so ultimately all categories of radioactive waste will have to be placed in a deep geologic repository. This final step can only be implemented when both enough waste is available as well as finances. There are two practical ways to fulfil these two requirements. Either share a repository with another country or wait sufficiently long to generate enough waste as well as money.

The countries' policy lays down that all radioactive waste will be stored above ground in engineered structures allowing retrieval at all times, for a period of at least 100 years. Thereafter geological disposal is foreseen. The choice to store for a long time was well considered and was not taken as a 'wait and see' option. This is clearly demonstrated by the fact that integral parts of the policy are: the establishment of the capital growth fund for future maintenance and disposal and a clear choice for the ownership of the waste within COVRA. This policy does not leave an undue burden of waste generated today to future generations. Only the execution of the disposal action is left as a task for the future. A disposal solution is at principle available and the money will become available in the capital growth fund. The policy is based on a step-wise decision process in which all decisions are taken to ensure safe disposal in a repository, but without excluding alternative solutions in the future.

COVRA has a site available of about 25 ha at the industrial area Vlissingen-Oost. Information on the siting process, licensing, construction and practical experience can be found in the literature and in the NEWMDB of the IAEA [1, 2, 3, 4]. Long-term storage was taken into account in the design of the facilities. Al storage facilities are modular. The available site offers enough space for the waste expected to be produced in the next hundred years. A lay out of the COVRA facilities as present today, is given in Figure A.1.

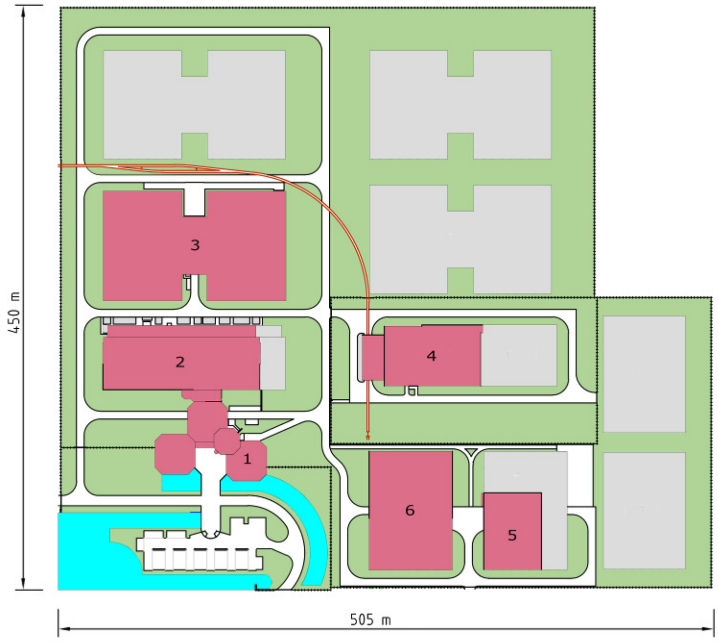

Figure A.1. Layout of the COVRA facilities in 2010 (In grey future expansions of the modular buildings are indicated)

1 – office building and exhibition centre;
2 – building for the treatment of low- and intermediate-level waste;
3 – storage building for conditioned low- and intermediate-level waste;
4 – storage building for high-level waste;
5 – storage building for low-level waste from the ore processing industry;
6 – storage building for depleted uranium.

All storage facilities are modular buildings. The storage building for low- and intermediate-level waste is H-shaped (nr. 3 in the figure) and it consists of a central reception bay surrounded by four storage modules. Each storage module presents a storage capacity for ten to fifteen years of waste production at the present rate. In total 16 storage modules for low- and intermediate-level waste can be constructed which represents at least some 160 years of waste production.

Of the storage building for (TE)NORM waste (nr 5 in the figure), only one third of the full building is in operation right now. One more building of approximately the same size could be constructed in the future. Of the storage building for depleted uranium waste (nr 6 in the figure), the full building is in operation right now but only half of the capacity is used. One or possibly two buildings will be used for the storage of depleted uranium. It is expected that the potential storage capacity will be sufficient for hundred years.

The storage building for high-level waste (nr 4 in the figure) can be doubled in capacity. The present capacity is sufficient for the existing nuclear programme until about 2015.

Since all wastes will be stored for a period of at least 100 years, this has to be taken into account in the design of the storage.

Low- and intermediate-level waste

Because of the small volume of waste and the large variety of waste forms it is important to centralise installations and know-how. The purpose of the treatment is to produce a waste package that is expected to last for at least 100 years and that can be handled after that period. The package should therefore:

- provide an uniform and stable containment;
- avoid possible spreading of radionuclides into the environment;
- lower the radiation dose of handling to acceptable levels;
- allow simple repair and monitoring;
- reduce the volume of the waste;
- be acceptable for final disposal.

For the low- and intermediate-level waste the desired package that meets the above criteria is a cemented waste package. The size of the resulting package is standardised and limited in size in order to ease later handling. Generally, packages with a final volume of 200 litre or 1000 litre are produced. The 200-litre drum is a galvanised steel drum with inside a layer of five centimetre of clean, uncontaminated concrete, embedding the waste. The 1000 litre packages are full concrete packages wherein a cemented waste form is present. In each package there is at least as much cement as waste volume. 200 litre packages with higher dose rate can be placed in removable concrete shielding containers of the same size as the 100-litre containers.

Figure A.2. Storage of low- and intermediate-level waste

Figure A.3. The storage of radioactive calcinate from phosphor production

The conditioned waste packages are stored in a dedicated storage building (LOG). Simplicity, but robustness was leading in the design. The storage building is constructed from prefabricated concrete elements. The outer shell, roof and walls, can be replaced while keeping the waste indoors. The storage building has a central reception area that is connected to four storage modules. Each module can accommodate ten years waste production. Technical provisions inside the modules are minimal: only supply of electricity and light. Both can easily be replaced. All other technical provisions are placed in the reception area. With mobile equipment the air humidity in the storage building is kept around 60%. Waste packages are stacked inside with forklift trucks. Waste packages are placed five rows thick and nine positions high, leaving open inspection corridors. In a group of five rows of packages, higher dose rate packages are placed in the middle in order to reduce dose to the workers and the environment (see Figure A.2). The exact position of each individual package is administrated. All containers must be free of outside contamination according to normal transport requirements. As a result contamination is not present inside the building. Nor fire detection or fire fighting equipment is present in the storage modules, since burnable materials are almost absent. Floor drainage has been judged to be useless and weakening the structure. The floor has upstanding edges that prevents water entering the building.

(TE)NORM and depleted U

The NORM (Naturally Occurring Radioactive Material) waste stored is a calcined product resulting from the production of phosphor in a dry/high temperature process. It is a stable product that does not need further conditioning to assure safe storage. Polonium-, lead- and bismuth-210, relatively short lived but highly radiotoxic nuclides, are concentrated in this waste. Radiation levels from these alpha-emitting radionuclides are very low at the outside of a package. After decay of the radionuclides the material will be cleared and brought outside the nuclear domain. Economics played an important role in the implementation of the storage solution. The calcinate produced at the phosphor plant is dried at the plant and collected in a specially designed 20-ft container. There are three filling positions in the roof of the container that can be closed with a sealed lid. Inside the container a polyethylene bag serves as a liner. The in- and outside of the container is preserved with high quality paint. The container can be filled with 30 tonnes of material. These containers are stacked four high in the container storage building (see Figure A.3). Inspection corridors are kept open, as well as an opening to retrieve the containers firstly stored.

The container storage building is a galvanised steel construction frame with steel insulation panels. High quality criteria were set for the construction and materials in order to meet 150 years lifetime with minimum maintenance. This building also, can be modularly expanded. Again, technical provisions inside the building are minimal. Per storage module an overhead crane is present. The very low radiation doses in the facility allow all maintenance inside. With mobile equipment the air humidity in the storage building is kept around 50%. All containers must be free of outside contamination according to normal transport requirements. So inside the building contamination is not present.

The solution for depleted uranium from enrichment activities, is similar to the one for the calcinate: storage of unconditioned material in larger containers, in this case storage of U_3O_8 in DV70 containers. For depleted U_3O_8 the argument to wait for decay to clearance levels is not applicable. The argument not to embed the material in a cement matrix is the potential value of the material as a future resource. If reuse does not take place in the far future and the decision is taken to dispose of the material, this can be done according to then applicable standards. Money for this treatment and for the final disposal is set aside in the capital growth fund in the same way as is done for all other waste stored at COVRA.

The storage building is a simple concrete construction with insulation panels. A concrete structure is used, because some shielding is required here. The building can modularly be expanded and per storage module an overhead crane is present. For maintenance the overhead crane can be brought to a central reception area that is shielded from the storage module. The same philosophy is followed in this storage building as in the other storage buildings: technical provisions inside the building are minimal. With mobile equipment the air humidity in the storage building is kept around 50%. As all containers must be free of outside contamination according to normal transport requirements, no contamination is present inside the building.

High-level waste

In the seventies it has been decided to reprocess all SF of the nuclear power plants in facilities abroad. Vitrified waste and compacted hulls and end caps are and will be returned to the Netherlands. The research reactors as well as the molybdenum production facility in the Netherlands produce SF and other high-level waste. A win-win situation could be obtained by combining the needs of the nuclear power sector with the needs of others. A packaging and storage facility is in operation for high-level reprocessing waste, SF from research reactors and spent uranium targets from molybdenum production. This facility, called HABOG by its acronym, is a modular vault with a passive cooling system. Heat-generating waste is stored in vertical wells, filled with a noble gas in order to prevent corrosion over the long storage period considered. Air convection brings cold air in that cools the wells at the outside and is discharged as warmer air via the ventilation stacks. Contamination of the air is not possible.

Figure A.4. Emplacement of the wells during construction

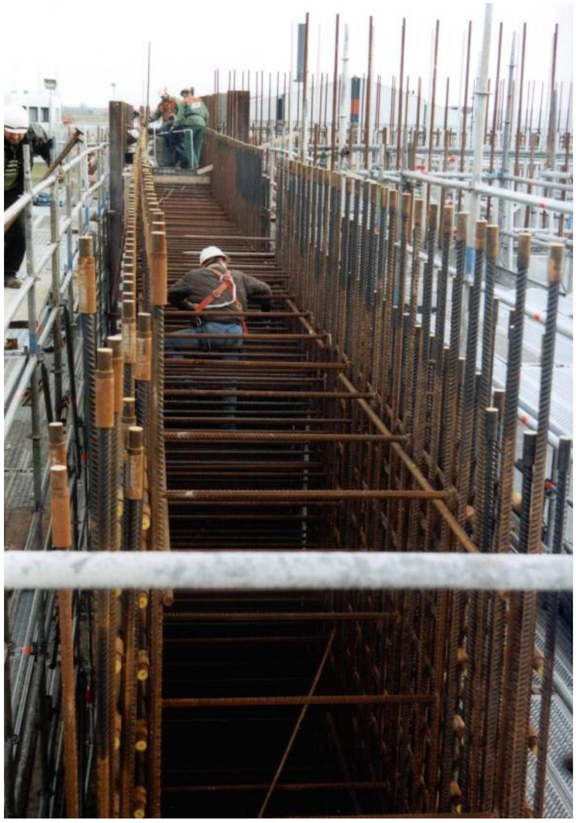

Figure A.5. Worker in the concrete at work in a 1,7 meter thick outer wall

The choice of this system that has no mechanical components is a direct result of the choice for long-term storage. The design of the concrete structure was based on a lifetime of at least 100 years. The facility has further been designed such that all events with a frequency of occurrence of 10^{-6} per year are taken into account and do not create any radiological risk to the outside world. There is spare capacity available to empty each storage module in order to allow for human inspection or repair. Also repacking is possible within the facility, including space to store the larger over packs. SNF from research reactors are packaged into stainless steel canisters compatible with the storage wells. These canisters are welded tight and filled with helium in order to check the weld and to create a non-corrosive environment for the waste. All waste packages stored are free of contamination on the outside. In the storage areas no mechanical or electrical equipment is present. Maintenance, repair or even replacement can be done in a radiation free environment.

(see Figure A.4, A.5 and A.6)

Fig. A.6. HABOG

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Annex 3

Inventory of Radioactive Waste

from

Country Waste Profile Report for Netherlands

Reporting year: 2010

Waste Classification Schemes

Country: NETHERLANDS Reporting Year: 2010

Waste Class Matrix: **IAEA Def.** This country does use the IAEA Scheme: Yes

Description: The Agency's standard matrix

	Distribution %			
Waste Class Name	VLLW	LLW	ILW	HLW
VLLW	100.0	0.0	0.0	0.0
LLW	0.0	100.0	0.0	0.0
ILW	0.0	0.0	100.0	0.0
HLW	0.0	0.0	0.0	100.0

Waste Class Matrix: **National** No

Description: LILW, is called in Dutch the category of 'laag- en middel radioactief afval'. For the Dutch situation no distinction is made between short lived and long lived. The reason for this is that shallow land burial is not applicable for the Netherlands and therefore all catagories of waste will be disposed of in a deep geologic repository after a period of long term storage. The long term storage will take place for a period of at least 100 years.

	Distribution %		
Waste Class Name	LILW-SL	LILW-LL	HLW
LILW	90.0	10.0	0.0
LILW, NORM	100.0	0.0	0.0
LILW, depU	0.0	100.0	0.0
HLW, non heat producing	0.0	100.0	0.0
HLW, heat producing	0.0	0.0	100.0

Comment **# 250: national waste categories**

Three groups of LILW are identified:
- LILW;
- LILW,NORM and
- LILW, depU

The first group, LILW is the 'normal' waste generated by the nuclear industry, users of radioactivity and users of radiation sources. According to the nature of the activity this waste group is further classified as follows:
- category A: all alpha bearing wastes
- category B: beta/gamma waste from nuclear power plants only
- category C: beta/gamma waste with halflife >15 years
- category D: beta/gamma waste with halflife <15 years.

All beta/gamma waste from the nuclear power plants is kept as a separate group because this is a well defined group that generally contains higher levels of strong emitting gamma nuclides. The A category is kept separate because these nuclides have long halflives and are highly radiotoxic. The separation between the C and D category is done on halflife, such as to include H-3 in the last category. Within a storage period of at least 100 years the last category will have decayed completely. SRS as a waste product is not kept separate.SRS is treated in the same way as 'normal'LILW, sources are embedded in a concrete matrix and subsequently stored together with other LILW.

HLW, heat producing, consists of:
- the vitrified waste from reprocessing of spent fuel from the two nuclear power plants (Borssele and Dodewaard);
- the spent fuel of the two research reactors (Petten and Delft).

HLW, non-heat producing, consists mainly of the reprocessing waste other than the vitrified residues. It also includes a small amount of waste from research on reactor fuel and some decommissioning waste.

The waste class scheme for The Netherlands is not based on a law or a regulation. It is since long (1985) common practice to use this class scheme.

The percentages in the matrix are based upon a comparison of the definitions of waste classes in both The Netherlands' and the IAEA's waste classification schemes. The percentages cited are a best estimate.

Waste Classification Schemes

Country: NETHERLANDS Reporting Year: 2010

Definition of «unprocessed waste» and «processed waste»:

This country uses the following definitions:

	as-generated waste	processed for handling	processed for storage	processed for disposal
Unprocessed means:	x	x		
Processed means:			x	x

Comment **# 12224: Definitions for Unprocessed Waste and Processed W**

The LILW is processed in such a way that a cemented waste form results. These cemented waste forms (mostly 200 and 1000 litre packages) are suitable for at least 100 year storage in above ground buildings and are expected to be suitable also for deep geologic disposal. The LILW, NORM, is stored in 20 ft containers as unprocessed product. This is a calcinated product, that can easily be stored in containers for a period of 100 years. After 100 years the radioactivity will have decayed to a level that the material can be moved out of the radioactive materials regime (Po, Bi, and Pb-210 are short-lived). The material can either be reused, possibly after some treatment, in road-filling or comparable, or the material will be removed as chemical waste according to applicable rules and regulations at that time. The LILW, depleted uranium, is stored as unprocessed U3O8, in DV70 containers. The material is stored in an unprocessed way because of the potential value of the material in the future. If, after 100 years storage, the material has to be disposed of in a deep geological repository, it has to be treated according to the requirements for disposal at that time. The HLW, heat producing, consists of vitrified reprocessing waste and spent fuel from the research reactors. The vitrified product is suitable for long-term storage as well as for deep geological disposal. The spent fuel is contained in helium-filled canisters, which are suitable for long-term storage. Repackaging or reconditioning might be needed after 100 years according to the requirements for disposal at that time. The HLW, non heat producing, consists of compacted SE hulls and ends. This product is suitable for long-term storage as well as for deep geological disposal.

International Atomic Energy Agency | Page 1/1 | NEWMDB Report

Groups Overview

Country: NETHERLANDS | Reporting Year: 2010

Reporting Group:	COVRA
Inventory Reporting Date:	December 2010
Waste Matrix Used:	National
Description:	COVRA, Centrale Organisatie Voor Radioactief Afval (Central Organisation For Radioactive Waste), the radioactive waste management organisation in the Netherlands

Site Name	Facility Name	Facilities Defined		
Cogéma	spent fuel	processing		
COVRA	COVRA-AVG	processing		
	COVRA-stor		storage	

Comment **# 23114: SL (former BNFL)**

With one transport of vitrified high level waste canisters in 2010 from Sellafield Ltd. (former BNFL) to COVRA N.V. all waste originating from reprocessing of Dutch spent fuel elements from n.p.p. Dodewaard by Sellafield Ltd. has been returned to The Netherlands.

Site (Structure) : Cogéma

Country: NETHERLANDS

Reporting Year: 2010

Full Name: Cogéma reprocessing facility

License Holder(s): Cogéma

The following list the waste management facilities that are located at this site.

Facility:	**spent fuel**
Description:	For a full description of the Cogéma rep[rocessing facility go to the France site. At Cogéma the spent fuel of the Borssele nuclear power plant is stored , waiting to be reprocessed.

Processing part of facility **spent fuel**

The following shows processing status for waste classes and SRS.

Actual	Actual	Planned
LILW	No	No
LILW, NORM	No	No
LILW, depU	No	No
HLW, non heat producing	No	No
HLW, heat producing	No	No

Type:	Treatment, Conditioning
Year opened:	0

Site (Data) : Cogéma

Country: NETHERLANDS Reporting Year: 2010

Site Name: Cogéma

Full Name: Cogéma reprocessing facility

Inventory Reporting Date: December 2010 Waste Matrix Used: National

Processing - Treatment method(s)

	Status			
Method	Planned	R&D program	Current practice method use over the last 5 years	Past Practice
Calcination	N	N	Same	N
Chemical Precipitation	N	N	Same	N
Compaction	N	N	Increase	N
Size Reduction	N	N	Same	N
Wastewater Treatment	N	N	Same	N

Processing - Conditioning method(s)

	Status			
Method	Planned	R&D program	Current practice method use over the last 5 years	Past Practice
Bituminization	N	N	Suspended	N
Cementation	N	N	Same	N
Encapsulation	N	N	Same	N
Grouting	N	N	Same	N
Vitrification	N	N	Same	N

Site (Structure) : COVRA

Country: NETHERLANDS Reporting Year: 2010

Full Name: National radioactive waste treatment and storage site of COVRA

License Holder(s): COVRA N.V.
Spanjeweg 1
P.O.Box 202
4380 AE Vlissingen
The Netherlands

The following list the waste management facilities that are located at this site.

Facility:	COVRA-AVG
Description:	AVG, AfvalVerwerkingsGebouw (Waste Treatment Building) is the building at the COVRA site where low and intermediate level waste is treated and conditioned.

Processing part of facility COVRA-AVG

The following shows processing status for waste classes and SRS.

Actual	Actual	Planned
LILW	No	No
LILW, NORM	No	No
LILW, depU	No	No
HLW, non heat producing	No	No
HLW, heat producing	No	No

Type:	Treatment, Conditioning
Year opened:	1992

Site (Structure) : COVRA

Country: NETHERLANDS Reporting Year: 2010

Facility:	COVRA-stor
Description:	Separate storage buildings are present at the COVRA site for LILW (LOG), HLW (HABOG), NORM (COG) and for depleted U (VOG)

Storage part of facility **COVRA-stor**

The following shows storage status for waste classes and SRS.

Waste Class	Actual	Planned
LILW	Yes	Yes
LILW, NORM	Yes	Yes
LILW, depU	Yes	Yes
HLW, non heat producing	Yes	Yes
HLW, heat producing	Yes	Yes

List SRS?	No
List UMMT?	

Capacity:	All buildings are constructed such as to allow modular extension. At the site (25 ha) room is available for the waste expected to be generated in a period of 100 years.

Site (Data) : COVRA

Country: NETHERLANDS Reporting Year: 2010

Site Name: COVRA

Full Name: National radioactive waste treatment and storage site of COVRA

Inventory Reporting Date: December 2010 Waste Matrix Used: National

Waste Inventory

Est=distribution is an estimate, Proc.=Is the waste processed (Yes/No)? RO=Reactor Operations, FF/FE=Fuel Fabrication/Fuel Enrichment, RP=Reprocessing, NA=Nuclear Applications,DF=Defence, DC/RE=Decommissioning/Remediation, ND=Not Determined

Waste Class: **LILW**

Waste Class Name	Location / Facility	Proc	Est.	Volume (m³)	RO %	FF/FE %	RP %	NA %	DF %	DC/RE %	ND %
LILW	Storage / COVRA-stor	Y	N	9854.000	52.00	0.00	0.00	48.00	0.00	0.00	0.00

Waste Class: **LILW, NORM**

Waste Class Name	Location / Facility	Proc	Est.	Volume (m³)	RO %	FF/FE %	RP %	NA %	DF %	DC/RE %	ND %
LILW, NORM	Storage / COVRA-stor	N	N	4950.000	0.00	0.00	0.00	0.00	0.00	0.00	100.00

Comment **# 9595: Waste Storage facilities/Class LILW, NORM**

The LILW, NORM is generated in the phosphor plant. Because of the nature of the production process it is a calcinate with Po-210, Bi-210 and Pb-210 only.

Waste Class: **LILW, depU**

Waste Class Name	Location / Facility	Proc	Est.	Volume (m³)	RO %	FF/FE %	RP %	NA %	DF %	DC/RE %	ND %
LILW, depU	Storage / COVRA-stor	N	N	5736.500	0.00	100.00	0.00	0.00	0.00	0.00	0.00

Waste Class: **HLW, non heat producing**

Waste Class Name	Location / Facility	Proc	Est.	Volume (m³)	RO %	FF/FE %	RP %	NA %	DF %	DC/RE %	ND %
HLW, non heat producing	Storage / COVRA-stor	Y	N	15.800	100.00	0.00	0.00	0.00	0.00	0.00	0.00

Waste Class: **HLW, heat producing**

Waste Class Name	Location / Facility	Proc	Est.	Volume (m³)	RO %	FF/FE %	RP %	NA %	DF %	DC/RE %	ND %
HLW, heat producing	Storage / COVRA-stor	N	N	5.600	0.00	0.00	0.00	100.00	0.00	0.00	0.00
HLW, heat producing	Storage / COVRA-stor	Y	N	30.200	100.00	0.00	0.00	0.00	0.00	0.00	0.00

Comment **# 9614: Waste Storage facilities/Class HLW, heat produc**

The processed waste consists of the vitrified waste product resulting from the reprocessing of fuel from n.p.p. Borssele and n.p.p. Dodewaard. Apart from this waste also 4.8 m3 of spent fuel from the research reactors at Petten and Delft is stored at COVRA as well as 0.8 m3 of enriched uraniumfilters from molybdenum production. Spent fuel and filters are packaged in a canister filled with helium; they are however considered here as 'unprocessed' waste.

Site (Data) : COVRA

Country: NETHERLANDS Reporting Year: 2010

Processing - Treatment method(s)

Method	Status			
	Planned	R&D program	Current practice method use over the last 5 years	Past Practice
Chemical Precipitation	N	N	Same	N
Compaction	N	N	Same	N
Incineration	N	N	Same	N
Shredding and Compaction	N	N	Same	N
Size Reduction	N	N	Same	N
Super Compaction	N	N	Same	N
Wastewater Treatment	N	N	Same	N

Processing - Conditioning method(s)

Method	Status			
	Planned	R&D program	Current practice method use over the last 5 years	Past Practice
Cementation	N	N	Same	N
Encapsulation	N	N	Same	N

Comment **# 7369: Cementation and encapsulation**

All LILW is brought into a cemented waste form for storage.
The spent fuel of the research reactors as well as the uranium filters from molybdenum production are encapsulated in a cannister filled with helium gas.

Regulators

Country: NETHERLANDS | Reporting Year: 2010

Name:	**VROM**
Full Name:	Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (Ministry of Housing, Spatial Planning and Environment)
Divison:	Directie Stoffen, Veiligheid, Straling (Directorate for Chemicals, Safety, Radiation protection) VROM Inspectie (Inspectotate General) KernFysische Dienst (Department of Nuclear Safety, Swecurity and Safeguards)
City or Town:	Den Haag (The Hague)

Comment **# 5218: Wastes that are regulated by the Regulator**

Matrix National - HLW, heat producing, HLW, non heat producing, LILW

Name:	EZ
Full Name:	Ministerie van Economische Zaken (Ministry of Economic Affairs)
Divison:	Directoraat-Generaal voor Marktordening en Energie (Directorate-General for Energy)
City or Town:	Den Haag (The Hague)

Comment **# 5219: Wastes that are regulated by the Regulator**

Matrix National - HLW, heat producing, HLW, non heat producing, LILW

Name:	**SZW**
Full Name:	Ministerie van Sociale Zaken en Werkgelegenheid (Ministry of Social Affairs and Employment)
Divison:	Directie Arbeidsveiligheid en -Gezondheid (Directorate for Safety and Safety at Work)
City or Town:	Den Haag (The Hague)

Regulations / Laws

Country: NETHERLANDS Reporting Year: 2010

Name:	**Kew**		
Title or Name:	Kernenergiewet (Nuclear Energy Act)		
Reference Number:	Staatsblad 82, 1963, last revised 2006		
Date Promulgated or Proclaimed:		2/21/1963	Law

Comment **# 5220: Wastes that are regulated by the Law**

Matrix National - HLW, heat producing, HLW, non heat producing, LILW

Name:	**WMO-decree**		
Title or Name:	Beschikking inzake erkenning Centrale Organisatie voor Radioactief Afval N.V. als ophaaldienst (Decree on establishment of COVRA as recognised waste management organisation)		
Reference Number:	Staatsblad 176, 1987, last revised 2007 Stc 246		
Date Promulgated or Proclaimed:		8/31/1987	Law

Comment **# 5221: Wastes that are regulated by the Law**

Matrix National - HLW, heat producing, HLW, non heat producing, LILW

Name:	**Wm**		
Title or Name:	Environmental Protection Act (Wet milieubeheer)		
Reference Number:	Staatsblad 442, 1979, as amended 2007, Stc 414		
Date Promulgated or Proclaimed:		6/13/1979	Law

Name:	**Awb**		
Title or Name:	General Administrative Law Act (Algemene wet bestuursrecht)		
Reference Number:	Staatsblad 315, 1992 ,as amended 2008, Stc 561		
Date Promulgated or Proclaimed:		6/4/1992	Law

Milestones

Country: NETHERLANDS | Reporting Year: 2010

Start Year or Reference Year:	2010	End Year:	
Description of Milestone:			
With one transport of vitrified high level waste canisters in 2010 from Sellafield Ltd. to COVRA N.V. all waste originating from reprosessing of Dutch spent fuel ellements from n.p.p. Dodewaard by SL (former BNFL) has been returned to The Netherlands			

Start Year or Reference Year:	2010	End Year:	
Description of Milestone:			
Foreign countries have noticed the Dutch communication policy about radioactive waste. In 2010 COVRA received an honourable mention from the Italian Pimby (Please In My BackYard) foundation. Every year the foundation gives out awards to organisations who engage in debate with citizens about large infrastructural projects. The Pimby foundation thinks that COVRA sets a good example in her way of making storage of radioactive waste a subject of discussion. The jury indicated to be impressed about the constructive way COVRA draws attention to radioactive waste and how COVRA treats radioactive waste as if it's art.			

Start Year or Reference Year:	2008	End Year:	
Description of Milestone:			
At the PIME (Public Information Materials Exchange) 2008 conference in Prague, organised by the European Nuclear Society, COVRA received the PIME Award for communication in the nuclear industry. The HLW storage building of COVRA is not only a technical storage facility but also a piece of art, developed by the artist William Verstraeten. The visual appeal of the building and its nature as a talking point have lead to a great number of visitors. Because of this succes COVRA continued to use its facilities also for other needs in society such as depot storage for cultural heritage items. In the unused space of the LILW storage building museum artifacts are stored. This is a good starting point for discussions with members of the public on radioactive waste management and the time management involved.			

Start Year or Reference Year:	2006	End Year:	2034
Description of Milestone:			
The nuclear power plant Borssele started its operational life in 1973. Originally a lifetime of 30 year was foreseen. After technical improvements and evaluation it has been decided to extend the lifetime to 60 years. In 2006 an agreement was signed with the government that approves operation of the npp till 2033. Included in this agreement is the decision for direct dismantling at the end of the operational life.			

Start Year or Reference Year:	2003	End Year:	2130
Description of Milestone:			
Between 2003 and 2015 the HABOG building will receive HLW, this is the active phase of the facility. Between 2015 and 2130 HABOG will be in a passive storage phase. From 2130 all LILW, HLW and SF will be placed in a disposal facility, where the waste will be retrievable untill the decision is taken for permanent closure.			

Milestones

Country: NETHERLANDS Reporting Year: 2010

Start Year or Reference Year:	2002	End Year:	
Description of Milestone:			
In April 2002 all shares within COVRA were transferred from the largest waste producers to the State. All shares were transferred to the State because: - the n.p.p. Dodewaard stopped the production of electricity in 1997; - the Energy Research Foundation (ECN) placed its nuclear activities in a special business unit (NRG) together with the nuclear activities of KEMA and therfore ECN was no longer interested to hold shares in COVRA; - liberalisation of the electricity market and therefore the n.p.p. Borsele focussed on core-business activities; - no important nuclear activities are expected in the foreseeable future. As only shareholder acts the Ministry of Finance. This Ministry keeps close contacts with the Ministry of Environment, which is responsible for the general policy of the Netherlands with respect to radioactive waste.			

Start Year or Reference Year:	1994	End Year:	2003
Description of Milestone:			
In 1994 the preparations were started to obtain a license for the storage building for HLW and SF (HABOG building). After a long legal process, the granted license could be used in 1999. Construction of HABOG started in 1999 and was finished in 2003. In September 2003 the facility was officially inaugurated by HM the Queen Beatrix. The first HLW was stored in the building in November of that year.			

Start Year or Reference Year:	1984	End Year:	1992
Description of Milestone:			
Between 1984 and 1987 a site selection procedure was followed to find a site where treatment and long term storage of all the nations radioactive waste could be established. In 1987 COVRA applied for a license (Nuclear Energy Act) for the present site at the Harbour and Industrial Area Vlissingen-Oost. The license was granted in 1989. Construction of waste treatment and storage facilities for LILW took place between 1989 and 1992. All LILW temporarily stored at the Petten site was transferred to the new site between 1992 and 1994.			

Start Year or Reference Year:	1982	End Year:	1992
Description of Milestone:			
Seadumping was abandoned. COVRA was established as national waste management organisation. COVRA started as private company with limited liability (Naamloze Vennootschap or N.V. in Dutch). Shareholders: - 30% n.p.p. Borssele (EPZ) - 30% n.p.p. Dodewaard (GKN) - 30% Energy Research Foundation (ECN) - 10% the State of the Netherlands. The structure changed in 2002 (see milestone 2002) As an interim solution all LILW was conditioned and stored at the site of the Energy Research Foundation at Petten (Noord-Holland). This ended in 1992, because a new site was opened at the Harbour and Industrial Area Vlissingen-Oost.			

Start Year or Reference Year:	1950	End Year:	1982
Description of Milestone:			
Seadumping was used as disposal for LILW.			

Policies

Country: NETHERLANDS | Reporting Year: 2010

National Systems

	Policy	(Yes;Partially;No)
Q14	Has your Country implemented a national policy for radioactive waste management?	Yes

Comment **# 7380: National waste management policy**

Since 1984 the government of the Netherlands follows a straightforward policy based on the principle that hazardous materials must be ' isolated, controlled and monitored'. Main elements of this policy are:
- all kinds and categories of radioactive waste will be stored for at least 100 years above ground in engineered structures which allow retrieval at all times;
- long-term storage, together with a central treatment facility is seen as a normal industrial activity and will be located on one single site;
- research will be performed on final disposal possibilities within the Netherlands or within an international framework;
- COVRA will take care of all the wastes produced.

Direct disposal is not yet feasible in the Netherlands. A disposal site for this type of waste is not available, the public acceptability for deep geologic disposal is low and the small volumes of waste do not yet require an immediate final solution. Also the financial burden of a direct disposal facility is prohibitive for the small quantities concerned. The money can however be generated when a capital growth fund is allowed to grow over a substantial time period.

Long-term storage also allows for the application of future international or regional disposal solutions or even complete new techniques to remove the hazardous constituents.

The choice to store for a long time was well considered and was not taken as a 'wait and see' option. This is clearly demonstrated by the fact that integral parts of the policy are:
- the creation of a capital growth fund;
- a clear choice to transfer the ownership of the waste fully to COVRA.

This policy does not leave the burden of the waste generated today to future generations. Only the execution of the disposal is left as a task for the future, as will be the closing of the disposal site. This is a step-wise approach, where each step can be undone and replaced by another activity if so desired.

	Strategies	(Yes;Partially;No)
Q15	Has your country developed strategies to implement a national policy?	Yes

	Requirements	(Yes;Partially;No)
Q17	identified the parties involved in the different steps of radioactive waste management	Yes
Q18	specified a rational set of safety, radiological and environmental protection objectives	Yes
Q19	implemented a mechanism to identify existing and anticipated radioactive wastes	Yes
Q20	implemented controls over radioactive waste generation	Yes
Q21	identified available methods and facilities to process, store and dispose of radioactive waste on an appropriate time-scale	Yes
Q22	taken into account interdependencies among all steps in radioactive waste generation and management	Yes
Q23	implemented appropriate research and development to support the operational and regulatory needs	Yes
Q24	implemented a funding structure and the allocation of resources that are essential for radioactive waste management	Yes
Q25	implemented formal mechanisms for disseminating information to the public and for public consultation	Yes

Policies

Country: NETHERLANDS | Reporting Year: 2010

	Responsibilities	(Complete;Incomplete)
	Member State Responsibility	
Q28	establish and implement a legal framework for the management of radioactive waste	Complete
Q29	establish or designate a regulatory body that has the responsibility for carrying out the regulatory function with regard to safety and the protection of human health and the environment.	Complete
Q30	define the responsibilities of waste generators and operators of waste management facilities	Complete
Q31	provide for adequate resources	Complete
	Regulatory Body Responsibility	
Q33	enforce compliance with regulatory requirements	Complete
Q34	implement the licensing process	Complete
Q35	advise the government	Complete
	Waste Generator and Operators of Waste Management Facilities Responsibility	
Q37	identify an acceptable destination for the radioactive waste	Complete
Q114	comply with legal requirements	Complete

	Activities	(Yes;Partially;No)
Q43	perform safety and environmental impact assessments for radioactive waste management facilities	Yes
Q44	ensure adequate radiation protection for workers, the general public and the environment	Yes
Q45	ensure suitable staff, equipment, facilities, training and operating procedures are available to perform the safe radioactive waste management steps	Yes
Q46	establish and implement a quality assurance programme for the radioactive waste generated or its processing, storage and disposal	Yes
Q47	establish and keep records of appropriate information regarding the generation, processing, storage and disposal of radioactive waste, including an inventory of radioactive waste	Yes
Q48	provide surveillance and control of activities involving radioactive waste as required by the regulatory body	Yes
Q49	collect, analyze and, as appropriate, share operational experience to ensure continued safety improvements in radioactive waste management	Yes
Q50	conduct or otherwise ensure appropriate research and development to support operational needs in radioactive waste management	Yes

Policies

	Clearance	(Yes;No)
Q128	Does your country have "clearly defined clearance levels based on radiological criteria, with policy statements that material below those levels can be recycled or disposed of with non-radioactive wastes"?	Yes
Q129	Has your country ever used a "case-by-case" approach to clearing radioactive wastes (excluding spent/disused sealed radioactive sources)?	No
Q130	Has your country ever used clearance levels to dispose of, reuse or recycle radioactive waste as non-radioactive waste or as a non-radioactive resource (excluding spent/disused sealed radioactive sources)?	Yes

Comment **# 9714: Policies National Systems-Clearance**

Clearance is regularly used for short lived waste in the medical and research area. Waste can be stored for two years maximum at the generator's site to allow for decay under the clearance level. Then the waste is disposed of as non-radioactive material.
Clearance and exemption levels are the same in the national legislation.

Disposal Facilities

	Licensing	(Yes - All;Yes - Some;No)
	If any of the following are part of your disposal policy, indicate Yes - All if they apply to all facilities, indicate Yes - Some if the apply to only some of the facilities or indicate No if they are not part of your policy at all.	
Q53	Environmental Assessment (EA)	Yes - All
Q54	Environmental Impact Statement (EIS)	Yes - All
Q55	Performance Assessment (PA)	Yes - All
Q56	Quality Assurance (QA)	Yes - All
Q57	Safety Assessment (SA)	Yes - All
Q59	If Quality Assurance is part of your Country's current, waste disposal facility licensing policy, does the QA Program conform to international standards (such as the ISO9000 series)?	Yes - All

	Operation	(Yes - All;Yes - Some;No)
Q60	Does your Country have formal, documented waste acceptance criteria for its operating or proposed disposal facilities?	Yes - Some

Comment **# 351: Acceptance criteria for disposal**

There is no operating disposal facility, however waste has to be conditioned according to approved schemes and then it will be suitable for final disposal (reference disposal facility is a deep disposal facility in salt). For LILW and for HLW conditioning schemes are present, not yet for SF.

	Post-Closure	(Yes;No)
Q61	Does your Country have any written policies to address the maintenance of records that describe the design, location and inventory of waste disposal facilities?	No
Q63	Does your Country have any written policies to address active institutional controls or passive institutional controls, such as monitoring or access restrictions?	No

Policies

Country: NETHERLANDS

Reporting Year: 2010

Processing/Storage

	Policies/Procedures	(Yes;No)
	Does your country have written policies or written procedures for the following:	
Q73	waste sorting/segregation	Yes
Q74	waste minimization	Yes
Q75	waste storage	Yes
Q76	processing and/or storing and/or disposing of nuclear fuel cycle waste separately from non-nuclear fuel cycle waste (also known as nuclear applications waste)	No
Q78	Does your country have any legislation, regulation, or policy that waste processing must take place prior to storage (see following note)	Yes

	Implementation	(Yes;No)
Q80	In your Country are there any waste processing facilities at the same location where the waste is generated?	Yes
Q81	In your Country are there any centralized waste processing facilities?	Yes
Q82	In your Country are there any mobile waste processing facilities?	Yes

	Foreign	(Yes;No)
Q121	Has your country sent any wastes or spent fuel to another country for processing (reprocessing for fuel)?	Yes
Q122	Will some or all of the product(s) of processing/reprocessing be returned to your country?	Yes
Q123	Currently, are any of your country's wastes (processed or unprocessed, including the products of reprocessing) or spent fuel being stored in another country?	Yes
Q124	Has your country accepted any wastes or spent fuel from another country for processing (reprocessing for fuel)?	No

Policies

Country: NETHERLANDS | Reporting Year: 2010

Spent/Disused SRS

	Registration	(Yes;No)
Q84	Is there a national level registry?	Yes
Q85	If answer was yes, is the registry used only for disused/spent SRS?	No
Q87	Are there regional-level registries (one or more)?	No
Q90	Are there local-level registries (one or more)?	No

	Procedures	(Yes;No)
Q91	Does your Country have documented procedures in place to ensure that sealed radioactive sources (SRS) are transferred to secure facilities in a timely manner after their user declares them to be spent?	Yes

	Agreements	(Yes;No)
	Does your Country have any agreements in place whereby spent sealed radioactive sources (SRS) are returned to their supplier by the user (check all options that apply)?	
Q93	Government to Government agreements	No
Q94	Government - Supplier agreements	No
Q95	Supplier-User agreements	Yes
Q97	Do any agreements include suppliers that are outside of your Country?	Yes

	Release / Disposal	(Yes;No)
Q99	Does your Country have any regulations to free-release spent sealed radioactive sources (SRS)?	No
Q100	Has your Country disposed of spent SRS in existing disposal facilities for LILW or HLW waste?	No
Q101	Does your Country plan to dispose of spent SRS in existing or planned disposal facilities for LILW or HLW waste?	Yes
Q102	Has your Country implemented dedicated disposal facilities for spent SRS?	No
Q103	Does your Country have plans to implement dedicated disposal facilities for spent SRS?	No

Import-Export

	Radioactive Waste	(Yes;No)
Q104	Does your Country have laws or Regulations restricting either the import or export of radioactive waste (excluding spent fuel)?	Yes

	Spent Fuel	(Yes;No)
Q105	Does your Country have laws or Regulations restricting either the import or export of spent fuel?	Yes

Policies

Country: NETHERLANDS Reporting Year: 2010

Liquid HLW

	Storage	(Yes;No)
Q106	Does your Country have high-level liquid wastes in storage?	No

UMMT

	Responsibility	(Yes;No)
Q110	Does your Country have any Uranium Mine and Mill Tailings sites that do not have a designated authority to manage them?	No

Decommissioning

	Funding	(Yes - All;Yes - Some;No)
Q111	Does your Country require that funds should be set aside in support of future waste management activities, such as decommissioning activities?	Yes - All

	Facilities	(Yes;No)
Q119	Does Your Country have any nuclear fuel cycle facilities?	Yes
Q120	Does Your Country have any nuclear applications facilities (non fuel cycle facilities)?	Yes

	Timeframe	(Yes - All;Yes - Some;No)
Q112	Does your Country require a time frame for the decommissioning of nuclear fuel cycle facilities once these facilities cease operation?	Yes - All
Q113	Does your Country require a time frame for the decommissioning of non-nuclear fuel cycle facilities once these facilities cease operation?	No

Annex 4

Inventory of spent fuel

Status as of December 2010

Spent Fuel Management Facility: COVRA

Spent fuel is included in the HLW reported in the earlier tables. In HABOG are stored 24 canisters with spent fuel from research reactors, 4 canisters with spent targets from molybdenum production, 168 vitrified waste canisters and 88 canisters with compacted hulls and ends. The total activity is 2060 PBq.

Spent Fuel Management Facility: Borssele NPP

The total quantity is about 80,041 kg.

Approximate masses/element: 308 kg.

	Number	**U mass (g)**
Irradiated fuel elements (LEU):	266	80040992

Spent Fuel Management Facility: HFR

The total quantity is about 674 kg. This number will vary over the year for reasons explained in the note below (< 10%).

	Number	**U mass (g)**
Irradiated fuel elements (LEU):	205	570348
Irradiated control rod elements (LEU):	43	95765
Irradiated fuel elements (HEU):	18	8694
Irradiated control rod elements (HEU):	0	0
Total irradiated:	266	674807

Note: updates are made at the end of every month. The inventory of irradiated fuel at the HFR varies almost every month as per cycle (with 11 cycles/year) 6 new elements (5 fuel, 1 control rod) are put into use.

Spent Fuel Management Facility: HOR

The total quantity is about 25 kg

Approximate masses uranium total fresh HEU element: 0 g (fuel element), 0 g (control rods element)

Approximate masses uranium total fresh LEU element: 1519 g (fuel element), 800 g (control rods element)

	Number	U mass (g)
Irradiated fuel elements (HEU):	16	2006
Irradiated fuel elements (LEU)	15	20728
Irradiated control rod elements (HEU):	5	312
Irradiated control rod elements (LEU):	1	2181
Total irradiated:	39	25227

Annex 5

Communication policy

Goals

The Netherlands' policy on radioactive waste management is to isolate, control, and monitor radioactive waste in above ground structures for at least a hundred year, after which geological disposal is foreseen. During the period of interim storage all necessary technical, economical, and social arrangements are to be made in such a way that geological disposal can really be implemented afterwards. This involves a clear choice for the ownership of the waste, developing appropriate financing schemes, resolving outstanding technical issues, preserving the expertise and knowledge, gaining public understanding of the waste management issues and building public support.

Transparency of nuclear activities and communication to the public are the cornerstones of such a process: to build confidence in the regulator and in the safety of radioactive waste management, to enable a dialogue among stakeholders and/or public debate on the final disposal. Clear communication on challenges and opportunities in the nuclear industry is also necessary to interest young people in the nuclear field and preserve the available knowledge. The challenge for the Netherlands is the long timetable involved: to build and maintain public trust in the waste management solution for a hundred years, but at the same time to be prepared for implementation in case of any change to the current timetable, arising by way of future European directives, for example.

Based on international experience with nuclear communication, important elements of communication and public information policy can be defined. These include:

- provide information in clear language on the existing solutions for waste management;
- build up trust and confidence in the available information, by increasing transparency and giving access to all (non-sensitive) information;
- look for opportunities to start a dialogue, open nuclear facilities to the public and promote local involvement;
- examine ways to better inform the public in objective and factual terms about all aspects of nuclear energy and waste management in particular;
- exchange and develop best practice at national and European level, by creating a platform or stimulate existing ones.

Practice

In the Netherlands, responsibility of public information on radioactive waste management is shared between the government and the nuclear sector. As part of this responsibility, the Ministry of Economic Affairs, Agriculture and Innovation provides a general information on radiation, nuclear safety and radioactive waste management. The Dutch Government gives a base subsidy to NRG for public information on nuclear technology and its applications and participates in European platforms on (among others) transparency in the nuclear industry, such as the ENSREG (regulators) and the European Nuclear Energy Forum (stakeholders).

Transparency and clear communication to the public are important objectives for the nuclear sector. Nuclear companies have the policy that all news, either good or bad, is sent to the media proactively. Most nuclear companies have visitors centres, organize open days and tours of the facilities (for the general public, students, politics and press), and give guest lectures at schools and universities. A platform, Nucleair Nederland (Nuclear Netherlands), was created to exchange national best practices in communication at a national level, and to provide a central contact point for information on all nuclear applications. To exchange best practices in communication at European level, the Netherlands is with two members well represented in Nuclear Information Committee in Europe.

Figure A.7 Nucleair Nederland has published information in clear language on nuclear applications in the Netherlands: brochures for adults (a), kids (b) and on effects of Chernobyl 25 years after (c) and a website with all documents and news about Dutch nuclear organisations from abroad, e.g. frequently asked questions about Fukushima (d).

COVRA

Transparency and communication are an integrated part of the operations of radioactive waste management organisation, COVRA. Because of the long-term activities, COVRA can only function effectively when it has a good, open and transparent relationship with the public and particularly with the local population. When COVRA in 1992 constructed its facilities at a new site, it took it as a challenge to build a good relationship with the local population.

From the beginning attention was paid to psychological and emotional factors in the design of the technical facilities. All the installations have been designed so that visitors can have a look at the work as it is done. Creating a good working atmosphere open to visitors was aimed at. The idea was not to create just a visitors centre at the site, but to make the site and all of its facilities the visitors centre. During construction of HABOG - an interim store for high-level radioactive waste - the idea was born to take this one step further, do something really special. Discussions with an artist, William Verstraeten, resulted in a provocative, idea. He launched the idea to integrate the HLW building, HABOG, into an artistical concept. He created 'Metamorphosis'.

HABOG features a bright orange exterior and the prominent display of Albert Einstein's equation $E=mc^2$ and Max Planck's $E=hv$. Designed to last for up to 300 years, it contains the waste resulting from the reprocessing of the spent nuclear fuel from the Netherlands' nuclear power stations Borssele and Dodewaard as well as spent fuel from research reactors and the spent uranium targets of molybdenum production.

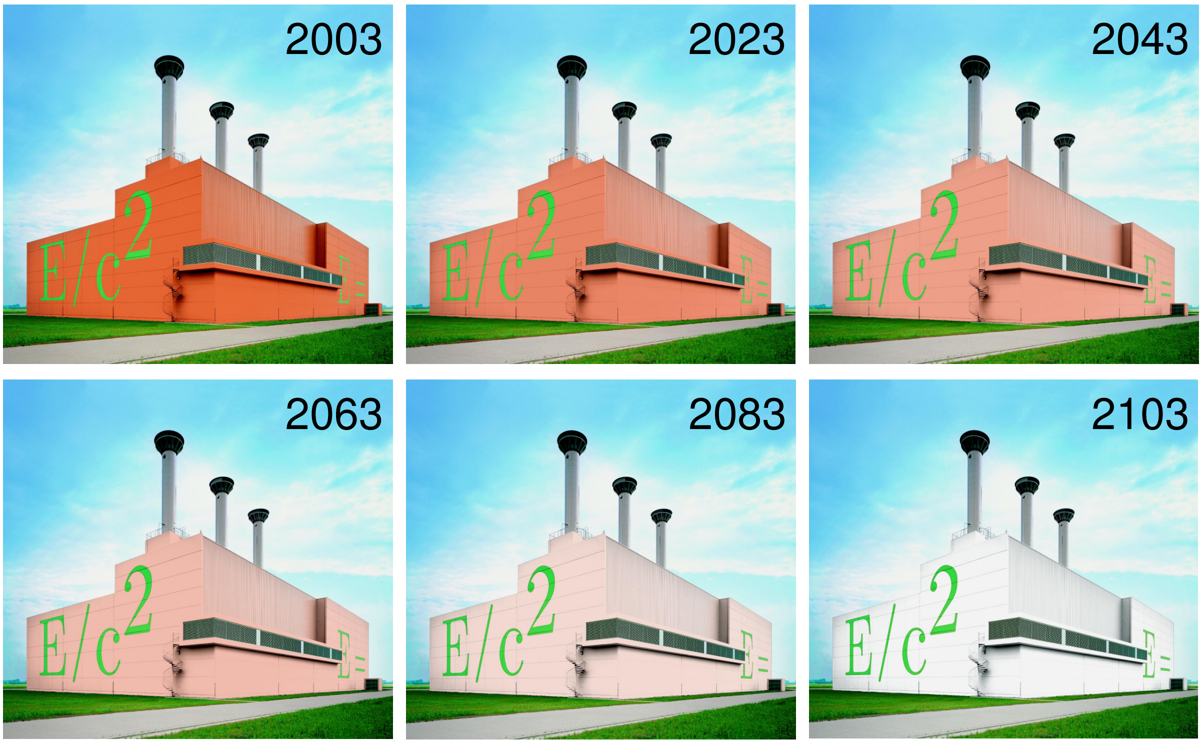

Figure A.8 Repainting HABOG's exterior every 20 years in lighter and lighter shades of orange until reaching white symbolises the decrease radioactivity of the waste stored inside.

The waste inside HABOG is planned to remain there for at least 100 years, during which time its radioactivity will decrease through decay. This process is symbolised by the colour of the building's exterior, which is to be repainted every 20 years in lighter and lighter shades of orange until reaching white. The orange colour was chosen because it is halfway between red and green, which usually symbolise danger and safety.

HABOG is more than an interim store, it is a communication tool. It helps to explain the concept of radioactivity in simple not technical way. It is an 'attraction' that draws people to the COVRA facilities, people from the region, but also from all over the country and abroad. It provokes questions and stimulates discussion about radioactive waste and its management. People remember the story of the building, the changing colour which helps them to understand the process of decay and the safety of radioactive waste storage.

Another way to start the dialogue is the communication about long-term storage. The link between the storage processes of museums and of radioactive waste helps people to visualize and better understand the concept of long-term storage. Radioactive waste storage had many resemblances with museums, in particular with respect to storage and control on the long term. The conditioned COVRA storage buildings have enough unused space to store the regional museum collections and the museums always cope with shortage of storage space. In 2009, the museums have signed a 100-year agreement with COVRA to make use of waste storage as a regional museum depot at no cost.

International recognition

In the 2009 IAEA waste safety appraisal of COVRA, the communication policy of COVRA was recorded as one of its good practices. It was concluded that inviting people to visit the site and presenting its activities through art to facilitate the communication of radioactive waste management activities to the public has lead to increasing transparency and confidence building of the public. At the ENEF Prague Plenary meeting May 2011 two years later, the communication policy was also identified as one of the good practices on information, communication, participation and decision-making in nuclear matters.

In 2010, COVRA has won an award presented by the Italian foundation Pimby (Please in my backyard) for its transparent communication about radioactive waste management to the general public.

Annex 6

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