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

Third review conference (May 2009)

Ministry of Housing, Spatial Planning and the Environment

Ministry of Social Affairs and Employment

Ministry of Economic Affairs

Ministry of Foreign Affairs

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Contents:

Section K

Section L

LIST OF SYMBOLS AND ABBREVIATIONS

Acronym	Full name	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
Bvser	Besluit Vervoer Splijtstoffen, Ertsen en Radioactieve stoffen	Transport of Fissionable Materials, Ores, and Radioactive Substances Decree
BWR	Boiling Water Reactor	
BZ	Buitenlandse Zaken	(Ministry of) Foreign Affairs (the Netherlands)
BZK	Binnenlandse Zaken en Koninkrijksrelaties	(Ministry of) the Interior
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
EIS	Environmental Impact Statement	
EPZ	Elektriciteitsproductie-maatschappij Zuidwest	(Operator of the Borssele NPP)
EZ	Economische Zaken	(Ministry of) Economic Affairs (the Netherlands)
HABOG	Hoogradioactief AfvalBehandelings- en Opslag Gebouw	High-level Waste Treatment and Storage Building
HEU	High Enriched Uranium	
HFR	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	
IOD	Inlichtingen en Opsporingsdienst	Investigation Service (VROM)
JRC	Joint Research Centre	
Kew	Kernenergiewet	Nuclear Energy Act
KFD	Kernfysische Dienst	Department of Nuclear Safety, Security and Safeguards (the

		Netherlands)
LEU	Low Enriched Uranium	
LILW	Low and Intermediate Level Waste	
LNV	Landbouw, Natuurbehoud en Visserij	(Ministry of) Agriculture, Nature Management and Fisheries
LOG	Laagradioactief afval Opslag Gebouw	Low level Waste Storage Building
MOX	Mixed OXide fuel	
NABIS	Natuurlijke Bronnen van Ioniserende Straling	Natural Sources of Ionising Radiation
NDRIS	National Dose Registration and Information System	
NEWMD	Net-enabled Waste Management Database of the IAEA	
NEWS	Nuclear Event Web-based System of the IAEA (with NEA and WANO)	
NORM	Naturally Occurring Radioactive Material	
NPK	Nationaal Plan Kernongevallenbestrijding	National Nuclear Emergency Plan
NPP	Nuclear Power Plant	
NRG	Nuclear Research and Consulting Group	
NVR	Nucleaire Veiligheids-Richtlijn	Nuclear safety rule (the Netherlands)
PWR	Pressurized Water Reactor	
QA	Quality Assurance	
RID	Reactor Institute Delft	
RIVM	Rijks Instituut voor Volksgezondheid en Milieuhygiëne	National Institute of Public Health and the Environment
SAR	Safety Analysis Report	
SVS	Stoffen, Veiligheid en Straling	(Directorate for) Chemicals, Safety and Radiation Protection (the Netherlands)
SE	Safe Enclosure	
SF	Spent Fuel	
SNB	Straling, Nucleaire en Bioveiligheid	Radiation Protection, Nuclear and Biosafety Division
SZW	Sociale Zaken en Werkgelegenheid	(Ministry of) Social Affairs and Employment
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material (see also NORM).	
V&W	Verkeer en Waterstaat	(Ministry of) Transport, Public Works and Water Management
VI	VROM Inspectie	VROM Inspection
VOG	Verarmd uranium Opslag Gebouw	Storage Building for Depleted

		Uranium
VROM	Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer	(Ministry of) Housing, Spatial Planning and the Environment (the Netherlands)
VWS	Volksgezondheid, Welzijn en Sport	(Ministry of) Health, Welfare and Sport
Wm	Wet Milieubeheer	Environmental Protection Act

Section A

Introduction

Objective

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. The Joint Convention also requires each party to report on the national implementation of these principles to review meetings of the parties to this Convention. This report describes the manner in which the Netherlands is fulfilling its obligations under the Joint Convention.

Structure of the report

The report follows closely the structure as suggested in INFCIRC/604, "Guidelines regarding the form and structure of national reports". Where appropriate, more detailed information is provided in the Annexes. Consequently, in this third national report the different articles from the Joint Convention are addressed as follows:

Section A – this section is the introduction containing general information

Section B – Article 32 paragraph 1, reporting obligations.

Section C – Article 3, scope of application.

Section D – Article 32 paragraph 2, reporting obligations.

Section E – Articles 18 - 20, general safety provisions, 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. Only one nuclear power plant is in operation: the Borssele PWR (Siemens/KWU design, 515 MWe); another NPP, the Dodewaard BWR (GE design, 60 MWe) has been shut-down in 1997. It is now in the safe enclosure stage of decommissioning. Furthermore, there are three research reactors in operation: the High Flux Reactor ("HFR", 50 MW_{th}) of the European Commission's Joint Research Centre (JRC) in Petten, the Low Flux Reactor ("LFR", 30 kW_{th}) in Petten and the "Hoger Onderwijs Reactor" ("HOR", 3 MW_{th}) at the Reactor Institute Delft of the Delft University of Technology.

Consequently, both the total quantities of spent fuel and radioactive waste which have to be managed and the proportion of high-level and long-lived waste are likewise modest. Many of the radioactive waste management activities are necessarily centralized in one agency in order to take as much benefit as possible from the economy of scale. This explains why a major part of the report is devoted to the activities of COVRA, the Central Organisation for Radioactive Waste, in Borsele.

Originally the radioactive waste storage facility was located at the research establishment at Petten. This facility was at first managed by ECN, later by COVRA. This explains why a certain amount of historical radioactive waste is still stored at the Petten site. It is, however, scheduled to be conditioned, repacked and transferred to the present storage facility of COVRA in a period of about 10 years.

Major developments since submission of the second national report

- In June 2006 the Dutch government, in office until the end of 2006, signed an agreement (Covenant) with the owners of the Borssele NPP, which allows for operation until the end of 2033, if the requirements of the operating license and the Covenant continue to be met. Two of these requirements are relevant in the framework of this convention: the requirement of direct dismantling of the Borssele NPP after final shut down of the plant, and the requirement to establish adequate financial resources for decommissioning.

  As initially operation of the Borssele NPP was foreseen until the end of 2015, the storage capacity at COVRA will eventually have to be extended, (current capacity for high level waste is sufficient for waste generation until 2015).

- According to the current contract between the operator of the Borssele NPP 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[1] entered into force, which prescribes that a return-scheme for the radioactive waste has to be formalised at the moment the spent fuel is sent 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 needs to be concluded. The Dutch government has started the formal procedures to arrange this agreement by presenting a proposal to Parliament, establishing a return-scheme for the spent fuel under the current contract. In the meantime, no transports of spent fuel from Borssele to AREVA can take place, which means that the spent fuel, for the time being, has to be stored at Borssele's fuel pool.

- The "Energy Report", published on June 18th 2008, contains the energy-vision of the Dutch government. The report focuses on the question how to ensure a reliable, affordable and clean energy supply on the short and long term. The current government has decided that, during their term of office, no decisions concerning new nuclear power plants will be made. However, for the future no energy option will be excluded. With a view to decision making by the next government three scenarios regarding the potential role of nuclear power in the future will be elaborated, including transparent and consistent preconditions.

[1] 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.

Based on this scenario-analysis, a next government can make reliable decisions on the future role of nuclear power.

- A proposal for a revision of the Nuclear Energy Act, aiming to patch some known deficiencies as well as to introduce new issues, has been presented to Parliament in 2006 by the former government. However, due to elections and the installation of the new (current) government, the amendment-procedure was substantially slowed down. At the time of writing this report the amendment-procedure had not yet been completed. A relevant issue concerns the provision of a legal basis to introduce more specific regulation on decommissioning. This regulation is intended to stipulate that requirements can be formulated regarding the dismantling strategy for nuclear installations. Furthermore, the operator of a nuclear facility will be required to make available adequate financial resources for decommissioning at the moment that these are required.
- After shut-down in 1997, the first stage of decommissioning was completed for the Dodewaard NPP in 2005 (a safe enclosure during 40 years). 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. COVRA and GKN - the current owner of the NPP - are discussing how to agree on these costs. As regards the spent fuel: all spent fuel has been removed from the storage pool and is transferred to Sellafield, UK, for reprocessing. The separated plutonium from the Dodewaard NPP will be transferred to AREVA for MOX fuel fabrication. The remaining waste will be returned to the Netherlands in 2009, and shipped to COVRA for long-term storage.
- For the conditioning and repacking of some historical high level waste present in the Waste Storage Facility (WSF) building at the Petten site, a dedicated hot cell facility ("HAVA-VU") will be built. The license application, including an EIA, was submitted to the competent authorities in 2007. It is expected that by the end of 2008 the license can be issued. After repacking, the waste will be transferred to the COVRA-facilities in the next 10 years.
- As regards the policy for disused sources, the HASS-directive [24] has been implemented in the Radiation Protection Decree [2] and the High Active Sources Ordinance [25] in 2006.

Main themes addressed at the second Review Conference

Although no specific recommendations for improvement have been made at the second Review Conference, questions before the meeting and discussions at the meeting focused on a limited number of themes, as specified below. In the main report these themes will be covered in more detail. The main themes are:

- As the Dodewaard NPP will be dismantled after a 40 years waiting period, the preservation of knowledge for more than a generation is a challenge. This will be addressed in section K.
- With regard to the decommissioning of the nuclear facilities appropriate financing schemes are of high importance. This will be addressed in section F.

Section B

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.

Policies and Practices

32.1 (i) Spent fuel management policy

The formal government policy 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), and reprocessing-contracts were concluded for all spent fuel of the NPP's 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.

32.1 (ii) Spent fuel management practices

Spent fuel from the NPP's

Spent fuel from the Borssele NPP is kept in storage in the spent fuel pool at the reactor site. 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 removed from the reactor core, while the design of the fuel storage racks ensures control of criticality. After a cooling period of 1 to 3 years (dependent on the safety requirements of the transport packages and the reprocessors' specifications), the spent fuel is transferred to La Hague for reprocessing. Regular transports ensure that the fuel pool inventory is kept to a practical minimum, as required by the plant operating license.

As regards the plutonium extracted from reprocessed spent fuel of the Borssele NPP under previous contracts, all of this has been sold for reuse in MOX-elements in NPP's. Reprocessed uranium is also reused in new fuel elements, mostly in the Borssele NPP. The plutonium generated under the current contract, will also be reused in NPP's. Also the Borssele NPP intends to use MOX in the coming years. The application procedure for a license for the use of MOX-elements was started in 2008.

All spent fuel from the Dodewaard NPP has been removed from the storage pool. In a shipment, conducted 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 was sold to a European NPP. The separated plutonium from the Dodewaard NPP will finally be sold to AREVA. The remaining waste will be returned to the Netherlands in 2009, 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 or returned to the original supplier in the USA. 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 from the reactor core.

Since May 2006 the HFR only uses low enriched fuel (LEU, with an enrichment of less than 20%). This is in line with the worldwide move to abandon the use of HEU for non-proliferation reasons. The European Commission facilitated transfer of spent fuel from the HFR to the USA by providing a dedicated budget for it. In May 2005 the actual shipment consisting of 400 elements was carried out. Another 200 elements were shipped to COVRA in 2006 and 2007.

The consumption of fuel in the LFR is very low. The original fuel elements are still in use and the LFR is not discussed further in this report.

Also at the HOR some spent fuel is stored in the spent fuel pool. In 2004 most of the spent HEU fuel has been transferred to the HABOG facility at COVRA. In 1998 a conversion of HEU fuel to LEU fuel was started. With the last HEU fuel element removed from the core at 10 January 2005 the conversion was completed.

32.1 (iii) Radioactive waste management policy

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

Consideration of this report led, in regard to the first area, to the establishment of the Central Organisation for Radioactive Waste (COVRA) in Borsele, and in regard to the second, to the establishment of a research programme on disposal of radioactive waste. Pending the outcome of research into 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 wastes generated in a period of at least 100 years.

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 done 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, in which case 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 society, doubt may be raised on the capacity of society to fulfil the control requirement.

The Netherlands has a very high ground water table, and under these circumstances shallow land burial is not acceptable for the low and medium level waste. 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 disposal is the preferred management option.

Also it should be realised that the cumulative waste volume that is actually in storage right now is only a few thousand m^3. For such a small volume it is not economically feasible to construct a deep geologic disposal facility, as the costs are mainly determined by the construction costs of such a facility. The waste volume collected in a period of 100 years was judged as large enough to make a disposal facility viable. However, the recent decision to postpone the closure of the Borssele NPP to 2033 implies an additional 30 years of production of high level waste, as well as an additional 30 years of cost contribution to the disposal fund. This means that a shorter storage period than 100 years could become possible.

For this '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 to an acceptable level.
- 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.
- In the period of 100 years the heat-generating waste 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.
- In 100 years from now new techniques or management options can become available.

Consequently, it was concluded in the policy report of 1984 that a dedicated solution for the Netherlands is to store the waste in buildings for a period of at least 100 years and to prepare financially, technically and socially the deep disposal during this period in such a way that it can really be implemented after the storage period. Of course at that time society has the freedom of choice between a continuation of the storage for another 100 years, to realise the final disposal, or 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 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).

In 1993 a 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 considered suitable for this purpose and, hence, the prospect of a waste disposal facility being available within the next few decades is 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, which now 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 always be possible.

The reasons for introducing this concept of retrievability came 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 at present, 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.

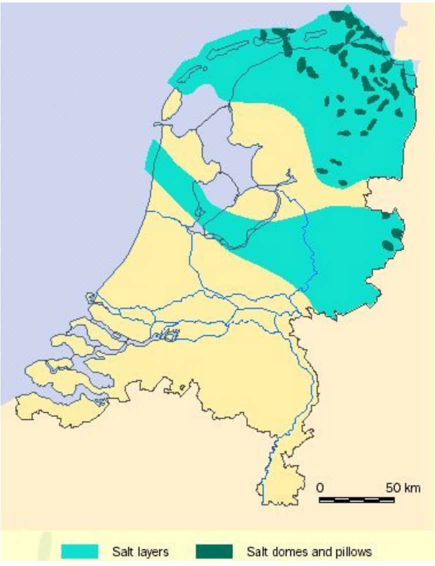


Figure 1. Distribution of salt formations

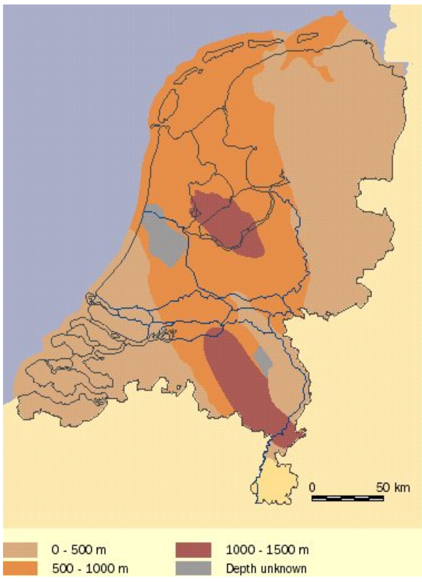


Figure 2. Distribution and depth of the Boom Clay

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 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, aimed at demonstrating the technical feasibility of a retrievable underground repository in salt and clay formations. In 2001 the study 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. Although the results may not be representative of the views of a broader public, including other institutions with social or ideological objectives, some preliminary conclusions could be drawn. The following statements reflect the position of many environmental groups:

- Radioactive waste management is strongly associated with the negative image of nuclear power. 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 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 recommended that attention be given to the requirements for monitoring of retrievable repositories. Non-technical aspects will also be addressed.

Although the Parliament has agreed with the proposed research programme, it has not started yet due to lack of funds, as – in the opinion of the Dutch government – the industry should pay for a substantial part of the costs.

32.1 (iv) Radioactive waste management practices

Storage facilities

Except for radioactive wastes with a half-life less than 100 days, which is allowed to decay at the sites where it is being generated, all radioactive waste produced in the Netherlands is managed by COVRA, the Central Organisation for Radioactive Waste. COVRA operates a facility at the industrial area Vlissingen-Oost in the south-west of the country.

Transferral of the radioactive waste to COVRA includes transferral of the property and liabilities. The fact that COVRA takes full title of waste is reflected in the Transfer document and laid down in the General Conditions of COVRA.

As mentioned earlier, a substantial volume of the waste will decay to a non-radioactive level in 100 years. To be able to keep track of the actual level, the radioactive content of each package is recorded in a database.Thus, the expected date that 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 Annex 1 of Directive 96/29/Euratom (the Basic Safety Standards). Exceptions are Ra-226, Ra-228, and Co-60. The clearance levels of these radionuclides differ from the basic safety standards: 1 Bq/g instead of 10 Bq/g.

Further details about the storage facilities are given in Annex 1.

Low and intermediate level waste

Low level radioactive waste 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 cemented waste, originating from nuclear power production, and delivered in a conditioned form to COVRA contribute to the annual arisings of LILW. In 2007 about 143 m^3 of conditioned LILW was added to the inventory, which amounted to a total of 9078 m^3 at the end of 2007. Without correction for decay this corresponded to a total of 1970 TBq. The activity is dominated by the radionuclides ^{60}Co, ^{3}H and ^{137}Cs.

(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 a license is required, below this – but above the exemption levels – a notification to the authorities is sufficient. Furthermore, the legislation for (TE)NORM allows a user to mix up naturally occurring radioactive material with other materials for recycling purposes. Mixing up NORM with the solitary aim of dilution is not allowed.

(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 in France converted to solid uranium oxide 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. At the end of 2007, a total of 478 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 have decayed to exemption/clearance levels within 100 to 150 years. So after the foreseen storage at COVRA as radioactive waste, the material can be disposed of as conventional waste. The wastes are stored in large freight containers in a modular storagebuilding specifically built for this purpose. At the end of 2007 a total of 113 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 these wastes have radioactivity concentrations below the exemption levels, as specified in Annex 1 of the Radiation Protection Decree. As far as possible these wastes are reused as additives for the preparation of building materials, e.g. for road construction. Other wastes, particularly mixed wastes, containing both radioactive material and other hazardous material are destined to be disposed of in repositories for chemical waste. Consequently, the quantities kept in storage may vary considerably. NORM materials with radioactivity concentrations in excess of the exemption limits are stored at some sites of raw materials processing industries. The quantities are estimated to amount to about 50,000 tonnes.

High level waste

The high level waste at COVRA consists partly of heat-generating waste (vitrified waste from reprocessed spent fuel from the NPP's 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 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 storage vault 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 are put into vertical storage wells cooled by natural ventilation. The HABOG storage facility is in full operation since 2003. At the end of 2007, a total of 29.6 m^3 HLW was kept in storage.

The spent fuel elements of the research reactors are delivered to COVRA in a cask containing a basket with circa 30 elements. 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).

As mentioned at page 12, there still is some historical high level waste present in the Waste Storage Facility (WSF) building at the Petten site . This waste, resulting from some four decades of nuclear research at that facility, exists of fuel material residues (spent uranium targets and irradiated fuel) and some fission and activation products. A dedicated hot cell facility ("HAVA-VU") will be built for conditioning and repacking the waste, after which it will be transferred to the COVRA-facilities in the next 10 years. The license application, including an EIA, was submitted to the competent authorities in 2007. It is expected that the license can be issued by the end of 2008.

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 for this 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 a small amount of 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 (Fr) and Sellafield (UK) 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

The following spent fuel management facilities can be distinguished:

Location	Spent fuel storage facility	Features
Borsele	Dry storage in vaults	COVRA facility for treatment and storage of HLW and SF (HABOG)
Borssele	Fuel storage pond	Pond belongs to nuclear power station where spent fuel is stored temporarily before shipment to La Hague for reprocessing
Petten	Fuel storage pond	Belongs to the HFR research reactor; fuel is stored temporarily awaiting shipment to USA or COVRA
	Dry storage in drums.	NRG Waste Storage Facility; spent fuel samples from HFR irradiation experiments; stored in concrete-lined vaults
Delft	Fuel storage pond	Belongs to HOR research reactor

32.2 (ii) Inventory of spent fuel

Annex 3 gives the inventory of spent fuel held in storage at the various locations.

32.2 (iii) Radioactive waste management facilities

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.

Also waste storage departments of the NPP Borssele and those of the research reactors are not specifically mentioned, because a general license 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.

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 facility for treatment and storage of LILW.
	Dry storage of NORM and (TE)NORM-waste in containers	COVRA container storage facility.
	Dry storage of small containers of depleted uraniumoxide.	COVRA facility for storage of U_3O_8; this waste may be retrieved and converted when uranium prices increase.
Petten	Dry storage of unconditioned waste in drums.	NRG Waste Storage Facility; partly HLW from irradiation experiments; to be transferred to COVRA

Table 2. Radioactive Waste Management Facilities

32.2 (iv) Inventory of radioactive waste

Annex 2 gives the inventory of radioactive waste held in storage at the various locations.

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

Facility	***Date of closure***	***State of decommissioning***
Dodewaard NPP	1997	Safe enclosure as of 01/07/2005

Table 3. 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.

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 (1963, as amended 2006); (Kew);

- the Environmental Protection Act (1979, as amended 2002); (Wm);
- General Administrative Law Act (1992, as amended 2003); (Awb).

The basic legislation governing nuclear activities is contained in the **Nuclear Energy Act**. The Nuclear Energy Act was designed to do two things at once: to regulate the use of nuclear energy and radioactive techniques, and to lay down rules for the protection of the public and workers against the associated risks. In practice, however, the law has developed almost entirely to do the latter. It sets out the basic rules on nuclear energy, makes provisions for radiation protection, designates the various competent authorities and outlines their responsibilities.

Licences for nuclear facilities are granted jointly by the Minister of Housing, Spatial Planning and the Environment, the Minister of Economic Affairs, and the Minister of Social Affairs and Employment (plus, where relevant, *some* other ministers whose departments may be involved). Together, these ministers form the competent authorities as defined by the Nuclear Energy Act and are jointly responsible for assessing the licence applications and granting the licences. The Minister of Housing, Spatial Planning and the Environment acts as the co-ordinator in this respect. The powers and responsibilities of the various ministers are described in more detail in the section on Article 19.2 (ii) of this Convention.

With regard to nuclear energy, the purpose of the Act is to regulate (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 have also been issued containing additional regulations 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 are:

- 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 Naturally Occurring Radioactive Material (NORM) this is further elaborated in the ministerial ordinance Natural Sources of Ionising radiation. This ordinance establishes a reporting system and protective measures for workers and environment.

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 should install detection portals to monitor scrap activity-levels, and should 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. This Directive (96/29/Euratom) is incorporated in the relevant Dutch regulations.

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, and (c) the operation of sites at which these materials are stored, used or processed.

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.

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

c) Licenses are also required for building, 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 nuclear power plant 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.

The decommissioning of nuclear installations is regarded as a special form of modification and is treated in a similar way. In 2002 the Nuclear Installations, Fissionable Materials and Ores Decree (Bkse) was amended to meet the requirements set by Council Directive 96/29/Euratom with regard to the protection of workers and members of the public from the hazards of ionising radiation. The Directive had introduced a new licence requirement for the shut-down and decommissioning of nuclear installations. The amendment of Bkse had the effect of incorporating these regulations in Dutch legislation.

Where modifications are only minor, the licensee may make use of a special provision in the Act (Section 18) that allows such modifications to be made without amendment of the licence. In such cases, the licensee need only submit a notification describing the planned modification.

This notification system can be used only if the consequences of the modification for man and environment are within the limits of the licence in force.

Licences for nuclear installations are issued under the joint responsibility of the Minister of Housing, Spatial Planning and the Environment, the Minister of Economic Affairs and the Minister of Social Affairs and Employment (plus other ministers, where relevant).

The Bkse decree 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.

In addition to these regulations on the handling of fissionable materials, the Nuclear Energy Act includes a separate chapter (Chapter VI) on intervention and emergency planning and response.

b.2 Environmental Protection Act (Wm)

In compliance with this Act and the Environmental Impact Assessment Decree, the licensing procedure for the construction of a nuclear plant includes a requirement to draft an environmental impact assessment. In certain circumstances, an environmental impact assessment 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 must 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 environmental impact assessments 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 license to a facility (e.g. for waste management). At the same time, copies of the draft decision and of the documents submitted by the applicant must be made available for inspection by the general public. All members of the public are free to lodge written objections to the draft decision and to ask for a hearing 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 provides for a system of general goal oriented rules and regulations. For spent fuel and radioactive waste management facilities few specific rules exist. One of the legal documents in which radioactive waste is specifically mentioned is Article 37 of the Radiation Protection Decree [2], which stipulates that an authorized user of radioactive material is allowed to dispose of radioactive material without a license 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 license 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 as the centralised waste management organisation. 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.

b. Nuclear Safety Rules

The Nuclear Energy Act (Article 21.1) provides the basis for a system of more detailed safety regulations concerning the design, operation and quality assurance of nuclear power plants. 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 (SSS). NVRs on design and operation of nuclear power plants have been implemented in the licenses for the Borssele NPP and the research reactors, which 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 license conditions by the operator. A NVR on Quality Assurance is implemented in the Quality Assurance Nuclear Power Plants Ordinance [26].

For spent fuel and radioactive waste management facilities formally adopted NVRs do not exist yet. Two draft NVRs are under development, one on predisposal management of radioactive waste, based on IAEA Safety Series No. WS-R-2 [5], the other one on decommissioning of nuclear power plants, based on IAEA Safety Series No. WS-G-2.1 [6] Pending their review, adjustment to national circumstances and adoption in due time, the regulatory body uses the IAEA Safety Standards Series documents as reference material for inspection purposes.

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 [7] (Bkse), and
- the Radiation Protection Decree [2] (Bs).

These decrees set the following criteria:

Normal 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 in the table below:

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 4. Design base accidents for nuclear facilities

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

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 building, 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.

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.

Article 15a of the Nuclear Energy Act lists the ministers who are responsible for licensing. As was already mentioned in the section on Article 19.1, responsibility for nuclear activities is not centralised, but is divided among a number of ministers who consult each other and also issue regulations jointly, as required, in accordance with their area of competence. The subdivision of responsibilities is as follows:

- the Minister of Housing, Spatial Planning and the Environment (VROM) is responsible, together with the Minister of Economic Affairs (EZ) and the Minister of Social Affairs and Employment (SZW), for licensing nuclear installations and activities;
- the Minister of Housing, Spatial Planning and the Environment is responsible, together with the Minister of Social Affairs and Employment for licensing the use of radioactive materials and radiation-emitting devices;
- the Minister of Housing, Spatial Planning and the Environment is responsible for all public health and safety aspects, including radiation protection of members of the public. The Minister of Economic Affairs is responsible for energy supply policy, the Minister of Social Affairs and Employment is responsible for radiation protection at places of work.

Other ministers may be consulted on nuclear activities which fall within their particular sphere of competence; for instance, discharges of radioactive material in air and water involve the Minister of Agriculture, Nature Management and Fisheries (LNV), and the Minister of Transport, Public Works and Water Management (V&W). The subject of emergency response also involves these two Ministers as well as the Minister of the Interior (BZK) and the Minister of Health, Welfare and Sport (VWS). See the table below for an overview.

	LNV	V&W	BZK	VWS
Discharges in air	X			
Discharges in water	X	X		
Transport		X		
Emergency provisions	X	X	X	X
Medical applications				X

Table 5. Responsibilities for different aspects of nuclear activities

Presently steps are taken to reduce the number of authorities involved in order to streamline the licensing procedures and reduce the administrative burden.

Under the terms of the Public Health Act, a Public Health Council exists to advise the ministers on issues concerning radiation protection and public health.

The first three ministers mentioned above are also the competent ministers for the suspension or withdrawal of a licence.

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.

As stated before (see section on Article 19.1, sub b.1) in cases where only minor modifications are at stake, the licensee may make use of a special provision in the Act (Article 18) that allows such modifications to be made without a licence. In these cases the licensee only has to submit a report describing the intended modification. This reporting system can only be used if the consequences of the modification for man and environment are within the limits of the licence in force. The notification is published and open to appeal.

The regulatory body conducts regular reviews to establish whether the restrictions and conditions under which a license has been granted are still sufficient to protect man 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 license

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

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

General

Article 58 of the Nuclear Energy Act states that the Ministers 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. Since 1 March 2004 the national regulatory body for supervision of Dutch nuclear installations is the Department of Nuclear Safety, Security and Safeguards (KFD) of the Inspectorate of the Ministry of Housing, Spatial Planning and the Environment (VI: VROM Inspectorate). A separate section of the KFD is responsible for supervision of nuclear security and safeguards (NBS).

At the same ministry, the Chemicals, Safety and Radiation Protection Directorate (SVS) is responsible for assessing whether the radiological safety (and in the near future also the security) objectives have been met. It should be noted that this directorate is responsible for policymaking and licensing, and does not perform inspections. SVS 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 nuclear power plants 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 body reviews and assesses the documentation submitted by the applicant. This may include the Environmental Impact Assessment Report and Safety Report with underlying safety analyses within the framework of a licence renewal or modification request, proposals for design changes, changes to Technical Specifications, etc.

The KFD assesses whether the NVR's (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. SVS 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 license, the safety analysis report, the Technical Specifications and any self-imposed requirements;
- to report any violation of the license conditions and if necessary to initiate enforcement action;

- to check that the licensee is conducting its activities in accordance with its Quality Assurance 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.

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 RAW management
Housing, Spatial Planning and the Environment (VROM)	Directorate of Chemicals, Safety, Radiation Protection (SVS)	• Setting policies, developing regulations and issuing licenses; • Making technical assessments in a limited number of areas. • Developing security guidelines.	• all
VROM	VROM-Inspection/ 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
VROM	VROM-Inspection/ Department on Emergency Response (CM)	• Preparing and co-ordinating actions in case of emergencies	• all
Ministry of Social Affairs and Employment;	Directorate for Safety and Health at Work	• Occupational safety related to nuclear power generation and other applications of radiation.	• all
Ministry of Economic Affairs	Directorate for Energy Production	• Security of energy supply	• 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 process. Consequently, the generation of waste should be prevented. Realising that most processes have already been optimised in previous decades for economic reasons, it is more realistic to state that generation of waste should be minimised. 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).
- 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.
- 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.
- 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.
- While recognising that existing salt and clay formations in the deep underground provide a good natural isolation of the waste, a disposal method which excludes the possibility of retrieval is not in line with this policy and is therefore rejected.

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

As discussed in the section on Article 19, several ministers are jointly 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 Housing, Spatial Planning and the Environment (VROM) (see also Figure 3)
  - Directorate-General for the Environment (DGM)
    - Directorate for Chemicals, Safety, Radiation Protection (SVS)
  - 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
- Ministry of Economic Affairs (EZ)
  - Directorate-General for Energy
    - Directorate for Energy Production

The Ministry of Housing, Spatial Planning and the Environment has overall responsibility for legislation concerning the Nuclear Energy Act, for licensing and for ensuring that the current legislation is being adequately enforced. It is also responsible for the technical safety considerations on which the decision to grant or reject an application for a license is based. These considerations are mainly based on assessments and inspections by the KFD, which advises the licensing body (SVS) 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. Policymaking and the regulation for the protection of workers, however, is the responsibility of Ministry of Social Affairs and Employment.

The various bodies within the Ministry of Housing, Spatial Planning and the Environment, together with the Ministry of Social Affairs and Employment, are responsible for formulating the conditions attached to the license concerning the safety and the (radiation) protection of the workers and the public and the environment.

All inspection bodies of the Ministry of Housing, Spatial Planning and the Environment are merged into a single unified Inspectorate-General (VROM-Inspection or VI). This ensures the separation of inspection and enforcement from legislation activities, policymaking and licensing. The Inspectorate is divided in five regions within the country. Besides these regional organisations the VI consists of the VROM-IOD (Investigation Service) and the KFD.

All supervision tasks for the nuclear installations in the Netherlands have been integrated in the KFD, including those for nuclear security and safeguards. It is foreseen that also the responsibilities and tasks in the field of radioactive materials (including disused sealed sources and waste) will be transferred to the KFD.

Figure 3 illustrates the current organisation of the Regulatory Body within VROM.

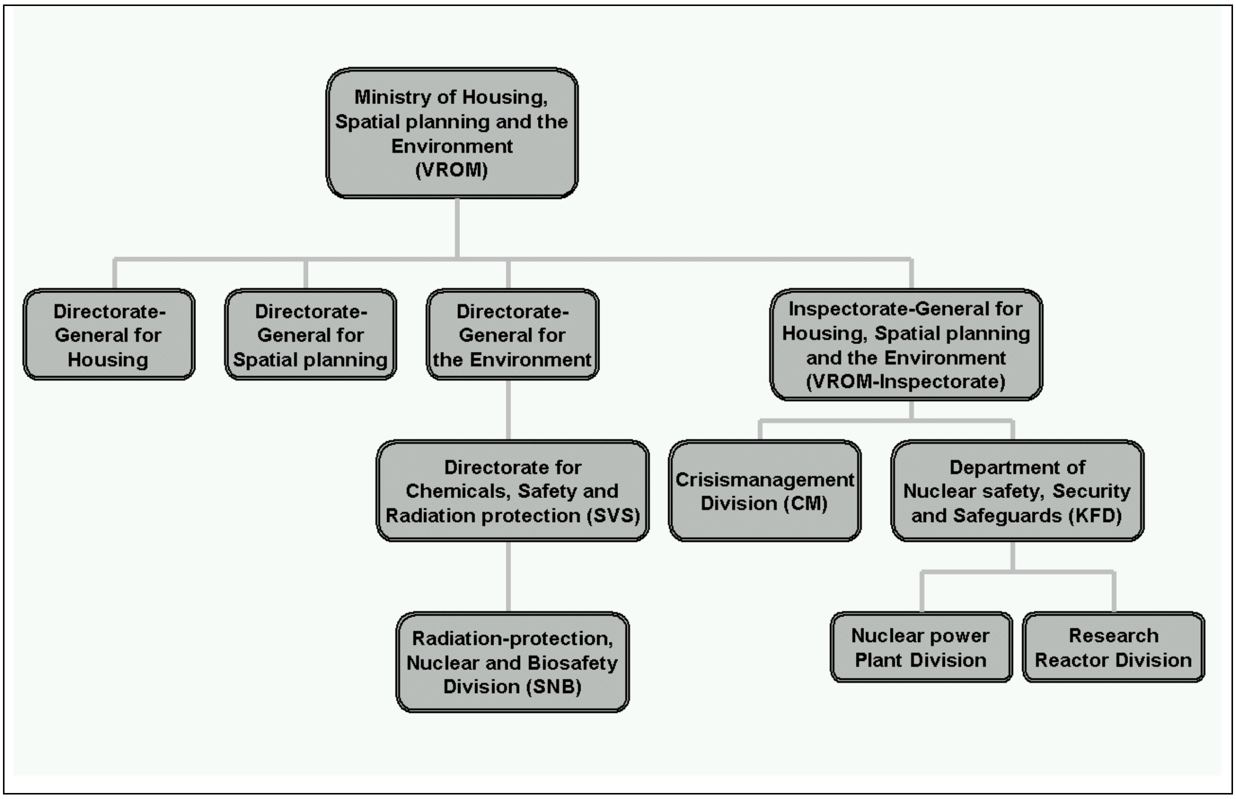


Figure 3. Nuclear safety and radiation protection within the Ministry of the Environment

Regulatory Body

The Nuclear Regulatory Body in the Netherlands is formed by several entities, of which the most important are SVS and KFD, both from the Ministry of Housing, Spatial Planning and the Environment. These organisations will be described in more detail in this paragraph.

According to the Nuclear Energy Act, the Ministry of Social Affairs and Employment and the Ministry of Economic Affairs are also part of the Regulatory Body. The Directorate Health and Safety at Work within the Ministry of Social Affairs is responsible for the legal aspects of radiation protection of workers. The Directorate-General for Energy (Ministry of Economic Affairs) is responsible for aspects concerning the energy demand and energy supply. In these two organisations only a few employees are devoted to Nuclear Energy Act matters.

The Ministry of VROM, however, takes the lead in the co-ordination with other ministries involved. The responsibilities of other ministries are limited to the specific areas of their responsibility.

With an aging staff and a difficult labour market, the staffing of the Regulatory body and the preservation of knowledge and expertise is a matter of concern. Therefore, an active recruitment is essential and new employees are nowadays recruited one year before retirement of staff-members. As a result, the average age of the Regulatory body is decreasing since 2005.

Directorate for Chemicals, Safety and Radiation Protection (SVS)

The main task of this Directorate is 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 have been included recently. The Directorate is also responsible for licensing of nuclear installations and nuclear transports in general (all procedural aspects), as well as for all aspects of radiation protection and external safety. It has expertise in the following disciplines at its disposal: radiation protection, nuclear safety, nuclear security, risk assessment, radioactive waste management including disposal and legal and licensing matters. These disciplines are grouped together in the Radiation Protection, Nuclear and Biosafety division (SNB). The duties mentioned above do not require any specific budget, apart from resources to cover research and staffing costs and SVS's annual contribution to support the work of the National Institute for Public Health and the Environment (RIVM).

The total professional staff of SVS, assigned to nuclear, waste, radiation and transport safety, including legal support and management is currently about 10 full time staff equivalents.

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 safety organizations.

The core disciplines are:

- mechanical engineering;
- metallurgy;
- 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.

Basically, there is one specialist (university-level) member of staff for each discipline (but two for process technology, for metallurgy/materials engineering and radiation protection). Although all these professionals are also inspectors supporting the field inspector (10%), their main job consists of assessing documents submitted by licensees in accordance with licence requirements (80%) and conducting assessments in the context of licensing/rulemaking (10%). Three professional (tertiary vocational college-level) members of staff are available full-time to conduct routine installation inspections (field inspectors). In the case of security and safeguards, the staff consists of four people, two within the formation and two on a temporary basis (for a period of two years).

The current KFD professional formation is about 23 full-time staff equivalents, including three managers. A relatively large number of staff retired at the end of 2005, but have been replaced with new staff. In the next five years, an additional six employees wil retire. Other challenges are the anticipated workload, combined with possible future budget and staff cuts.

Current organisation

The organisation has been changed from a matrix to a line organisation with two divisions of about equal size; one for Research Reactors (RRs) and one for Nuclear Power Plants (NPPs). The divisions share an administration bureau. The new organisational structure creates a focus on a limited number of licensees per division, and it provides for a 'one-stop shop' of regulation for the license.

To prevent loss of knowledge and too tight relationships with the licensees, a policy of rotation of staff between the divisions has been established, which takes account of the annual work programme. In addition, the two department heads will rotate every three years.

The basic key to deploy staff to the different types of nuclear installations is the potential risk, but also the public attention, operational occurrences and incidents or inspection findings have their influence.

KFD has a formal quality system that has been audited several times. The system will now be transformed to the Dutch INK system, which is comparable to ISO 9001:2000.

20.2 Independence of regulatory functions

On 21 June 1999, a decree was published in which the care for the maintenance and implementation of the Nuclear Energy Act and for the regulations based upon this act was transferred from the Minister of Economic Affairs to the Minister of Housing, Spatial Planning and the Environment. This means inter alia that the prime responsibility for the licensing of nuclear installations lies with the minister who is responsible for the protection of the public and the environment. The influence of the Minister of Economic Affairs is restricted to aspects concerning the energy supply. Through this arrangement the conditions as described in Article 20.2 of this Convention concerning effective separation are fully satisfied. The aforementioned proposal for revision of the Nuclear Energy Act, presented to Parliament in 2006 by the former government, aims to lay down the responsibility for licensing solely with the Minister of Housing, Spatial Planning and the Environment.

During the Convention of Nuclear Safety of April 2008 in Vienna the issue of the financial independency of the Dutch Regulatory Body was addressed several times, as well as the preservation of nuclear knowledge, especially related to the expected budget cuts for governmental organisations. This was identified as one of the challenges for the future.

Section F

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.

Other General Safety Provisions

21.1 Prime responsibility for Safety

The principle that the prime responsibility for safety lies with the licensee is laid down in several layers of regulation. The highest level is the Nuclear Energy Act where in the explanatory memorandum of Article 37b it is stated that the licensee must operate a nuclear facility in a manner that reflects the most recent safety insights.

In the next layer, the Radiation Protection Decree, Articles 9–11 and the Nuclear Installations, Fissionable materials and Ores Decree, Article 19, the operating organisation is held responsible for providing adequate human and financial resources in order to ensure that the facility can be operated in a safe way. More specifically these articles specify that the licensee should meet the following conditions:

- The licensee should take steps to ensure that all practices involving radioactive material should be conducted by or under supervision of a qualified expert.
- The licensee is required to provide financial resources which are adequate to protect persons against the harmful effects of ionising radiation.
- The licensee is required to ensure that plans for work activities involving radioactive material are thoroughly reviewed, risks are adequately analysed and final approval is accorded by or under responsibility of the qualified expert prior to commencement of the work.
- The licensee is required to ensure that radiation protection equipment is maintained in a good condition and that deficient equipment or parts thereof are repaired or replaced.

Although the structure is slightly different, articles 8 and 9 of the Nuclear Installations, Fissionable materials and Ores Decree, which is in the same layer as the Radiation Protection Decree, stipulate that in the documents to be submitted when applying for a license, the applicant should demonstrate that persons are adequately protected against the effects of these materials.

In a new Art. 10 of this decree, an application for a decommissioning license should include a description of the proposed decommissioning strategy, a decommissioning plan and a demonstration of adequate financial resources for the implementation of this decommissioning plan.

21.2 Responsibility of Contracting Party if there is no license 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 Department of Nuclear Safety, Security and Safeguards and the Health Inspectorate have been empowered to impound such material and have it transferred it to designated institutes, which are equipped and licensed to manage these materials.

These institutes which have been designated by a special decree[8] are the following:

The Nuclear Research and Consultancy Group (NRG) in Petten and the Central Organisation for Radioactive Waste (COVRA) in Borsele for fissionable materials and the same institutes as well as the National Institute for Health and the Environment in Bilthoven 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 license should 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.

The COVRA waste management facility 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 high level waste, the utilities and the operators of research reactors have 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 the Energy Research Foundation (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 for 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. 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 Meuro of which M€ 820.- 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 was 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. Every 5 years since, the basis for the cost estimate has been re-assessed. The 2008 re-assessment is underway.

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 SNF.

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

22 (iii) Institutional controls

As regards institutional control, the next research programme on underground disposal will address this issue and make proposals on the types of institutional control necessary, taking in particular account of the monitoring needs to ensure 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 nuclear power plants, 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 [9] is used as source material for the QA programme of COVRA. Since this Code is specific for NPP’s, provisions from the industrial standards NEN-ISO 9000 – 9004 have also been implemented

Regulations

The QA system of COVRA is part of the operating license 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 Department of Nuclear Safety, Security and Safeguards.

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.

Quality assurance within the regulatory body

In 1997 the KFD started with a formal process to introduce a quality system for all its tasks. Traceability, predictability and optimisation of the regulatory activities were the leading principles in this QA-process. In 1999 the KFD obtained its first ISO-9001 certificate. The ISO certification was chosen inter alia because this standard is well known in industrial and governmental circles.

By application of the Quality System the following benefits were obtained:

- A transparent organisation structure and procedures in which the decision making process became visible;
- An improved awareness of the required quality of the processes in which the KFD is involved;
- The formulation of objectives and projects with feedback of the results accomplished;
- A better separation of policy and assessment/ inspection in the performance of tasks;
- A structured approach accommodating improvements where necessary.

The KFD Quality System is based on NEN-EN-ISO 9001 and NVR 1.3 (Code for Quality Assurance for the Nuclear Power Plants, adapted from IAEA Code Safety Series 50-C-Q (Rev.1) with accompanying safety guides. The ISO standard requires a quality management system that is performance-based and is consequently considered more appropriate to the work of the regulatory body.

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 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 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.

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.

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
- employer category (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 below 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	1.0-6.0	6.0-20.0	>20.0	Total	>1.0	>6.0	>20.0
		(frequency)					(%)	
Year								
1998	1372	282	10	0	1664	17.5	0.60	0.00
1999	1205	174	7	0	1386	13.1	0.51	0.00
2000	1300	270	19	0	1589	18.2	1.20	0.00
2001	1230	229	3	0	1462	15.9	0.21	0.00
2002	1152	146	0	0	1298	11.2	0.00	0.00
2003	1233	158	0	0	1391	11.4	0.00	0.00
2004	1238	297	14	0	1549	20.1	0.90	0.00
2005	1246	111	1	0	1358	8.2	0.07	0.00
2006	1192	269	8	0	1469	18.9	0.55	0.00
2007	1452	138	4	0	1594	8.9	0.25	0.00

Table 7. Dosimetric data in the nuclear industry

To be more specific to the purpose of the report, 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 2007 the highest individual dose recorded for the 39 radiation workers was 1.2 mSv. The collective dose for these persons was about 17,7 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

Part of the reactor pool at HFR is used for the temporary storage of spent fuel, pending transport to the USA or to COVRA. In another section of the pool the operating reactor vessel is located. This means the 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. The collective dose for the 150 workers in and around the HFR is presented in Table 9.

Year	2000	2001	2002	2003	2004	2005	2006	2007
Collective dose (man.mSv)	108.8	112.0	95.9	127.8	134.8	194.2	246.4	193.2

Table 9. Collective doses at the HFR.

These doses include the dose incurred during handling operations with spent fuel. Each reactor cycle of 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 NPP's, 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. On top of this 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 a 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 thermoluminescent 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 (National Institute for Public Health and the Environment, RIVM) monitor the radiation levels at the border of the establishment continuously. In 2004 the ambient dose due to the activities at COVRA amounted to 0.014 mSv. This is approximately one-third of the limit accorded to COVRA in the operating license.

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. Normal 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 order of magnitude of 1 × per 10 – 100 year.
- 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 order of magnitude of 1 × per 100 – 1,000,000 year.

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 High Level Waste (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 license of COVRA. In Table 10 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 license, as demonstrated in the diagram in Figures 4a and 4b.

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

Table 10. Authorized discharges at COVRA

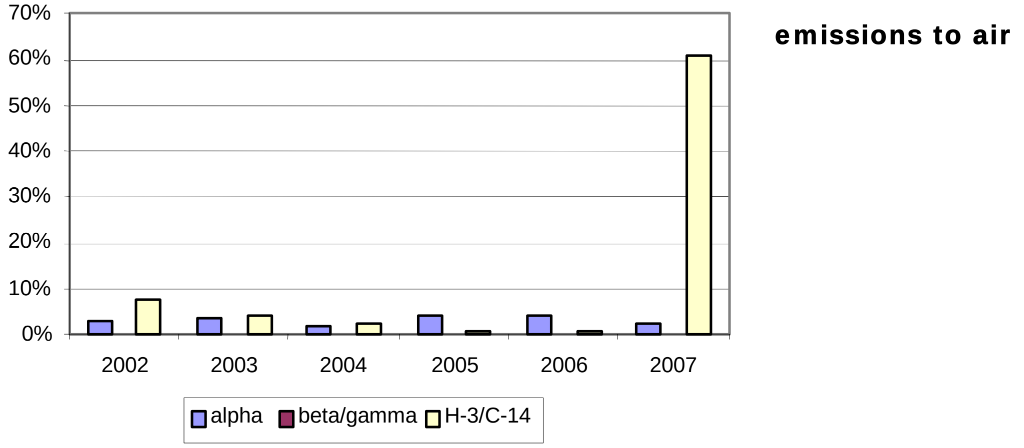
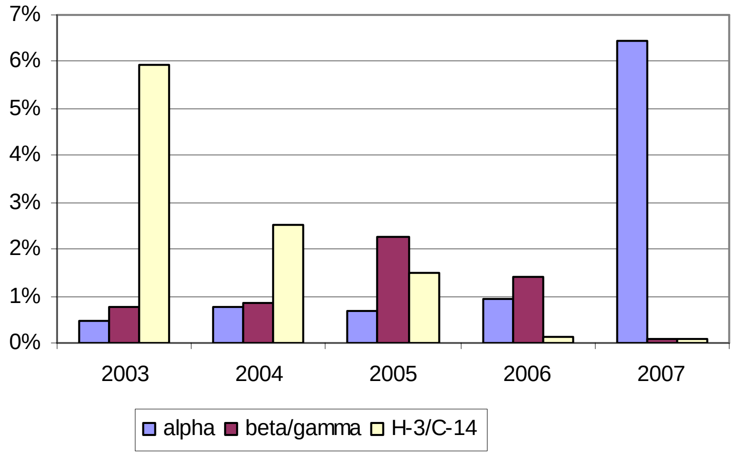


Figure 4a. Emissions of radionuclides to the air as a percentage of the annual limit (source COVRA).



emissions to water

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

Discharges from the HFR.

Argon-41 is the dominant component of the regular discharges of HFR. 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 11:

Year	2000	2001	2002	2003	2004	2005	2006	2007
Discharge (TBq)	9.9	8.0	6.2	7.4	8.2	5.6	4.6	4.6

Table 11. Airborne emissions from the HFR.

These discharges 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.

For completeness the discharges from the Borssele NPP (already included in the national report to the Convention on Nuclear Safety) are given in Annex 4.

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 licenses 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 license. 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 alarm and coordination centre where all reports of nuclear incidents and accidents as well as other environmental incidents are reported. This centre is staffed and accessible 24 hours a day.
- A (nuclear) Planning and Advice Unit. This unit 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 unit consists of a front-office, where the emergency situation is analysed and advice on measures is drafted, and back-offices for radiological, medical, operational and administrative 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), which operates the national radiological monitoring network and monitoring vans and also collects data from other institutes. Alongside the radiological experts, the department of nuclear safety, security and safeguards (KFD) plays 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 act as extra pairs of eyes and ears for the NPK organisation.
- A policy team at the Ministry of the Interior's National Coordination Centre. This team decides on the measures to be taken. It is composed of ministers and senior civil servants, and chaired by the Minister of Housing, Spatial Planning and the Environment or the Minister of the Interior.
- The National Information Centre also located within the Ministry of the Interior. 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.

The NPK organisation has currently been revitalised in order to achieve closer harmonisation with the regular emergency planning and response organisations. The main purpose of the project was the reduction of the differences between nuclear emergency preparedness and planning and response for other "regular" types of disasters and crises. Another main objective was improvement of the organisation and the means to inform the public and the media in case of a nuclear emergency. The envisaged outcome of the revitalisation programme is a package of measures aimed to improve both the preparedness to accidents and the effectiveness of the response. New directives, handbooks, monitoring strategies and equipment are in place. The next step will be to make all the results operational at all levels of government and emergency organisations.

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 is 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:

Direct intervention	(Projected Dose)
Preventive evacuation:	1000 mSv H_{eff} or 5000 mSv H_{th} (2 days)
First day evacuation:	200 mSv H_{eff} or 1500 mSv H_{th} (2 days)
Late evacuation:	250-50 mSv (first year dose)
Relocation/return:	250-50 mSv (first 50 years after return)
Iodine prophylaxis:	100 mSv (child); adult 1000 mSv (2 days)
Sheltering:	10 mSv H_{eff} or 500-50 mSv H_{th} (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 First day evacuation, Iodine prophylaxis and for sheltering have recently 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. 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 full-scale exercise was 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 NL (e.g. municipality of Borsele, regional safety authorities 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 NPP's 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 NPP's 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. Compatability with border-countries is improved, although slight differences due to national circumstances remain. The local Nuclear Emergency plans will be updated to implement the new policy (expected to be finished in 2008).

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

Introduction

In the Netherlands the following nuclear facilities are in operation or have been shut down recently.

Table 12. Status of nuclear facilities

Name of facility	Type	Power	Status	Date of closure
Borssele	NPP	515 MW_e	Operational	2033
Dodewaard	NPP	60 MW_e	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}	Operational	N.a.
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.

The Dodewaard NPP is the only nuclear facility that is currently in a state of decommissioning. It was shut down in 1997 after 28 years of operation.

National policy

In principle the operator is responsible for all aspects of decommissioning. International consensus exists that there are basically three different strategies for the decommissioning of nuclear power stations:

- direct dismantling within a period of ten years;
- delayed dismantling within 50 years, after bringing the facility in a safe enclosure (SE);
- "in situ" dismantling after a period of SE;

In the EIA for the Dodewaard NPP these three strategies were considered. In principle, the operator of the NPP designates one of these strategies as the preferred alternative on the basis of a decommissioning plan. Since the environmental impact was minute for all strategies considered, the operator decided in favour of the least expensive strategy, namely postponed dismantling, with a waiting period of 40 years. Although the government had a slight preference for immediate dismantling for various reasons, no objection was raised against the decision of the operator.

After dismantling of all the structures of the NPP the end-point is:

- Removal of all potentially contaminated structures and installations;
- Proper management of radioactive waste;
- Removal of residual radioactive contamination from the site according to agreed clearance levels. The target is clearance for unrestricted use.

This corresponds with what is generally described as the "green field" situation.

In May 2002 a license was granted to GKN, the operator of the NPP Dodewaard, to bring and keep the plant in a safe enclosure. One of the requirements in the license for safe enclosure is to keep a record system of the inventory of all radioactive materials and components, which have become contaminated or activated during operation, and to update it every five years. In July 2005 the stage of safe enclosure was achieved.

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.

COVRA will remain in operation for at least 100 years. Close to the anticipated closure date decommissioning plans will be made. However, decommissioning costs are not considered excessive.

26 (i) Qualified staff and financial resources

Qualified staff

The safe enclosure period for the NPP Dodewaard is scheduled to last 40 years. In the license applying for this safe enclosure period the operator is required to appoint a radiological expert, 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.
- 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.

Regarding the Borssele NPP, in the Covenant between the operator and the government it is confirmed that the NPP will be dismantled directly after operation.

Financial resources

There has been a general understanding that the "polluter pays principle" applies. Consequently, the operators of the NPP's have made financial reservations for decommissioning on a voluntary basis. In the case of the Borssele NPP these voluntary reservations were formalised in the Covenant. The decommissioning funds are managed by the utilities. However, with a view to international developments in this area, it is envisaged to establish a legal basis in the Nuclear Energy Act. As mentioned before, a proposal for a revision of the Nuclear Energy Act has been presented to Parliament in 2006, introducing a legal basis for requiring the operator of a nuclear facility to ensure that adequate financial resources are available at the moment that these are required.

In the case of the Dodewaard NPP the costs of decommissioning were calculated in 1994 and updated in 1999 with the programme STILLKO 2, a cost evaluation model using the net present value method, developed by NIS Ingenieurgesellschaft mbH. The STILLKO 2 programme has been used for the calculation of the decommissioning cost of other NPP's in Belgium and Germany. By utilising the STILLKO 2 model the total non-discounted decommissioning costs including the preparation for safe enclosure and a 40 years waiting period for the Dodewaard NPP were estimated at about M€ 160.- (price index 1999). New calculations of decommissioning costs are foreseen in 2009, including the costst of a new dismantling-scenario in 2015.

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

However, 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.

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.

It is envisaged that COVRA, which is a 100% state owned company, will become responsible for the shut down Dodewaard NPP. This decision in principle was taken to improve the efficiency of radioactive waste management in connection to the

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

decommissioning steps following the removal of all spent fuel from the NPP. It was considered that the decommissioning activities (in principle for all nuclear facilities in the Netherlands) can be managed more efficiently by one organisation.

26 (iii) Emergency preparedness

The provisions set out under article 25 apply generically.

26 (iv) Record keeping

In the preparatory phase to the safe enclosure the licensee of the NPP Dodewaard completed the establishment of the Dodewaard Inventory System (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.

Section G

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.

Safety of Spent Fuel Management

4 (i) Criticality and removal of residual heat

Management of spent fuel originating from Dutch reactors occurs at five different locations (three in the Netherlands, the other locations 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 plants in France and the UK.

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 (NPP's), 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 the decommissioning phase. 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; 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 High Flux Reactor (HFR) at JRC at 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) In September 2003 the HABOG facility of COVRA was officially inaugurated by H.M. Queen Beatrix. The facility 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 2007, 140 vitrified glass canisters, 18 spent fuel containers from the HOR in Delft, 18 spent fuel containers from the HFR in Petten as well as 2 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 the UK and France. The radioactive residues from reprocessing activities will in due time be returned to the Netherlands and stored in the HABOG facility at COVRA. For Dodewaard NPP the return of all HLW is planned for 2009. For Borssele NPP at the end of 2008 a total of 140 vitrified waste canisters have been returned.

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 beginning of the nuclear era in the Netherlands the operators of the two NPP's 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 and is increasing steadily.

The operator of the Borssele NPP has arranged for the recycling of its reprocessing products (uranium, plutonium), and has recently initiated a license application for the use of MOX. Regarding the products of past and future Dodewaard fuel reprocessing, the uranium was sold to a European NPP, while the plutonium recently was sold to a fuel fabricating company for fabricating MOX fuel.

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 [11] (see scheme of Figure 5 below).

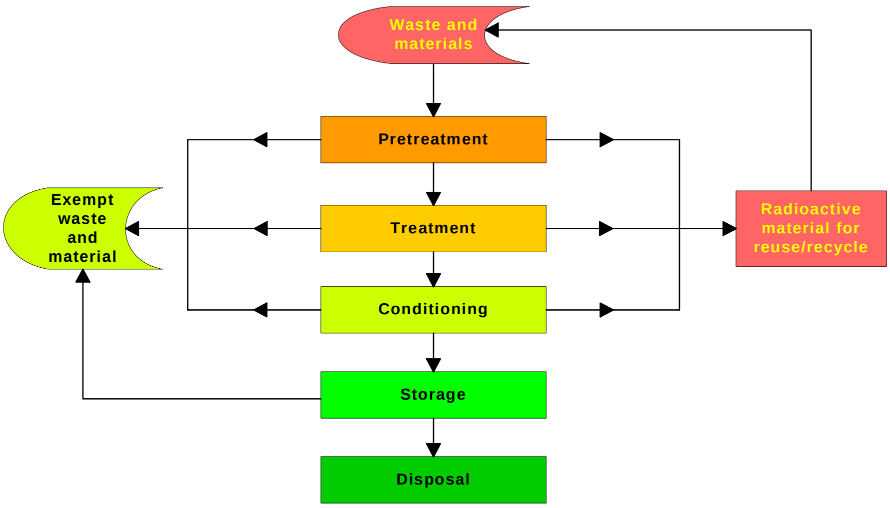


Figure 5. Basic steps in Radioactive Waste Management

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.

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* 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 NPP's 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 NPP's 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 (or incidentally to the original supplier in the USA) 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 guidelines from, and under supervision of, the 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 NPP’s 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 licenses of the nuclear facilities, regular transports of spent fuel from the NPP’s 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 NPP’s 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 NPP’s. 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 facility for the treatment and storage of high-level waste 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 to set 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.

The operator of the Borssele NPP has chosen for the option of reprocessing of its spent fuel. Some spent fuel is kept in storage in the fuel pool at the Borssele reactor site, waiting for transport to the reprocessing facility. As mentioned before, since 2006 no transports could have been carried out, as a new bilateral agreement will have to be concluded between France and the Netherlands. When a return-scheme for the radioactive waste is formalised, new transports will be scheduled as soon as possible. Most of the spent fuel not yet sheared is kept in storage at the reprocessing plants in France and the UK, waiting for reprocessing. The management of this SF is exercised under the authority of the French and UK government respectively.

The only other spent fuel management facility is the HABOG facility, managed by COVRA. This facility is designed to store conditioned SF 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 license 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 will be completed in the end of 2009.

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 license 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 license 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.

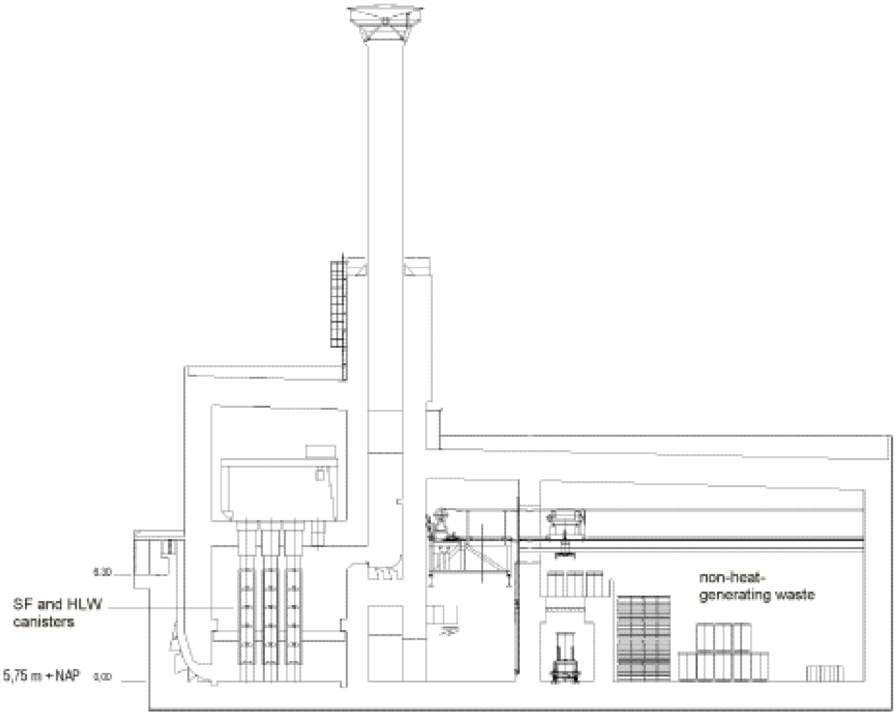

Figure 6. Cross-section of the HABOG facility

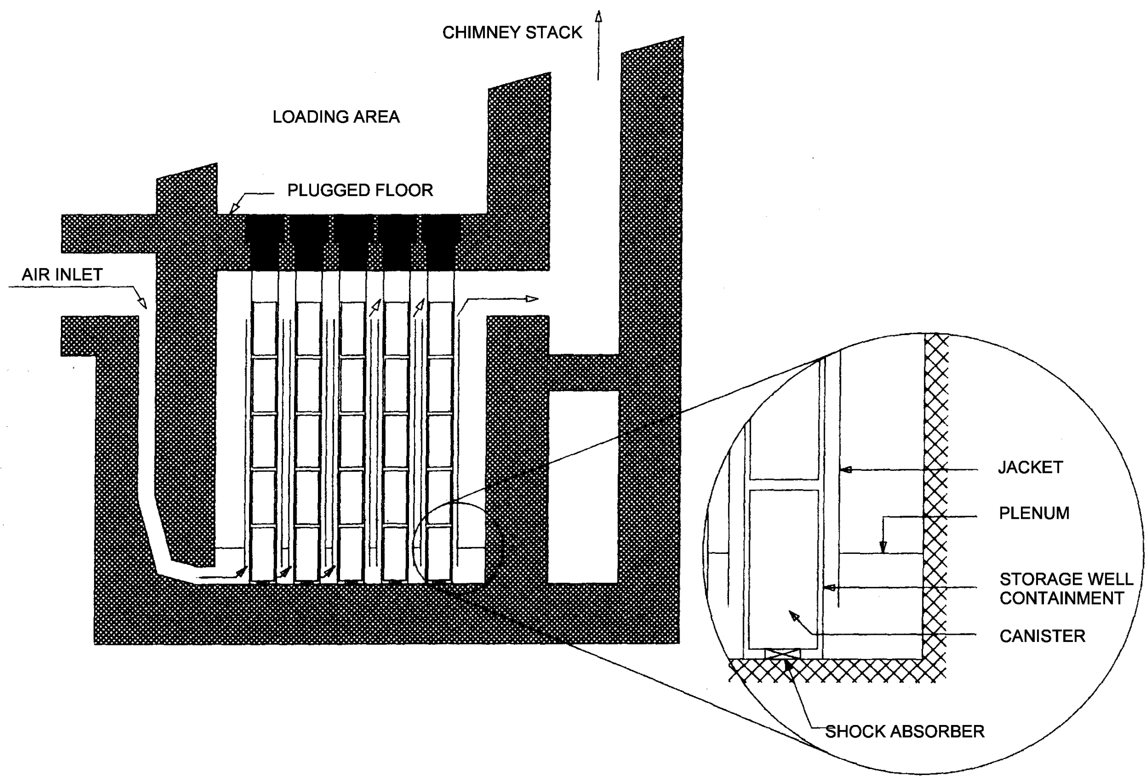

Figure 7. Storage wells for SF and HLW in the HABOG

The HABOG is a vault type storage facility divided in two separate compartments. The first compartment is used for the storage of drums and other packages containing high level waste that does not need to be cooled (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 NPP's and for SF originating from the research reactors. SF 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 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 SF by application of neutron absorbers and by a suitable geometry of the SF.
- Assurance of adequate cooling of heat-generating HLW.
- Possibility to move SF 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 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

- The ventilation system is composed of two separate systems: a passive system, based on natural air convection (SF and HLW requiring cooling) and a mechanical system (other HLW). In the former system the ventilation air is never in contact with any radioactive material or contaminated surfaces and is, consequently, not monitored. In the latter system the ventilation air is passed over filters before being released through the ventilation stack. This system is designed in such a way that the air flows from areas with no or low contamination to areas with a potentially higher contamination.

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 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.

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 license 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 NPP's must be covered or incorporated in the Safety Report (SR), which is submitted to the regulatory body. A typical example are the requirements against the site specific external hazards, such as military aircraft crashes, external flooding, seismic events and gas cloud explosions.

After obtaining the license but before construction the licensee drafts and submits to the regulatory body the Safety Analysis Report (SAR) and supporting topical reports, which give a detailed description of the facility and present 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 building the licensee submits the report 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 are foreseen and there will be no need for revision of the Safety Report, which is the basis of the license. However, all the results of the commissioning programme are incorporated in a full update of the detailed SAR.

As IAEA regulations are fairly general and hence lack technical detail, the licensing basis for the HABOG building was based on the French state of the art for SF/HLW storage. As an independent assessment tool for the SAR the USA ANS/ANSI standard 57-9-1992 was incorporated.

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 [12], 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 13:

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 13. 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 lead 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.

A detailed scheme of all steps in the EIA procedure is presented in Table 14.

Time limits (weeks)	Environmental Impact Assessment (EIA)	What happens?
	Inception memorandum (EIA)	The proponent present the inception memorandum (also called: notification of intent or starting note) with a brief description of the proposed activity. The competent authority makes the memorandum public. The procedure begins.
6	Public participation comment and advising	In a public participation period of 6 weeks, the public and the advisers comment and advise on the memorandum to the competent authority. This participation and advising aims at the guidelines for the contents of the EIS. The advice of the EIA commission on the guidelines is especially important.
13	Guidelines	13 weeks after the publication of the inception memorandum the competent authority draws up the guidelines. The guidelines define the environmental effects and alternatives to be assessed in the Environmental Impact Statement.
	Production of the Environmental Impact Statement (EIS)	The proponent is responsible for drawing up the Environmental Impact Statement. There is no maximum time limit. In this phase an intensive interaction between the EIS-process and the development of the project or plan is recommended. As soon as the EIS is ready, the proponent sends it with the license application or draft plan to the competent authority.
6	Acceptation of the Environmental Impact Statement (EIS)	The competent authority checks the Environmental Impact Statement on the basis of the guidelines and legal requirements within 6 weeks.
8	Publication of the Environmental Impact Statement and license application for the draft plan	The competent authority publishes the Environmental Impact Statement within 8 weeks after receiving it. The EIS is published simultaneously with the license application for public comment and advising. An EIS for a plan is published together with the draft plan.
6	Public participation, advising and hearing	The public and the advisers give their comments on the Environmental Impact Statement and on the license application or draft plan. The public participation is at least 6 weeks. A hearing is included.
5	Review of the Environmental Impact Statement by the EIA Commission	Within 5 weeks after the public participation period, the EIA Commission reviews the EIS both for completeness and scientific quality, taking into account the comments from the advisers and public participation.
	Decision	The competent authority decides on the basis of the EIA and the received comments and advice. It motivates in the decision how the EIS (impacts and alternatives) and comments were taken into account. The competent authority must also formulatie an evaluation programme.
	Evaluation	In cooperation with the proponent, the competent authority evaluates the environmental impacts on the basis of the evaluation programme. If necessary, the competent authority may order extra mitigating measures to reduce the environmental effects.

Table 14. General scheme of the E.I.A.-procedure in the Netherlands

Although strictly speaking the example given in table 14 is not applying to spent fuel management operations, because these were not operational at the time, it can still be considered as representative.

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 license. The annual reports of COVRA on releases and radiation levels at the fence of the facility show that this favourable situation continues also in 2005, 2006 and 2007 .

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) License 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 license 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 license condition stipulates that the safety of the installation shall be periodically reviewed in the light of operating experience and new insights. A review of operational aspects shall be performed once every five years, whilst a more 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 licenses 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 licenses are usually granted by one ministerial decision. The issue of a license is conditional on a favourable outcome of the review of the safety assessment of the facility by the Department of Nuclear Safety, Security and Safeguards of the Ministry of Housing, Spatial Planning and the Environment 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 license to operate the facility or to modify the facility. The technical specifications and the assumptions underlying the postulated accident scenarios are laid down in a Safety Analysis Report. It is the responsibility of the operator to demonstrate to the 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 license conditions for the operator, which are attached to and form a constituent part of the operating license, specify the obligations that the operator has to meet. Some of these license conditions form the basis for the establishment of operational limits that ensure that under foreseeable circumstances the authorized limits, as set by the licence, will not be exceeded. Other license conditions demand that periodic reviews be carried out with the aim to assess whether the assumptions, which form the basis of the safety assessment of the facility, are still valid. The results of these periodic reviews are submitted to the 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 license conditions for the operator as specified in the operating license. The licensee has such a management system in place.

Examples of such license 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 license was awarded are still applicable.

9 (iv) Engineering and technical support

During the active period of COVRA waste will be accepted and actively stored in the facility. 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 2014 (the originally anicipated 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 license 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 license 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

As set out under Article 7 (ii), no decommissioning plans have been made during the design stage of the SF/HLW storage facility HABOG. A formal reason is that neither the Joint Convention nor any other legal requirement was in place according to which such a plan had to be made. A more practical reason is the form of the waste stored in the HABOG-facility. All waste 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.

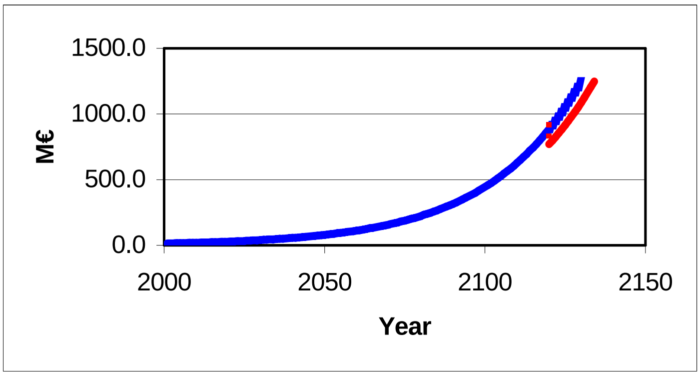

Figure 8. Growth of the radioactive waste management fund

In addition, in view of the anticipated storage period (~100 years) there is ample time to make decommissioning plans or provide for facility upgrades.

The adjacent graph (Figure 8), representing the growth of the fund for future radioactive waste management, demonstrates that, if in 2120 money would be drawn from it for the construction of a replacement of the HABOG (100 Meuro), 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.

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.

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 supercompactor, an incinerator for liquid organic waste and an incinerator for animal carcasses. The LILW facility has now been in operation for more than 15 years. The whole waste management facility got a major regulatory overhaul in the framework of a revision of the license for the construction and operation of the HABOG.

At the Petten site, a temporary hot cell facility ("HAVA-VU") will be build for conditioning en repacking the high level waste still present in the Waste Storage Facility. It is intended that all the waste is transferred to COVRA within the next 10 years.

12 (ii) Past practices

1,575 drums (January 2007) of waste are stored at the NRG Waste Storage Facility at Petten. This waste, resulting from some four decades of nuclear research at that facility, exists of high active waste containing fuel material residues and some highly active wastes not including fuel material (fission and activation products). The wastes are stored in metal drums placed inside concrete-lined pipes ("storage tubes").

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 new yet to build hot cell facility ("HAVA-VU") at the Petten site. The license application, including an EIA, was submitted to the competent authorities in 2007.

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 in the next 10 years.

ARTICLE 13. SITING OF PROPOSED FACILITIES

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

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

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

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

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

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

See 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 with cement. The solid components are supercompacted and conditioned with cement grout.

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 again conditioned with cement grout. 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, supercompacted and immobilised with cement grout.

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 cement. 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.

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 2,). 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 light-weight 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 [13] on the long-term underground disposal of radioactive and other highly toxic wastes, which was presented to parliament, and which now forms the basis for the further development of a 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 [14]. 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) License 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.

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.

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.

The Netherlands as a member state of the European Union has implemented in its national legislation [15] Council Directive nr. 92/3/Euratom [16]. This directive sets out similar requirements as the ones specified in paragraphs (i)-(v) of this article 27. However, small differences between article 27 of the Joint Convention and Council Directive 92/3 exist (e.g. prior consent of third country of destination is not required in the latter). As part of the policy of continuously improving and harmonising regulation, the European Commission has started the process of revision of this Directive in 2004, which resulted in Council Directive nr. 2006/117/Euratom.

Under these regulations imports and exports of radioactive waste require a license to be issued by the regulatory body (VROM/SVS). License applications for a transboundary shipment of radioactive waste should be made to the regulatory body using the standard document laid down in EC Decision 93/552 Euratom [17], which will be adapted to the new Directive.

Spent fuel destined for reprocessing is not considered as radioactive waste and consequently, does not fall under the scope of the Directive 92/3. 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 license 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 [18],[19],[20],[21],[22].

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.

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 license. A license 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 license 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 license. 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 [23]. 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.

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 92/3/Euratom[15] 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 (article 13).

Council Directive 2003/122/Euratom[24] 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 license 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

Decommissioning funds

A proposal for a revision of the Nuclear Energy Act, aiming to patch some known deficiencies as well as to introduce new issues, has been presented to Parliament in 2006 by the former government. However, due to elections and the installation of the new (current) government, the amendment-procedure was substantially slowed down. At the time of writing this report the amendment-procedure had not yet been completed.

One amendment that is relevant in the framework of this Convention is the introduction of a new article that provides the legal basis for requiring the operator of a nuclear facility to ensure that adequate financial resources are available for decommissioning at the moment that these are required. It further stipulates that the way of management of these decommissioning funds needs the approval of the Minister of VROM. Since the Nuclear Energy Act is a framework act, further details on the management of decommissioning funds and specification of acceptable methods for securing these funds in case of early termination of operation, will be elaborated in separate decrees or ordinances.

This amendment of the Nuclear Energy Act anticipates on an EC initiative for strengthening the regulations on decommissioning funds.

Maintenance of nuclear competence

A concern at the Review Conference was the identification of the difficulty to maintain nuclear competence during the waiting period of the shut down Dodewaard NPP, combined with the envisaged phase-out of nuclear energy in the Netherlands.

The main problems were the following:

- An aging workforce, with the prospect of many experts retiring within five years.
- An insufficient number of graduates with relevant studies from technical universities which could replace the vacancies.

However, in 2005 the government considered that the anticipated closure of the NPP Borssele in 2013 could lead to an increase of greenhouse gases and consequently compromise the objectives of the Kyoto protocol. It was decided that, in principle, the NPP could continue operation until 2033, contingent on a political agreement on some specific conditions. This requires that qualified personnel be available for a longer period.

The abovementioned developments have, at least at the level of the Regulatory Body, strengthened the determination to cope in a prudent way with the problem of retaining an adequately broad nuclear competence. So far serious shortcomings have been prevented by:

- Seeking efficiency gains by concentration of functions mainly within VROM.
- Outsourcing certain operational tasks to other national or international institutes.

Section L

Annexes

Annex 1.

Storage of Radioactive Waste in the Netherlands

Policy

Long-term storage of radioactive waste and spent nuclear fuel (SNF) is an essential element of the policy to manage radioactive waste and SNF 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 SNF of the two power reactors is reprocessed. For the SNF of the research reactors reprocessing is not foreseen.

The policy to manage the limited amount of waste and SNF is tailor-made to the country's needs and is a pragmatic and practical solution. The high groundwater table 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.

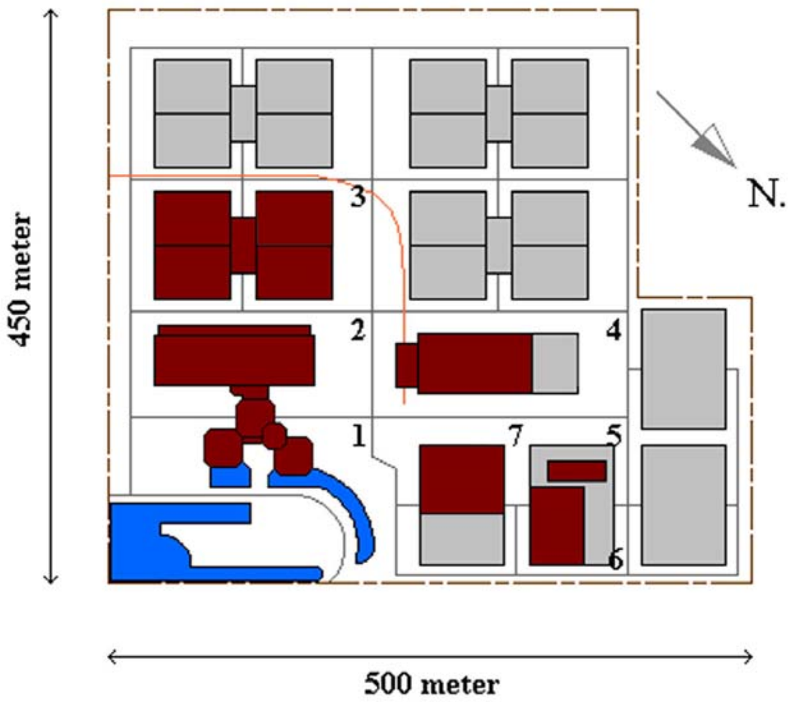

Figure A.1. Lay-out of the COVRA facilities in 2008
(In grey future expansions of the modular buildings are indicated)

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

All storage facilities are modular buildings. The storage building for low and medium 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 years of waste production at the present rate. In total 16 storage modules for low and medium level waste can be constructed which represents some 160 years of waste production.

Figure A.2. Storage of low and medium level waste

Of the storage building for (TE)NORM waste (nr 6 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 7 in the figure), only half of the full building is in operation right now. 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 medium 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 cement, 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.

The cemented 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 firefighting equipment is present in the storage modules, since burnable materials are 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.

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

High level waste

In the seventies it has been decided to reprocess all SNF of the nuclear power plants in facilities abroad. Vitrified waste and compacted hulls and endcaps are and will be returned to the Netherlands. The research reactors as well as the molybdenum production facility in the Netherlands produce SNF 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, SNF from research reactors and used 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.

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 overpacks. 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)

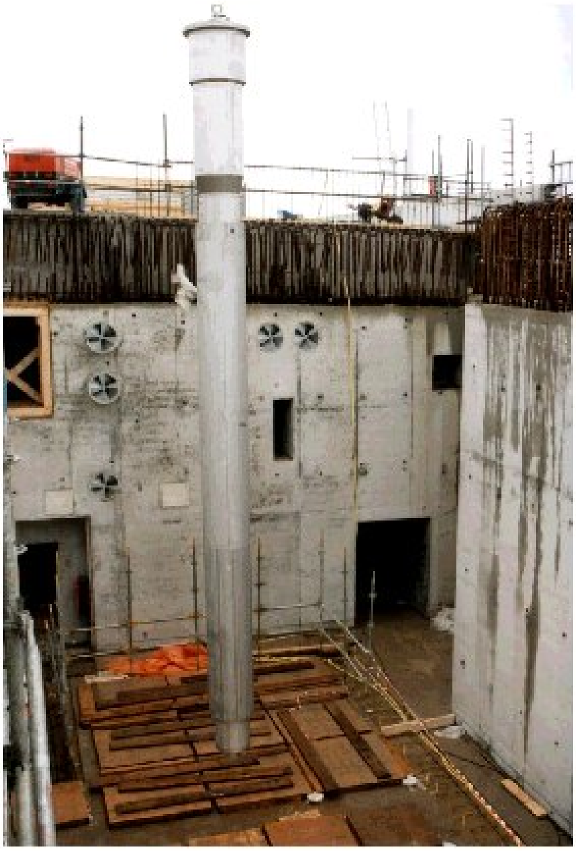

Figure A.4. Emplacement of the wells during constuction.

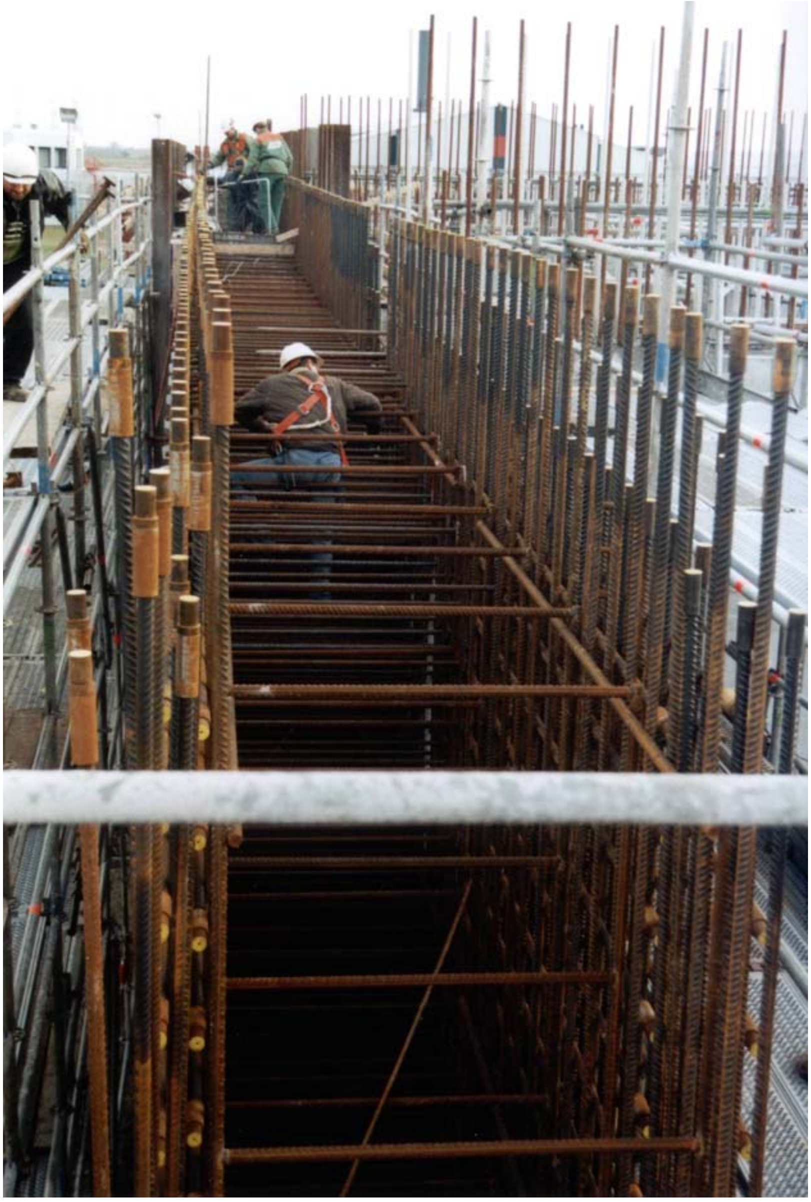

Figure A.5. Worker in the concrete at work in 1,7 meter thick outer wall.

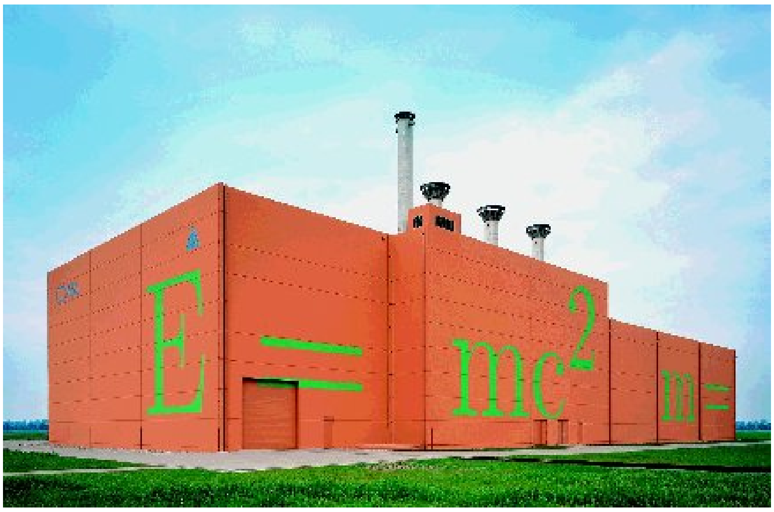

Figure A.6. HABOG

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4. INTERNATIONAL ATOMIC ENERGY AGENCY, Net Enabled Waste Management Data Base (NEWMDB), www.newmdb.iaea.org

Annex 2

Inventory of Radioactive Waste

from

Country Waste Profile Report for Netherlands

Reporting year: 2007

Waste Class Matrix(ces) Used/Defined

Country: Netherlands, Kingdom of the Reporting Year: 2007

Waste Class Matrix: IAEA Def. , Not Used

Description: The Agency's standard matrix

Waste Class Matrix: National

Waste Class Name	LILW_SL%	LILW_LL%	HLW%
LILW	90	10	0
LILW, NORM	100	0	0
LILW, depU	0	100	0
HLW, non heat producing	0	100	0
HLW, heat producing	0	0	100

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.

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 Class Matrix(ces) Used/Defined

Country: Netherlands, Kingdom of the Reporting Year: 2007

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

Undefined

	as-generated waste	processed for handling	processed for storage	processed for disposal
unprocessed				
processed				

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.

Groups Overview

Country: Netherlands, Kingdom of the Reporting Year: 2007

Note: The "2003 data collection cycle" asked Member States to report on wastes held at foreign facilities. Please see the following NEWMDB On Line Help page:

http://www-newmdb.iaea.org/showhelp.asp?Topic=18-4-1

However, some Member States had difficulty meeting this request for foreign reprocessing facilities. Additionally, Member States were divided on the issue. Some felt that the Member State in possession of foreign held waste should report it, others felt that the "owner" of the waste should report it, regardless of whether the waste was held abroad or not. Therefore, a decision was made to not publish information on foreign held waste until this matter was resolved.

Within this Groups Overview report, foreign waste management sites are indicated by italicized text. However, details of the sites (Site Structure) and the waste held (Site Data) are not published as part of this Member State's submission.

Please note, "sites" for the past practice of sea dumping are also denoted as "foreign" sites (italicized text). Details of the sites and the waste disposed are included in published Member State reports if this information was reported to the NEWMDB.

Reporting Group: COVRA

Inventory Reporting Date: December 2007

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		
BNFL (foreign)	spent fuel	processing		
Cogéma (foreign)	spent fuel	processing		
COVRA	COVRA-AVG	processing		
	COVRA-stor		storage	

Reporting Group COVRA, Site Structure: COVRA

Country: Netherlands, Kingdom of the Reporting Year: 2007

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.

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 the "COVRA-stor" facility

The following shows storage status for waste classes, and SRS.

Waste Class	Actual	Planned	Waste Class	Actual	Planned
LILW	Yes	Yes	LILW, NORM	Yes	Yes
LILW, depU	Yes	Yes	HLW, non heat producing	No	Yes
HLW, heat producing	Yes	Yes			
SRS	No	No			

List SRS?	No
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.

Types of Storage Units

Unit Name	Type	Year Opened	Closed?	Full?	Modular ?	Contains SRS?
LOG	building	1991	No	No	Yes	No
COG	building	2000	No	No	Yes	No
VOG	building	2004	No	No	Yes	No
HABOG	bunker	2003	No	No	Yes	No

International Atomic Energy Agency Page 1 of 1 NEWMDB Report

Reporting Group COVRA, Site Data: COVRA

Country: Netherlands, Kingdom of the Reporting Year: 2007

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

Inventory Reporting Date: December 2007 Waste Matrix: 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

Class	Location Facility	Proc.	Volume (m3)	Distribution in %							
				RO	FF FE	RP	NA	DF	DC RE	ND	Est
LILW	Storage COVRA-stor	Yes	9078	54	0	0	46	0	0	0	No
LILW, NORM	Storage COVRA-stor	No	2825	0	0	0	0	0	0	100	No

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.

Class	Location Facility	Proc.	Volume (m3)	RO	FF FE	RP	NA	DF	DC RE	ND	Est
LILW, depU	Storage COVRA-stor	No	1845	0	100	0	0	0	0	0	No
HLW, heat producing	Storage COVRA-stor	No	4.4	0	0	0	100	0	0	0	No
HLW, heat producing	Storage COVRA-stor	Yes	25.2	100	0	0	0	0	0	0	No

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. Apart from this waste also 3.2 m3 of spent fuel from the research reactors at Petten and Delft is stored at COVRA as well as 0.2 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.

Processing - Treatment method(s)

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

Processing - Conditioning method(s)

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

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, Kingdom of the

Reporting Year: 2007

Name	VROM
Full Name	Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (Ministry of Housing, Spatial Planning and Environment)
Division	Directie Stoffen, Afvalstoffen, Straling (Directorate for Chemicals, Waste, Radiation protection) KernFysische Dienst (Nuclear Safety Department)
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)
Division	Directoraat-Generaal voor Marktordening en Energie (Directorate-General for Markets and 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)
Division	Directie Arbeidsveiligheid en -Gezondheid (Directorate for Safety and Health at Work)
City or Town	Den Haag (The Hague)

REGULATIONS / LAWS

Country: Netherlands, Kingdom of the Reporting Year: 2007

Name	Kew	
Title or Name	Kernenergiewet (Nuclear Energy Act)	
Reference Number	Staatsblad 82, 1963, last revised 2003	
Date Promulgated or Proclaimed	1963-02-21	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	
Date Promulgated or Proclaimed	1987-08-31	Law

Comment #5221: Wastes that are regulated by the Law

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

MILESTONES

Country: Netherlands, Kingdom of the | Reporting Year: 2007

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

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:	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:	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:	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:	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, Kingdom of the Reporting Year: 2007

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:	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.			

Policies

Country: Netherlands, Kingdom of the Reporting Year: 2007

National Systems

	Policy	(Yes;Partially;No)
1	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)
2	Has your country developed strategies to implement a national policy?	Yes

	Requirements	(Yes;Partially;No)

Insert each of the following phrases into the question. "Has your country... ...according to IAEA Safety Series No. 111-S-1". For example, "Has your country identified the parties involved in the different steps of radioactive waste management according to IAEA Safety Series No. 111-S-1?

4	identified the parties involved in the different steps of radioactive waste management	Yes
5	specified a rational set of safety, radiological and environmental protection objectives	Yes
6	implemented a mechanism to identify existing and anticipated radioactive wastes	Yes
7	implemented controls over radioactive waste generation	Yes
8	identified available methods and facilities to process, store and dispose of radioactive waste on an appropriate time-scale	Yes
9	taken into account interdependencies among all steps in radioactive waste generation and management	Yes

Policies

Country: Netherlands, Kingdom of the **National Systems** Reporting Year: 2007

10	implemented appropriate research and development to support the operational and regulatory needs	Yes
11	implemented a funding structure and the allocation of resources that are essential for radioactive waste management	Yes
12	implemented formal mechanisms for disseminating information to the public and for public consultation	Yes

Responsibilities		(Complete;Incomplete)
Indicate whether or not the following responsibilities have been defined in your country according to IAEA Safety Series No. 111-S-1.		
Member State Responsibility		
15	establish and implement a legal framework for the management of radioactive waste	Complete
16	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
17	define the responsibilities of waste generators and operators of waste management facilities	Complete
18	provide for adequate resources	Complete
Regulatory Body Responsibility		
20	enforce compliance with regulatory requirements	Complete
21	implement the licensing process	Complete
22	advise the government	Complete
Waste Generator and Operators of Waste Management Facilities Responsibility		
24	identify an acceptable destination for the radioactive waste	Complete
101	comply with legal requirements	Complete

Activities		(Yes;Partially;No)
To indicate the status for implementing the responsibility to "manage radioactive waste safely" in your country, please answer the question "Does your country..." by inserting the following phrases. For example, "Does your country perform safety and environmental impact assessments?		
30	perform safety and environmental impact assessments for radioactive waste management facilities	Yes
31	ensure adequate radiation protection for workers, the general public and the environment	Yes
32	ensure suitable staff, equipment, facilities, training and operating procedures are available to perform the safe radioactive waste management steps	Yes
33	establish and implement a quality assurance programme for the radioactive waste generated or its processing, storage and disposal	Yes
34	establish and keep records of appropriate information regarding the generation, processing, storage and disposal of radioactive waste, including an inventory of radioactive waste	Yes
35	provide surveillance and control of activities involving radioactive waste as required by the regulatory body	Yes
36	collect, analyze and, as appropriate, share operational experience to ensure continued safety improvements in radioactive waste management	Yes
37	conduct or otherwise ensure appropriate research and development to support operational needs in radioactive waste management	Yes

Policies

	Clearance	(Yes;No)
115	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
116	Has your country ever used a "case-by-case" approach to clearing radioactive wastes (excluding spent/disused sealed radioactive sources)?	No
117	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

If the answer to the previous question is Yes, provide a brief description or reference documentation that describes previous clearance practices using the comments/attachments link below

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.

40	Environmental Assessment (EA)	Yes - All
41	Environmental Impact Statement (EIS)	Yes - All
42	Performance Assessment (PA)	Yes - All
43	Quality Assurance (QA)	Yes - All
44	Safety Assessment (SA)	Yes - All
46	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)
47	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)
48	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

Policies

Country: Netherlands, Kingdom of the | **Disposal Facilities** | Reporting Year: 2007

50	Does your Country have any written policies to address active institutional controls or passive institutional controls, such as monitoring or access restrictions?	No

Processing/Storage

	Policies/Procedures	(Yes;No)
	Does your country have written policies or written procedures for the following:	
60	waste sorting/segregation	Yes
61	waste minimization	Yes
62	waste storage	Yes
63	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
65	Does your country have any legislation, regulation, or policy that waste processing must take place prior to storage (see following note)	Yes

NOTE: The statement above implies wastes that require processing should not be placed into storage facilities (except for short-term, interim storage awaiting processing) in an unprocessed state for significant periods, where significant is defined by the regulatory body.

	Implementation	(Yes;No)
67	In your Country are there any waste processing facilities at the same location where the waste is generated?	Yes
68	In your Country are there any centralized waste processing facilities?	Yes
69	In your Country are there any mobile waste processing facilities?	Yes

	Foreign	(Yes;No)
108	Has your country sent any wastes or spent fuel to another country for processing (reprocessing for fuel)?	Yes
109	Will some or all of the product(s) of processing/reprocessing be returned to your country?	Yes
110	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
111	Has your country accepted any wastes or spent fuel from another country for processing (reprocessing for fuel)?	No

Spent SRS

	Registration	(Yes;No)
	Please indicate the types of registries used in your country for sealed radioactive sources (SRS) (please check all that apply)	
71	**Is there a national level registry?**	Yes
72	If answer was yes, is the registry used only for disused/spent SRS?	No
74	**Are there regional-level registries (one or more)?**	No
77	**Are there local-level registries (one or more)?**	No

Policies

Country: Netherlands, Kingdom of the **Spent SRS** Reporting Year: 2007

	Procedures	(Yes;No)
78	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)?	
80	Government to Government agreements	No
81	Government - Supplier agreements	No
82	Supplier-User agreements	Yes
84	Do any agreements include suppliers that are outside of your Country?	Yes

	Release / Disposal	(Yes;No)
86	Does your Country have any regulations to free-release spent sealed radioactive sources (SRS)?	No
87	Has your Country disposed of spent SRS in existing disposal facilities for LILW or HLW waste?	No
88	Does your Country plan to dispose of spent SRS in existing or planned disposal facilities for LILW or HLW waste?	Yes
89	Has your Country implemented dedicated disposal facilities for spent SRS?	No
90	Does your Country have plans to implement dedicated disposal facilities for spent SRS?	No

Import-Export

	Radioactive Waste	(Yes;No)
91	Does your Country have laws or Regulations restricting either the import or export of radioactive waste (excluding spent fuel)?	Yes

	Spent Fuel	(Yes;No)
92	Does your Country have laws or Regulations restricting either the import or export of spent fuel?	Yes

Liquid HLW

	Storage	(Yes;No)
93	Does your Country have high-level liquid wastes in storage?	No

UMMT

	Responsibility	(Yes;No)

Policies

Country: Netherlands, Kingdom of the UMMT Reporting Year: 2007

97	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)
98	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)
106	Does Your Country have any nuclear fuel cycle facilities?	Yes
107	Does Your Country have any nuclear applications facilities (non fuel cycle facilities)?	Yes

	Timeframe	(Yes - All;Yes - Some;No)
99	Does your Country require a time frame for the decommissioning of nuclear fuel cycle facilities once these facilities cease operation?	Yes - All
100	Does your Country require a time frame for the decommissioning of non-nuclear fuel cycle facilities once these facilities cease operation?	No

Annex 3.

Inventory of spent fuel

Status as of December 2007

Spent Fuel Management Facility: COVRA

Spent fuel is included in the HLW reported in the earlier tables. In HABOG are stored 20 canisters with spent fuel from research reactors and 140 vitrified waste canisters. The total activity is 1634 PBq.

Spent Fuel Management Facility: Borssele NPP

The total quantity is about 561585 kg.

Approximate masses/element: 308000 g.

	Number	U mass (g)
Irradiated fuel elements (LEU):	186	561585000

Spent Fuel Management Facility: HFR

The total quantity is about 137 kg. This number will vary over the year for reasons explained in the note below (< 10%).

Approximate masses/element: 500 g (fuel element), 330 g (control rods element)

	Number	U mass (g)
Irradiated fuel elements (LEU):	115	62831
Irradiated control rod elements (LEU):	23	10110
Irradiated fuel elements (HEU):	133	59738
Irradiated control rod elements (HEU):	15	4637
Total irradiated:	286	137316

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 14 kg

Approximate masses uranium total fresh HEU element: 204 g (fuel element), 108 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)	8	11147
Irradiated control rod elements (HEU):	5	312
Irradiated control rod elements (LEU):	1	734
Total irradiated:	30	14200

Annex 4

Airborne and liquid discharges from the Borssele NPP

Diagram 1.

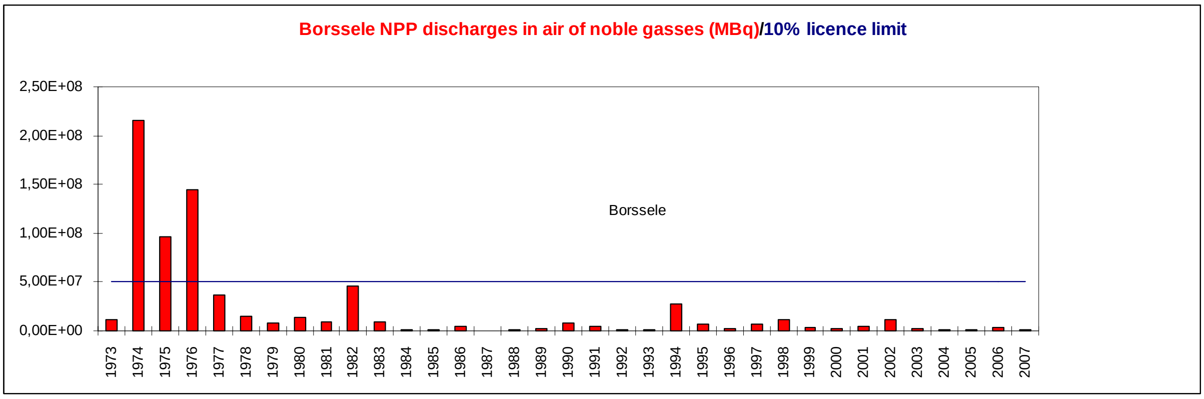


Diagram 2.

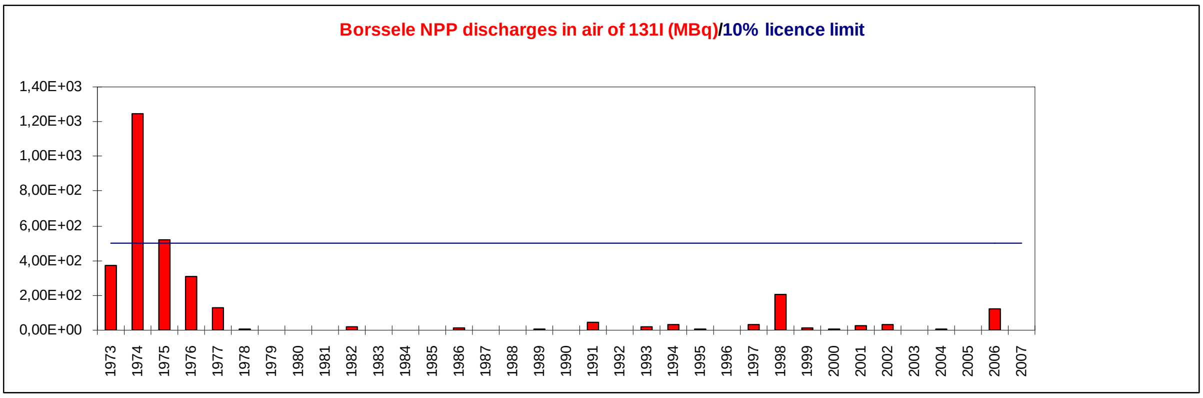


Diagram 3.

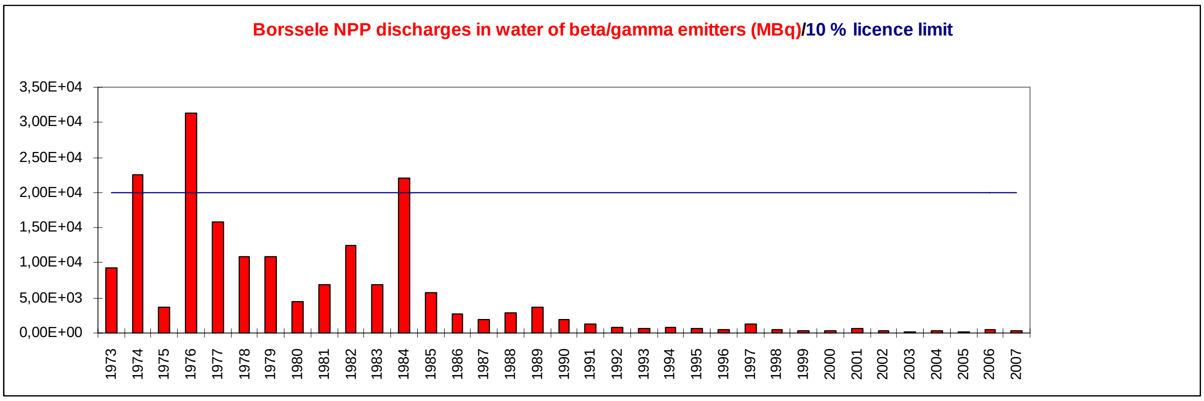
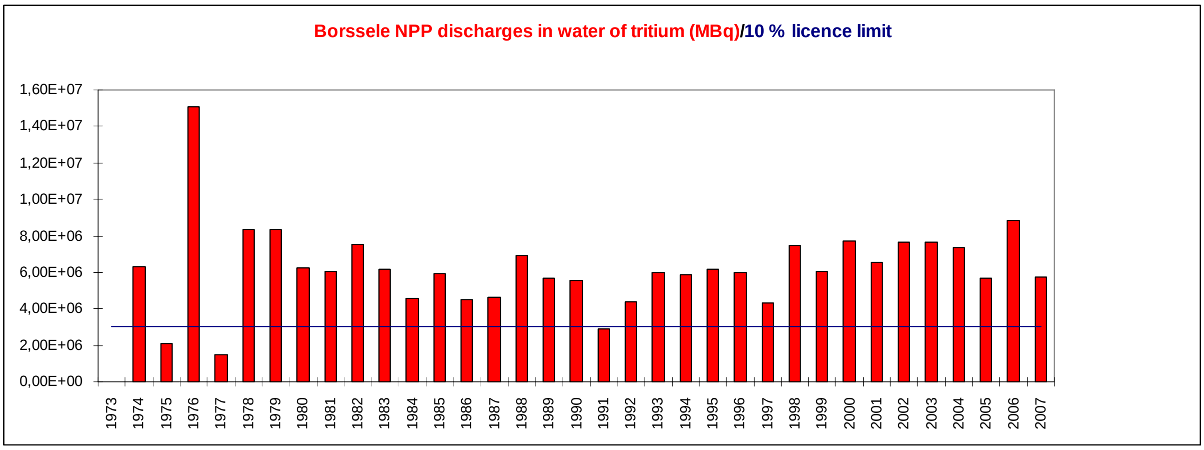


Diagram 4.


Borssele NPP discharges in water of tritium (MBq)/10 % licence limit
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1,40E+07
1,20E+07
1,00E+07
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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;
- 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 Housing, Spatial Planning and the Environment 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 nucleair technology and its applications and participates in European platforms on (among others) transparency in the nuclear industry, such as the High Level Group (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 brochures with information in clear language on the nuclear application in the Netherlands: for adults (left) and kids (right).

COVRA

Transparency and communication are an integrated part of the radioactive waste management organisation, COVRA, and its facilities. 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 built 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. 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 building 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.

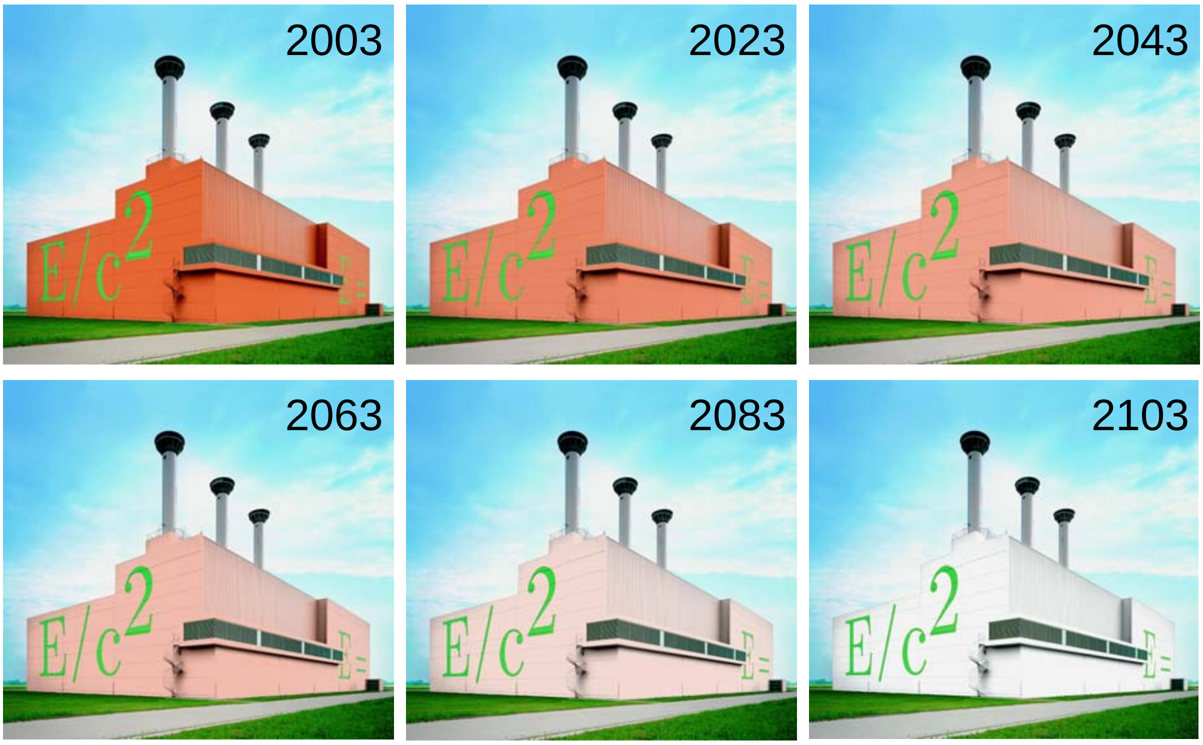

Figure A.8 Repainting HABOG's exterior every 20 years in lighter and lighter shades of orange until reaching white symbolises the decrease radioactivity of the waste stored inside.

The waste inside HABOG is planned to remain there for 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, that 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.

European Award for Communication Excellence

The artistic concept of the HABOG facility has won the PIME Award for communication in the nuclear industry. The award was presented at the PIME (Public Information Materials Exchange) conference in 2008, organised by the European Nuclear Society and held in Prague, Czech Republic.

Annex 6

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