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November–December 2009
Borssele, Netherlands

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PEER REVIEW OF THE RADIOACTIVE WASTE MANAGEMENT ACTIVITIES OF COVRA, NETHERLANDS

NOVEMBER–DECEMBER 2009
BORSSELE, NETHERLANDS

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FOREWORD

In the Netherlands, the management of radioactive waste is entrusted to the Centrale Organisatie Voor Radioactief Afval (COVRA), a State owned organization. COVRA is responsible for the predisposal management of all types of radioactive waste, as well as the siting and design of the planned deep geological disposal facility. As COVRA is a vital entity in the management of radioactive waste, an understanding was reached in the country on the necessity of a peer review of COVRA activities in an effort to improve public confidence and acceptability for the management of radioactive waste in the Netherlands.

Against this backdrop, the Government of the Netherlands, through the Inspectorate of the Ministry of Housing, Spatial Planning and the Environment (the Ministry), requested the IAEA to conduct a peer review of the activities of COVRA. Accordingly, on the basis of its statutory mandate to establish safety standards and to provide for their application, the IAEA organized an independent peer review team and performed an extensive review of the waste management activities performed by COVRA. All the waste management activities of COVRA, in particular those relating to the predisposal management of radioactive waste and the planning of geological disposal in accordance with national policy, were evaluated against the relevant IAEA safety standards.

Peer reviews are increasingly being acknowledged as an important component in building broader stakeholder confidence in the safety of facilities. The coming into force of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management has also focused attention on the demonstration of the safety of waste management facilities. This report presents the consensus view of the international group of experts convened by the IAEA to carry out the peer review. It will be of interest to organizations responsible for the development and operation of facilities for the disposal of radioactive waste, to regulatory bodies responsible for regulating their safety, technical support organizations and the broader range of stakeholders interested or affected by the development of such facilities.

The IAEA and the peer review team would like to express their appreciation for the open discussions and the very effective and constructive assistance of COVRA and the Ministry during the preparation and conduct of the mission.

EDITORIAL NOTE

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CONTENTS

1. INTRODUCTION

BACKGROUND

1.1. The IAEA is responsible for the development of international standards for the safety and protection of health, environment and property against ionizing radiation and also for assisting in the application of the standards in its Member States. The latter assistance is delivered through such mechanisms as peer review appraisals, technical cooperation projects, coordinated research projects, training, and information activities (conferences, workshops, etc.).

1.2. The IAEA Waste Safety Appraisal service is an independent peer review (hereinafter referred to as the 'peer review') of radioactive waste management that provides advice and assistance to operating organizations, regulators and to supporting organizations. It aims at strengthening and enhancing their performance in the areas related to the safe management of all types of radioactive waste. The service is available to all Member States with or without nuclear installations. The peer review is based on the current IAEA safety standards relevant to the predisposal and disposal of radioactive waste and, in particular, the Fundamental Safety Principles [1], Basic Safety Standards [2], and the Safety Requirements on Predisposal Management of Radioactive Waste [3], on Near Surface Disposal [4], and on Geological Disposal [5].

1.3. This service complements other services provided by the IAEA, such as the International Regulatory Review Service (IRRS) [6] and the Operational Safety Review Team (OSART) service [7]. These integrated, consistent and flexible services are intended to assist Member States in identifying strengths and in indicating areas for improvement in their national safety infrastructure, legislation and waste management activities as a whole.

1.4. Taking these opportunities into account, the Government of the Netherlands, through the Inspectorate of the Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieu (VROM, Ministry of Housing, Spatial Planning and the Environment, or The Ministry), requested the IAEA to conduct a peer review of the present activities of the State owned organization for management of radioactive waste in the country, Centrale Organisatie Voor Radioactief Afval (COVRA) [8]. In response, the IAEA organized a peer review, including a review mission that took place from 30 November to 4 December 2009 at the COVRA headquarters in Borssele.

OBJECTIVE

1.5. The purpose of the Waste Safety Appraisal was to evaluate the waste management activities performed by COVRA in accordance with the up to date international safety standards and, more specifically, IAEA Safety Standards Series No. GSR Part 5 on the Predisposal Management of Radioactive Waste [3].

SCOPE

1.6. The review covered safety aspects of all waste management activities performed by COVRA related to:

— Predisposal management of all radioactive waste delivered to COVRA;
— Planning for geological disposal in accordance with the national policy.

1.7. The radioactive waste management activities of COVRA cover the collection, processing and storage of low and intermediate level waste (LILW) and disused sealed sources as well as the storage of vitrified high level waste (HLW) from spent fuel reprocessing (e.g. vitrified waste), spent nuclear fuel from research reactors and other HLW, depleted uranium and waste containing naturally occurring radioactive material (NORM). The waste is generated by the Dodewaard (1968–1997) and Borssele (1973–2034) nuclear power plants; two research reactors at Petten and Delft, the URENCO uranium enrichment plant (Almelo site); and other users of radioactive material in the country such as hospitals.

1.8. With respect to the disposal of radioactive waste in deep geological formations, COVRA is responsible for the siting and design of the planned facility in the country and the evaluation of alternative options. Therefore, these activities were also within the scope of the mission.

1.9. Overall, 16 technical areas were evaluated, corresponding to the requirements of GSR Part 5 [3]. The national policy and strategy for waste management, the legal and regulatory framework, and the regulatory oversight were not subject to review, but were discussed for completeness and better understanding of the framework within which COVRA is performing its activities. Security aspects were also outside the scope of the mission since an International Physical Protection Advisory Service (IPPAS) mission of the IAEA was undertaken in 2008.

2. SUMMARY OF THE CONDUCT OF THE REVIEW

2.1. The review was carried out at the request of the Ministry of Housing, Spatial Planning and the Environment and entailed a self-evaluation by COVRA, a review of the self-assessment by an independent team of experts and on-site review by the team. The review team was composed of Gerhard Proehl (IAEA), Borislava Batandjieva (Austria), Denis Depauw (France) and Olivier Smidts (Belgium), who:

— Evaluated the responses of COVRA for all 21 technical areas of IAEA Safety Standards Series No. GSR Part 5 [3];
— Visited the site (i.e. the treatment facility for LILW (AVG), the storage facility for conditioned LILW (LOG) and the storage facility for HLW and spent nuclear fuel (HABOG);
— Presented questions and discussed the responses with the representatives of COVRA and the Ministry in order to evaluate compliance with the Safety Requirement GSR Part 5 [3].

2.2. The mission was conducted according to the agenda in Appendix I. The list of participants in the site mission is presented in Appendix II.

2.3. On the basis of the work performed, this report was prepared to summarize the approach to the peer review, and the observations, findings and conclusions (see Section 3) for each of the requirements of GSR Part 5 [3]. Following IAEA practice, the status of compliance, suggestions, recommendations and good practices were evaluated for all requirements that were within the scope of the peer review (see also paras 1.06–1.09). Recommendations were made with respect to areas of non-compliance, suggestions presented for areas where possible improvement could be made, and good practices identified when arrangements in place are exceptional.

3. OUTCOME OF THE REVIEW

3.1. To date, COVRA is the only organization in the Netherlands that is designated to collect, process and store radioactive waste from the waste

producers in the country. Therefore, COVRA manages four types of radioactive waste (according to its classification):

— HLW from the nuclear power plants, the research reactors and high enriched uranium (HEU) targets (from the production of molybdenum);
— LILW from the nuclear power plants, the research reactors, the enrichment plant, industry, and research and medical facilities;
— NORM waste from phosphate production;
— Depleted uranium.

3.2. Based on management of the above waste types, the following buildings are located at the COVRA site:

— An LILW treatment facility (AVG) (see Fig. 1);
— An LILW storage facility (LOG) (see Fig. 2).

The design capacity of the facility is 40 000 m^3, and 9349 m^3 had been placed for storage by the end of 2008.

— An HLW storage facility (HABOG). This facility (see Fig. 3) is designed for the storage of compacted HLW (320 canisters), vitrified waste from the spent fuel reprocessing (270 canisters) and also spent fuel from the research

FIG. 1. Treatment facility for LILW.

FIG. 2. Storage facility for LILW.

reactors (90 canisters). At the end of 2008, the stored inventory was 140 canisters of vitrified waste and 25 canisters of spent fuel were stored at the site.

— A storage facility for NORM waste (COG) (see Fig. 4). This facility has a capacity for the storage of 408 containers with calcined filter material from the phosphate industry. At the end of 2008, 153 containers were stored at this facility.
— A storage facility for depleted uranium (VOG). This facility has the capacity to store 1950 containers of depleted uranium (U_3O_8); by the end of 2008, 784 containers had been stored at the COVRA site.
— An administrative building.

3.3. In total, at the end of 2008, 30 m^3 of HLW, 9349 m^3 of LILW and 6444 m^3 of NORM waste were stored at the COVRA site. All storage buildings are designed for modular expansion. The present national policy considers the

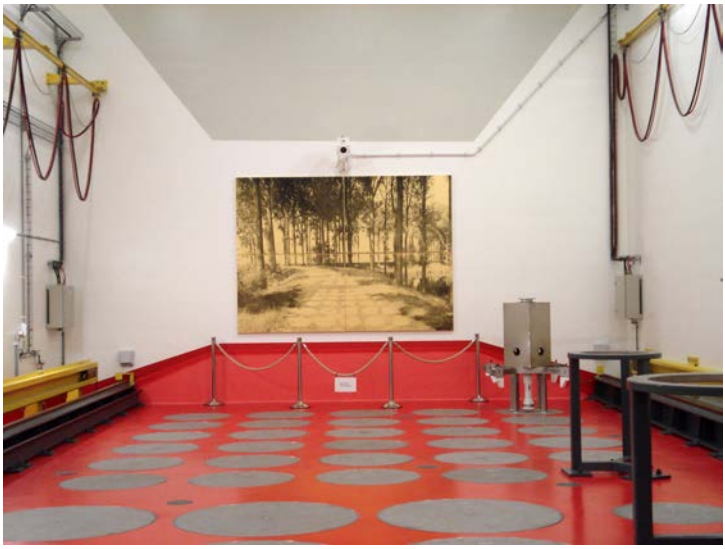

FIG. 3. Storage facility for HLW.

FIG. 4. Storage facility for NORM waste.

development of a geological disposal facility for all types of waste that will come into operation in 2130. Shallow land burial is not considered to be appropriate for the Netherlands due to high groundwater levels, the risks of flooding and the relatively small amounts of radioactive waste generated.

3.4. At the same time, the country is in the process of evaluating options for the construction of a new research reactor and a new nuclear power plant. If the plans for the expansion of nuclear energy are approved, it is expected that they will have an impact on the activities of COVRA in the future.

LEGAL AND REGULATORY FRAMEWORK

3.5. Requirement 1: "The government shall provide for an appropriate national legal and organizational framework within which radioactive waste management activities can be planned and safely carried out. This shall include the clear and unequivocal allocation of responsibilities, the securing of financial and other resources, and the provision of independent regulatory functions. Protection shall also be provided beyond national borders as appropriate and necessary if the impact on neighbouring countries would be possible to occur." [3]

Summary of the counterpart's response

3.6. There is a legal system for the management of radioactive waste that defines the responsibilities of operators (waste generators), regulators and COVRA (as a national State owned waste management organization [9]). The Directorate of Risk Assessment of the Ministry is responsible for the development of the legislation and guidelines, and also for issuing licences on safety of radioactive waste management [10]. In the light of the new considerations for the expansion of the nuclear industry, discussions are currently under way within the Ministry to evaluate the adequacy of the present legal system and infrastructure, and to identify necessary measures to meet the future plans, if they are approved by the Government. Also, the Ministry has initiated a study of the legal framework in other countries with the view to improve the national legislation, including that covering waste management activities and facilities.

Observations

3.7. There is a legal framework established and implemented in the Netherlands that comprises a Nuclear Energy Act [11], supported by several decrees (e.g. on radiation protection [12], nuclear installations [13] and transport [14]) and other ordinances. The Act and the decrees approved by the Parliament establish the safety principles and requirements for radioactive waste management. The ordinances provide more specific requirements and guidance and are issued by the Minister of Environment. The Decree on Radiation Protection is one of the main normative acts

that is relevant to waste management and the work performed by COVRA. It is based on European Union (EU) Directive 96/29 [15] (in line with the IAEA's Basic Safety Standards [2]).

3.8. The discussions during the site review mission confirmed that the current legislation follows the main international trends and practices. According to the Decree on Radiation Protection [12], radioactive waste is defined as "a radioactive material for which no further use, reuse or recycling is foreseen and which will not be discharged" [10]. However, the following differences have been observed:

(a) At present, there is no national scheme for classification of radioactive waste that applies to all producers of radioactive waste in the country. The definition of the different categories of waste is left with the waste generator. For example, COVRA applies the following waste classification that is based on heat generation, origin and dose rate of radioactive waste (and not on activity concentration):
   — HLW (non-heat generating and heat generating) from the nuclear research and processing of spent fuel in France and the United Kingdom;
   — LILW from the nuclear fuel cycle, institutional waste, etc.;
   — NORM (phosphate industry, etc.);
   — Depleted uranium (from the URENCO facility).

   On this basis, currently no distinction is made between short lived and long lived waste as described by the IAEA Safety Guide on Classification of Radioactive Waste [16]. The rationale for COVRA's approach to waste classification is based on the intention to dispose of all categories of radioactive waste in a deep geological disposal facility in the future.

   In addition, the LILW at the COVRA site is segregated according to the scheme in Table 1 [10].

   Taking into account the various waste producers in the country and the current application of the concepts of exemption, exclusion and clearance, the establishment of a unified waste classification based on the IAEA Safety Guide on Classification of Radioactive Waste [16] can be considered for the future minimization of waste. This could also be beneficial for the possible development of a national or regional (shared) geological disposal facility.

TABLE 1. LILW CATEGORIES

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 more than 15 years
D	Beta/gamma contaminated waste from producers other than nuclear power plants with a half-life less than 15 years

(b) According to Dutch legislation, a 'Safety Report' corresponds to the IAEA definition of 'a Safety Case'[1] [17]. A review of the Safety Report is required every five years (see also Requirement 14, para. 3.119), which is in line with international practice.

(c) Although the national policy of 1984 is to dispose of radioactive waste in a geological disposal facility [18], currently there is no legal framework that defines the safety requirements and criteria for siting, design, construction, operation and closure of such facilities. Use can be made of the recent international safety standards and in particular IAEA Safety Requirements No. WS-R-4 on Geological Disposal [5] and Safety Requirements SSR-5 on Disposal of Radioactive Waste [19].
Currently, there is a general requirement on waste retrievability that applies to all toxic waste in the Netherlands (including radioactive waste).

(d) Clearance of material is performed on a relatively small scale based on legally established clearance levels that are in line with the BSS [2]. This legislation is relevant only for decay storage of short lived waste, removal of NORM waste, and scrap metal from regulatory control [20]. However, decommissioning of facilities such as the Dodewaard nuclear power plant, the two research reactors and the current nuclear power installation is envisaged in the future. Therefore, legal provisions on clearance of bulk material and also material other than scrap metal will be required and the internationally agreed Safety Guide No. RS-G-1.7 [21] can be used.

(e) Similarly, with respect to decommissioning, the legislation will need to make provisions for release of sites (land and associated buildings) from regulatory control for restricted and unrestricted use. An IAEA Safety Guide (WS-G-5.1) [22] can serve as a good reference.

[1] A safety case is a collection of arguments and evidence in support of the safety of a facility or activity [17].

(f) With respect to safety assessment for the predisposal of radioactive waste, there are currently no regulatory requirements for safety assessment and therefore the IAEA's Code on the Safety of Nuclear Power Plants: Quality Assurance (Safety Series No. 50-C-QA, 1988) is being used as a reference. This standard has been superseded by Safety Requirement No. GSR Part 4 [23] and a Safety Guide [24], which could be taken into account in the future.

(g) It has been noted that, with respect to the long term management of radioactive waste, there are no specific legal requirements on minimizing the generation of radioactive waste. There is the additional consideration not to place undue burdens on future generations. However, the rules for minimization of non-radioactive waste in the Netherlands also apply to radioactive waste. A practical incentive to minimize radioactive waste is the application by COVRA of a price policy per volume of radioactive waste (for instance the price per dm^3 remains very moderate, even in the case of disused sealed sources, as mentioned in the High Activity Sealed Radioactive Sources and Orphan Sources Directive [25]). In addition, the Nuclear Energy Act, as revised in October 2009, also requires the nuclear power plants to have financial provisions for future dismantling, including management of the associated decommissioning waste.

(h) Optimization of waste management options is a requirement for all types of waste in the Netherlands, including radioactive waste.

(i) There is no regulatory requirement specifying the duration of record keeping related to waste management in the Netherlands.

NATIONAL POLICY AND STRATEGY ON RADIOACTIVE WASTE MANAGEMENT

3.9. Requirement 2: "To assure the effective management and control of radioactive waste, the government shall ensure that both a national policy and strategy on radioactive waste management are established. The policy and strategy shall be appropriate for the nature and amount of radioactive waste in the country, shall indicate the regulatory control required, and shall consider relevant societal factors. The policy and strategy shall be compatible with the Fundamental Safety Principles [1] and with international instruments, conventions and codes that have been ratified by the State. The national policy and strategy shall be the basis for decision making with respect to the management of radioactive waste." [3]

Summary of the counterpart's response

3.10. There is a national policy and strategy for collection, processing and storage for 100 years for all types of radioactive waste by COVRA, with the intention of future geological disposal in 2130.

Observations

3.11. The discussions during the mission provided a basis for the following observations:

(a) The current national policy and strategy envisage that a geological disposal site is operational in 2130, prior to which 30 years will be dedicated to siting and construction of the facility. However, currently, there are no specific milestones such as a programme for implementing this strategy. COVRA is the organization that needs to develop the geological disposal facility and currently follows a dual track policy — for development of a national disposal facility (in salt or clay formations) and to search for an opportunity to share such a facility with one or more countries.
A programme that identifies the necessary steps for research, site selection, design, construction, commissioning, operation, closure and post-closure of the disposal facility would facilitate the further implementation of the national waste management strategy. This would contribute to avoiding undue burdens on future generations and to making effective use of the current knowledge about radioactive waste management in the Netherlands.

(b) According to the policy, most of the radioactive waste generated in the Netherlands is collected, processed and stored at the COVRA site for 100 year storage, with the exception of very short lived waste and bulk NORM waste. The waste producers may store short lived waste only if after two years the radioactive waste is below clearance values defined in the legislation; otherwise, the radioactive waste must be delivered to COVRA. The NORM waste that is between one and ten times above the clearance values is disposed of in dedicated landfill sites in the country.

(c) There is political support for the construction of a new research reactor, and the option for development of new nuclear power plants is currently under political discussion in the Netherlands. A positive decision on the latter is expected to have an influence on the COVRA activities in the future. In addition, transport of nuclear power plant spent fuel for reprocessing to France after 2015 requires a new bilateral agreement between the Netherlands and France. Should this agreement not be concluded, the nuclear power plant spent fuel cannot be shipped abroad for reprocessing,

which would also have an impact on the radioactive waste management activities currently performed at the COVRA site (e.g. a need to increase the storage capacity).

(d) With respect to the future development of the nuclear industry in the country, the national Energy Report of 2008 [26] has addressed the following four scenarios (including the estimates for radioactive waste generation):
   — No nuclear power development;
   — Nuclear power development after 2040;
   — Replacement of the Borssele nuclear power plant after 2033;
   — Construction of a new nuclear power plant after 2020.

   At present, COVRA makes an estimate of the national radioactive waste inventory every five years. The last estimate was carried out in 2008 and will therefore need to be updated in accordance with the four alternative options discussed in the Energy Report of 2008.

(e) According to Dutch legislation, spent fuel from nuclear power plants is not considered radioactive waste; however, the spent fuel from research reactors is considered radioactive waste. At present, spent fuel from the Borssele nuclear power plant is reprocessed in France, and decisions have not been made to continue this practice after 2015 [10]. In practice, all radioactive material delivered to COVRA is considered radioactive waste.

(f) Although depleted uranium is also considered radioactive waste, it is currently treated by COVRA in such way that it could be used as a potential resource material in the future.

RESPONSIBILITIES OF THE REGULATORY BODY

3.12. Requirement 3: “The regulatory body shall establish the requirements for the development of radioactive waste management facilities and activities and shall set out the procedures for meeting the requirements for the various stages of the licensing process. The regulatory body shall review and assess the safety case, and the environmental impacts, of radioactive waste management facilities and activities as prepared by the operator both prior to authorization and periodically during operation. The regulatory body shall provide for issuing, amending, suspending or revoking licenses, subject to any necessary conditions. It shall carry out activities to verify that the operator meets these conditions. Enforcement actions shall be applied as necessary by the regulatory body in the event of deviations from, or non-compliance with, conditions and requirements.” [3]

Summary of the counterpart's response

3.13. The Nuclear Energy Act [11] and the supporting Ordinances establish a regulatory framework according to which the Ministry performs oversight of COVRA activities. In addition, specific requirements related to radioactive waste management activities and/or facilities are included as conditions of licence (e.g. a periodic safety review).

Observations

3.14. The regulatory body in the Netherlands consists of two organizations working closely together within the Ministry: The Directorate of Risk Assessment and the Department of Nuclear Safety, Security and Safeguards (KFD), of both VROM Inspectorate. This is an organization that is independent from the waste producers and is part of the Ministry (see Table 2, adapted from Ref. [10]). It regulates all radioactive waste management activities at COVRA, and the licences are signed by the Minister of Housing, Spatial Planning and the Environment. It also develops the regulatory requirements and performs control over the safety of the radioactive waste management activities and facilities of COVRA. However, as mentioned, requirements for geological disposal have not yet been developed.

3.15. The Ministry's requirement for periodic safety assessment and review is included as a licence condition in the present COVRA licence for operation. At the end of 2009, COVRA was performing the periodic review.

3.16. In performing its regulatory activities, the Ministry also makes use of IAEA review services (e.g. the International Physical Protection Advisory Service (IPPAS) and Waste Safety Appraisal) as well as independent evaluation by other international organizations such as the Gesellschaft für Reaktorsicherheit (Germany) and Bel V (Belgium).

RESPONSIBILITIES OF THE OPERATOR

3.17. Requirement 4: "Operators of radioactive waste predisposal management facilities or activities shall be responsible for their safety. The operator shall carry out safety assessments and develop a safety case, and shall ensure that the necessary activities for siting, design, construction, commissioning, operation, shutdown and decommissioning are carried out in compliance with legal and regulatory requirements." [3]

TABLE 2. RESPONSIBILITIES OF THE REGULATORY BODY

Ministry	Regulatory body	Responsibilities
Ministry of Housing, Spatial Planning and the Environment (VROM)	Directorate of Risk Assessment	Setting policies, developing regulations and issuing licences. Making technical assessments in a limited number of areas. Developing security guidelines.
	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.
	VROM Inspection/Department on Emergency Response (CM)	Preparing and coordinating actions in case of emergencies.

Summary of the counterpart's response

3.18. The principle that the prime responsibility for safety lies with the licensee is laid down in several levels of Dutch legislation. The highest level is the Nuclear Energy Act (Article 37b), which states that the licensee must operate a nuclear facility in a manner that reflects the most recent safety standards.

3.19. According to the Radiation Protection Decree [12] and the Decree on Nuclear Installations, and Fissionable Materials and Ores Decree [13], the operating organization (i.e. COVRA) is also responsible for providing adequate human and financial resources in order to ensure that the facility can be operated safely. The Radiation Protection Decree also states that only an authorized organization is allowed to manage radioactive waste in the country. Accordingly, only COVRA has been authorized.

3.20. All legal, technical and financial responsibilities of COVRA are described in the COVRA Licence to Operate No. EE/E 98030391, where Requirement III, para. 1 stipulates that "commissioning and operation of the facility must be in compliance with the Safety Report".

3.21. The Licence to Operate No. EE/E 98030391 (Requirement II, paras 1, 2.1, 2.2, 3 and 4) also requires all necessary activities for siting, design, construction, commissioning, operation, shutdown and decommissioning to be carried out in compliance with the regulatory requirements and within the national legislation.

Observations and findings

3.22. The response of COVRA to the questions during the review provided clarification on its previous answers (self-assessment). Also, Refs [27, 28] were made available and explained by COVRA.

3.23. The visits of the team to the LILW processing and storage facilities (AVG and LOG) and the HLW facility (HABOG for storage of reprocessing of nuclear power plant spent fuel and also spent fuel from the research reactors) demonstrated a generally good level of housekeeping and overall recognition of the importance of safety.

3.24. The discussions with COVRA personnel also showed that COVRA recognizes the necessity for constant effort to maintain and further develop the safety culture in the organization.

Conclusions

3.25. Based on the results of the self-assessment, the discussions with the counterpart and the on-site visits, it was concluded that there is compliance with this IAEA requirement.

SECURITY

3.26. Requirement 5: “Measures shall be implemented to ensure an appropriate level of security in the predisposal management of radioactive waste”. [3]

Summary of the counterpart’s response

The security measures at the COVRA site are defined in the Security Management Plan, which is part of the Quality Handbook (Chapter 21). An IAEA IPPAS mission [29] was conducted in 2008 to review the physical protection and the security measures on the site, and all information is provided in the IPPAS mission report.

Observations

3.27. On the basis of the self-assessment and the visit to the COVRA site, and also taking into account that an IPPAS mission was carried out in 2008, the team clarified a number of points; compliance with IAEA requirements was not evaluated by the team.

3.28. The 'walk through' in the facilities and the discussion with the COVRA management showed that measures have been implemented to integrate safety and security at the site. As an example, a number of the operating personnel also perform security functions on a rotating basis.

INTERDEPENDENCIES

3.29. Requirement 6: "Interdependences among all steps in predisposal management of radioactive waste, as well as the impact of anticipated disposal, shall be appropriately taken into account" [3].

Summary of the counterpart's response

3.30. COVRA is the sole organization in the Netherlands with responsibility for all steps in the predisposal management of radioactive waste. The basic steps cover: HLW coming from the reprocessing of nuclear power plant spent fuel; spent fuel from research reactors and filters from the molybdenum production facility (categorized as HLW); LILW from operating and decommissioning of the nuclear facilities; LILW from the use of nuclear materials and radiation sources (in industry, medicine, etc.); and NORM waste, for example from industrial phosphate production and depleted uranium. The steps identified and internationally agreed upon as pretreatment, treatment, conditioning, storage and disposal (see Fig. 5) have been applied at the COVRA site.

3.31. Spent fuel from the nuclear power plants is first temporarily stored in the storage pools at the reactor sites with the aim to reduce heat generation. It is then sent for reprocessing to France and the United Kingdom, and returned for storage by COVRA. This arrangement is consistent with the Netherlands' policy decision to store radioactive waste from the spent fuel reprocessing above ground for an interim period of 100 years until a long term solution is put in operation. On this basis, radioactive waste from reprocessing is conditioned, transported and stored in canisters that facilitate their long term storage in the HABOG facility (see Fig. 3). The storage facility is designed and operated in a way that does not

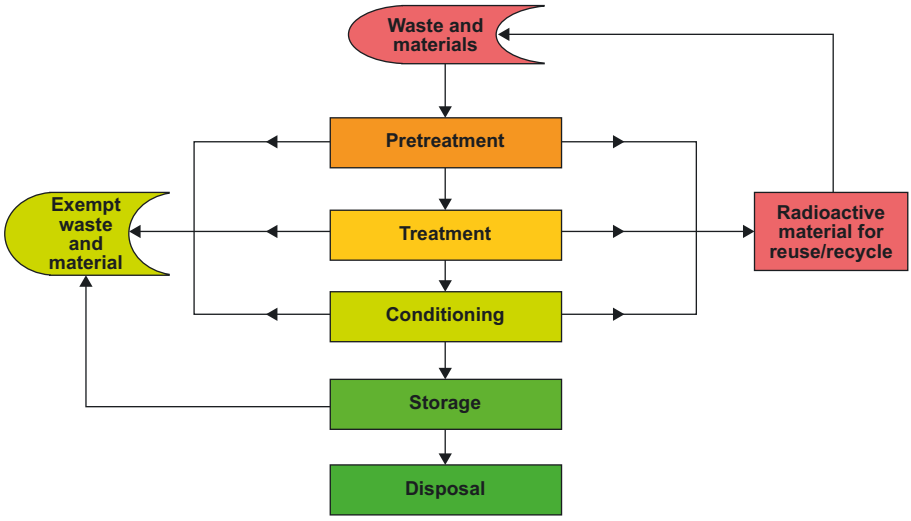

FIG. 5. Basic steps in radioactive waste management [10].

require significant maintenance. It is important to note that the technical specifications for the waste packages with vitrified radioactive waste are defined and approved by the Parliament of the Netherlands.

3.32. The spent fuel from research reactors and the filters from molybdenum production are packed in sealed canisters for long term storage in the HABOG facility. COVRA also visits the reprocessing facilities prior to the shipment of the HLW to the site.

3.33. The NORM waste (including residues from the phosphate industry) and the depleted uranium have stable chemical form and are also packed in containers for long term storage in the VOG and COG facilities.

3.34. LILW is processed (e.g. incineration, compaction) and then conditioned (i.e. cemented) in 200 L and 1000 L drums prior to storage for a 100 year period at the LOG facility (see Fig. 2). Concerning LILW, COVRA conducts periodic meetings with the larger radioactive waste producers in the country to maximize the efficiency of the whole waste management chain, i.e. from radioactive waste generation to storage at COVRA (i.e. LOG facility) and later subsequent geological disposal.

3.35. The general requirements and conditions for receipt of waste by COVRA include technical criteria for the transfer of ‘standard waste’ and criteria for

'non-standard waste', and are specified on a case by case basis. For radioactive waste categories A to D (see Table 1), COVRA requires that the radioactive waste is separated at the producers premises based on the origin, radionuclide content and half-life.

3.36. According to COVRA personnel, so far no decisions have been taken that would foreclose any of the available radioactive waste management options, including geological disposal.

Observations and findings

3.37. The responses from COVRA to the questions asked during the review provided more precision on the information presented as part of the self-assessment.

3.38. The current characteristics of the waste packages for storage of LILW are based on the studies performed in the 1980s and the assumptions for 100 year storage at the COVRA site. These characteristics need to be reviewed in light of the anticipated deep geological disposal (see also Requirement 12, para. 3.105).

3.39. In the longer term, for all other types of radioactive waste that fall within the responsibility of COVRA (e.g. decommissioning waste, end-pieces and hulls from reprocessing of spent nuclear fuel), the impact of the anticipated disposal on the waste (e.g. matrix, packages) also needs to be considered and evaluated.

Conclusions

3.40. Overall, based on the results of the self-assessment, discussions with the counterpart and the on-site visits, it was concluded that there is compliance with this IAEA requirement.

MANAGEMENT SYSTEMS

3.41. Requirement 7: "Management systems shall be applied to all stages and elements of the predisposal management of radioactive waste" [3].

Summary of the counterpart's response

3.42. The development and implementation of a management system is required in terms of the licence for the COVRA site. The management system is described

in the Safety Report that is part of the licence (an attachment) and hence is binding for all radioactive waste management activities that are performed on the site. The management system applies specifically to the design, construction, and safe operation of all radioactive waste management facilities.

3.43. The management system of COVRA is incorporated in the Quality, Occupational Safety and Environment Control (KAM) system: the KAM handbook, the technical specifications, procedures, working instructions and control programmes. These documents provide instructions for the following:

— Acceptance criteria for radioactive waste processing and storage;
— Facility operation, maintenance (preventive or corrective) and modification;
— Controls, tests and inspections;
— Emergency situations;
— Security;
— Design and construction control (in particular for new and modified facilities).

3.44. The management system is based on ‘safety fundamentals’, which correspond to the ALARA (as low as reasonably achievable) management principles of defence in depth, and ‘isolate, control and monitor’. These principles are also presented in the Safety Report of 1995. ALARA is the basic principle for radiation protection during radioactive waste management. Defence in depth and isolate, control and monitor are the basic principles to minimize the possible consequence of an accident. ‘Isolate, control and monitor’ is also the basic principle applied to minimize the probability of occurrence of an accident.

3.45. More specifically, COVRA has implemented a personnel qualification plan which sets out clear details of the responsibilities, authority interfaces, lines of communication, required level of expertise, training and education. The training plan ensures that an adequate number of staff with relevant expertise and appropriate training is always available. The training also covers non-technical staff working at the COVRA site. In addition, an important tool that has been applied is ’management by walking around’ during internal safety inspections.

3.46. All maintenance activities are registered in a dedicated maintenance system according to internal working instructions.

3.47. Relevant deviations during the radioactive waste management activities (e.g. process disturbances, incidents and accidents) are evaluated and discussed at operational deviation meetings (OSO) at COVRA. The purpose of these meetings is to discuss the cause, inform the staff and minimize the possible recurrence of the event. The evaluation results are reported and discussed at monthly meetings of the COVRA department heads.

3.48. Finally, the control process is evaluated during internal and external audits, as well as inspections.

Observations

3.49. There is a well developed management system that covers all radioactive waste management activities at the COVRA site. There is also recognition of the importance of: safety; competent personnel; conduct of self-assessment; and regular communication with the staff and the various stakeholders (e.g. the regulatory body, public and waste producers).

3.50. A well established record system is also in place that takes into account the need for long term preservation (where possible, the information is stored in both electronic and hard copies).

3.51. The operating personnel are involved in the preparation of the working instructions and procedures, and the management staff reviews and approves the documentation. However, the discussions revealed that currently there is no internal document that specifies the procedure (e.g. including scope, content structure) for development and review of the safety assessment and the Safety Report.

3.52. Also, due to the limited number of personnel (52 in total, nine heads of departments), in most cases, each staff member has more than one duty (e.g. safety and security).

3.53. The management system encourages prompt reporting and analysis of any deviations, incidents, or accidents. The dedicated group mentioned above, OSO, is established to discuss such events, to decide on the corrective actions, to draw the lessons learned, and to provide feedback on the operation of COVRA's facilities. This work aims at improvement of the overall safety at the site.

3.54. The management system has measures in place to allocate responsibilities for safety, e.g. for the maintenance of the facilities. A COVRA coordinator must

supervise the work (e.g. of contractors) and ensure compliance with safety requirements and internal procedures.

3.55. COVRA also implements an active communication programme with the public around the site and in the country. For example, in 2009 about 3000 people visited the site and several exhibitions were organized. The last one was opened at the end of the mission (see Fig. 6). The site is also cooperating with cultural heritage institutions in the Netherlands and offering authorized storage of historical artefacts at the LILW storage facility (LOG, see Fig. 7) due to the controlled storage environment. The design of the HABOG facility (see the cover of this report) has also been selected to communicate to the public the purpose of the building and the radioactive decay of the stored spent fuel and waste (i.e. it is intended that the HABOG facility will be repainted regularly in a lighter colour of orange).

Findings

3.56. On the basis of the review, the team identified the following:

— **Good practices.** The measures implemented by COVRA (presenting its activities through art, open days, etc.) to facilitate the communication of radioactive waste management activities to the public has led to increasing transparency and confidence building of the public. It has also contributed positively to the team building within COVRA.

FIG. 6. Archaeological artefacts stored at the LILW storage facility.

FIG. 7. Announcement of the photo exhibition at COVRA's premises.

— **Suggestion.** The management system at COVRA should include measures for control of the development, review and update of the safety assessment and safety case.
— **Suggestion.** Taking into account that each staff member has more than one duty, the management system should also include measures for independent internal review of all activities within the scope of COVRA.

Conclusions

3.57. Based on the results of the self-assessment, discussions with the counterpart and the on-site visits, it was concluded that there is compliance with this IAEA requirement, taking into accout the above mentioned good practice and suggestions.

RADIOACTIVE WASTE GENERATION AND CONTROL

3.58. Requirement 8: "All radioactive waste shall be identified and controlled. Radioactive waste raisings shall be kept to the minimum practicable." [3]

Summary of the counterpart's response

3.59. Measures for control and minimization of radioactive waste generation at the site, as well as the minimization of waste during the design, construction and operation of waste generating facilities are the responsibility of COVRA.

Observations

3.60. In the 1990s, COVRA carried out a comprehensive inventory of all radioactive waste in the country by contacting all national radioactive waste producers. Currently, this inventory is updated as a result of meetings with the main radioactive waste producers that generate about 85% of the volume in the country. The estimation of radioactive waste generation in the Netherlands is updated by COVRA every five years in order to assess and/or update the necessary financial resources for future geological disposal.

3.61. At present, all radioactive waste delivered to COVRA is intended for geological disposal and the cost per volume includes the geological disposal costs. The financial provisions for waste management at the COVRA site are based on the volume of the waste package after conditioning. This approach is applied as an incentive for the waste producers to reduce as much as possible the volume of the generated radioactive waste. In addition, COVRA is encouraging the radioactive waste producers to minimize their waste through technical advice, visits to the sites of waste producers, and meetings with large waste producers, where specific issues related to minimization are discussed.

3.62. Implementation of control measures for authorized discharges (gaseous and liquid) from the COVRA facilities were explained and illustrated during the site visit.

3.63. The general approach to the release of radioactive material from regulatory control (clearance) developed by COVRA is implemented on a case by case basis. An inventory of cleared material is prepared by COVRA annually and is presented to the Ministry (see, for instance, Ref. [30]). For example, the total operational, non-radioactive waste released from the site was 42.7 tonnes in 2008. There is one general procedure for clearance of paper, wood, rubble, scrap and other materials. The philosophy of off-site recycling or reuse of material has also been presented by COVRA.

Findings

3.64. The discussions with COVRA, based on the documents presented (e.g. declarations for waste packages) and the on-site visit illustrated that the radioactive waste received by and generated by COVRA are identified and controlled. Measures are in place to minimize radioactive waste arisings from external waste producers mainly through financial incentives and through segregation (i.e. red and blue bags) of radioactive waste generated at the site. There is also a system for tracking and recording of waste packages on the site.

Conclusions

3.65. Based on the results of the self-assessment, discussions with the counterpart and the on-site visits, it was concluded that there is compliance with this IAEA requirement.

RADIOACTIVE WASTE CHARACTERIZATION AND CLASSIFICATION

3.66. Requirement 9: "At various stages in the process of predisposal management of radioactive waste, the radioactive waste shall be characterized and classified in accordance with requirements established or approved by the regulatory body." [3]

Summary of the counterpart's response

3.67. As there is no national classification system for radioactive waste, COVRA has developed and applied a classification system for all waste management activities and facilities on the site. The approach to radioactive waste characterization is described in the Technical Specifications and the management system for the site.

Observations

Characterization of the radioactive waste

3.68. Characterization of 'standard', solid LILW is mainly carried out on the basis of the waste producer's declarations, which contain information about the origin, the type of radionuclides, the radioactivity, etc. COVRA reviews these forms and conducts visual inspections and measurements (e.g. mass and dose rate) of the radioactive waste to be received on the site. The information about the radioactive content of the waste drums produced for storage is followed up along

the radioactive waste processing steps by keeping track (in a traceable manner) of the different waste packages, which enter the composition of the final drum. Nevertheless, no further characterization of the radiological content (except from dose rate and mass measurements) is carried out on the final drum before storage in the LOG facility. Characterization and treatment of 'non-standard', solid LILW is performed on a case by case basis with the aim to produce waste packages that meet the conditioned waste specifications for the LOG storage facility.

3.69. For spent sealed sources and calibration sources, the information from the certificates and the declarations of the radioactive waste producers are the basis for the characterization of this waste upon receipt at the COVRA site. For other types of standard radioactive waste such as carcasses and scintillation vials. COVRA is applying the same approach of waste packages characterization, based on the declaration of the producers.

3.70. For HLW, COVRA is checking the relevant documentation on-site and also at La Hague (France) and Sellafield (the United Kingdom). The main focus of these visits is on whether the produced waste packages are in compliance with the specifications for transportation and subsequent storage at the HABOG facility. COVRA and the nuclear power plant operator also perform a 100% 'witness' function of the canisters. Upon arrival at the COVRA site, a second check is performed. Also, the services of a third party (i.e. Veritas and Lloyd Reg.) are used to carry out regular audits of the process on behalf of COVRA.

3.71. The spent fuel from research reactors is encapsulated in storage canisters in HABOG. The HEU waste from molybdenum production, depleted uranium and NORM waste are not processed at the COVRA site. The information provided about the waste characteristics in the producers' declarations are the basis of the characterization of this waste at the COVRA site. Also, COVRA carries out periodic audits at the producer/waste processor or analyses to verify waste characteristics.

3.72. Upon receipt of liquid radioactive waste by COVRA, samples are taken for analysis of the chemical and radiological characteristics of the waste prior to treatment and conditioning at the site. The results of these analyses complement the declarations provided by the radioactive waste producers.

3.73. Due to the limited amount of solid burnable radioactive waste produced annually in the Netherlands, COVRA has chosen the option to compact potentially burnable wastes. Incineration of specific types of radioactive waste (i.e. carcasses, organic liquids) is, however, conducted in a dedicated incineration

facility. After incineration, the ashes are not characterized from a radiological point of view prior to cementation in 200 L drums.

Classification of the radioactive waste

3.74. COVRA classifies the radioactive waste received at the site according to the following categories: LILW, HLW, spent fuel from research reactors, NORM and depleted uranium. For the LILW, four subcategories (A, B, C and D, as presented in Table 1) are considered. Nevertheless, for alpha bearing waste and radioactive waste from the nuclear power plants, no distinction is made between short and long lived LILW as recommended by the IAEA.

3.75. Effective volume reduction by the compaction of clothes, plastic and other LILW is realized by optimizing the distribution of radioactive waste belonging to the same waste class (i.e. A to D) between the drums.

3.76. In order to investigate the possibility for clearance of a part of the inventory of LILW drums in the future, COVRA carried out destructive tests in order to characterize 20 waste drums (200 L) stored in the LOG building and investigated possible disposal routes for the resulting cleared waste. The results of these tests (i.e. waste was cleared and disposed of in a conventional waste incinerator) were considered by COVRA as conclusive because they demonstrated that the clearance of certain LILW is possible.

Findings

3.77. The discussions with COVRA and the visit to the site showed that the classification system has been mainly developed on the assumption that all radioactive waste (including LILW) will be disposed of in a deep geological disposal facility. As no distinction is made between short and long lived LILW (categories A and B, see Table 1), this classification strategy could preclude further long term options abroad (e.g. regional (shared) near surface disposal facility). It does also not facilitate the minimization of radioactive waste inventory, e.g. through clearance of material (e.g. nuclear power plant waste that contains mainly ^{60}Co).

3.78. The current characterization of standard solid LILW relies mainly on the declarations of waste producers and the reliance on comparison of the inventories (bookkeeping) of the waste producers by the competent authority — the Ministry. However, this approach cannot provide sufficient confidence in the knowledge of radioactive waste characteristics and the estimation of the inventory (activities of

short and long lived radionuclides) in the radioactive waste packages for disposal in a facility other than a geological disposal facility.

3.79. Classification of the radioactive waste according to the chemical properties is derived on the basis of the European classification system for chemical waste (EURAL). The possible, but currently unforeseen release (i.e. current policy is geological disposal) of some radioactive waste packages or shallow land disposal after the storage period could require further investigations.

3.80. Although it appeared that through the years COVRA and the radioactive waste producers have built mutual confidence in the waste predisposal management, it is important that COVRA also implement measures for verification of the characteristics of the solid radioactive waste received on the site (e.g. consideration of sampling and radiological analysis).

3.81. It is suggested to implement measures in the radioactive waste characterization practice.

Suggestion. Adapt the classification system to allow the separation of short and long lived waste that would facilitate further radioactive waste minimization through storage for decay. (This could apply to future radioactive waste that will come from decommissioning of nuclear power plants, research reactors, etc.)

Suggestion. Consider improving independent verification of the waste inventory to provide sufficient confidence in the radiological characteristics of LILW packages before waste acceptance for storage in the LOG facility.

Conclusion

3.82. Based on the results of the self-assessment, discussions with the counterpart and the on-site visits, it was concluded that there is compliance with this IAEA requirement, taking into consideration the suggestions presented above.

RADIOACTIVE WASTE PROCESSING

3.83. Requirement 10: “Radioactive materials for which no further use is foreseen and with characteristics that make them unsuitable for authorized discharge, authorized use, or clearance from regulatory control shall be processed as radioactive waste. The processing of radioactive waste shall be based upon appropriate consideration of the characteristics of the waste and of the demands

imposed by the different steps in radioactive waste management (pre-treatment, treatment, conditioning, transport, storage and disposal). Waste packages shall be designed and produced such that the radioactive materials are appropriately contained during both normal operation and potential accident conditions assumed to occur in handling, storage, transport and disposal." [3]

Summary of the counterpart's response

3.84. Processing arrangements are described in the Technical Specifications (A3) of the KAM system (quality, occupational safety and environmental control) for the COVRA site. In the Safety Report of 1995 [31], these processing arrangements are explained together with the ongoing storage and planned future geological disposal.

Observations

3.85. COVRA is implementing a system for processing of all types of radioactive waste that are currently delivered to the site, i.e. liquid waste (organic and inorganic) and solid waste LILW from the nuclear power plants, medicine, industry, research, URENCO, etc. For 'standard' waste, specific procedures have been developed and are applied by COVRA. For 'non-standard' waste, e.g. legacy waste from Petten, the procedures and methods are developed on a case by case basis. The processing activities (e.g. compaction, cementation) are performed in the AVG treatment facility (see Fig. 1). The conditioned radioactive waste is stored for 100 years at the LOG facility in accordance with the current Safety Report of 1995 (an attachment to the license for operation) [32].

3.86. Potential incidents and accidents have been taken into account and evaluated by COVRA and the results are presented in the Safety Report [32]. The report covers all activities (including different steps of radioactive waste processing) and facilities at the COVRA site. The outcomes of the Safety Report have been incorporated in the current operational procedures.

3.87. Incidents that occurred during facilities operation have been analysed (e.g. OSO), and COVRA also uses experience feedback from other operators in the Netherlands and abroad.

3.88. Appropriate measures are taken for the handling of radioactive waste on the site.

Findings

3.89. On the basis of the visit to the AVG processing facility and discussions with the COVRA staff, it has been concluded that the processing of radioactive waste at COVRA is based on appropriate consideration of the characteristics of the waste and of the demands imposed by the different steps in radioactive waste management (pre-treatment, treatment, conditioning, handling and storage).

Conclusions

3.90. The conclusion of the team is that there is compliance with this IAEA requirement.

RADIOACTIVE WASTE STORAGE

3.91. Requirement 11: "Waste shall be stored in such a manner that it can be inspected, monitored, retrieved, and preserved in a condition suitable for subsequent management. Due account shall be taken of the expected period of storage, and to the extent possible passive safety features shall be applied. In particular for long term storage measures shall be taken that prevent the degradation of waste containment." [3]

Summary of the counterpart's response

3.92. Dedicated storage buildings have been designated for storage of different types of radioactive waste managed by COVRA:

— LOG building for conditioned LILW;
— VOG building for depleted uranium oxide;
— COG building for containers with calcinate (filtered dust from the phosphate industry);
— HABOG building for spent fuel and HLW.

3.93. As mentioned earlier, all radioactive wastes are intended to be stored for a 100 year period prior to geological disposal. Periodic inspections of stored conditioned radioactive waste are conducted in accordance with the internal instruction No. D03 that is part of the KAM system. For example, the LILW drums (see Fig. 8) are inspected every five to ten years. The maintenance and repair of waste packages, as well as retrieval of waste for processing, repackaging or disposal are also defined in COVRA's procedures.

3.94. The design basis of the storage facilities is the evaluation of the normal conditions and incidents presented in the Safety Report of 1995 (Chapters 10 and 11 in Ref. [31]). The construction activities are based on the Technical Requisition File. The buildings and installations of the radioactive waste storage facility of COVRA are designed to withstand external events (e.g. flooding for HABOG facility) and to retain their integrity (or at least mitigate the consequences) should an unplanned event occur.

Observations

3.95. COVRA is applying a graded approach to the storage of the various types of radioactive waste at its site – e.g. design and operation of the facilities for HLW (HABOG), LILW (LOG), depleted uranium in (VOG) and NORM waste (COG).

3.96. The design of the storage facilities is based on the use of passive safety measures that would require minimum maintenance in the future.

3.97. Appropriate measures to prevent the occurrence of criticality accident at the COVRA site are also implemented (e.g. in the management of liquid radioactive waste from molybdenum production and HLW).

3.98. Detailed questions have been clarified during the visit of the IAEA team to the storage facilities of COVRA (LOG and HABOG).

Findings

3.99. Radioactive waste is stored in the COVRA facilities in such a manner that it can be inspected, monitored, retrieved and preserved in a suitable condition for subsequent management. For example, the LILW drums (Fig. 8) are stored in the LOG facility horizontally and without lids, so the potential presence of liquids and/or change of matrix can be more easily detected and in a timely manner by COVRA and the necessary measures applied. Due account is also taken of the expected period of storage, and to the extent possible, passive safety features have been applied at the HABOG and LOG facilities. In particular, for long term storage, measures have been taken that minimize the degradation of waste containment through the installation and use of dehumidifiers.

3.100. **Good practice.** The measures applied in the design and operation of the LOG and HABOG storage facilities provide passive features that minimize the reliance on maintenance, facilitate the periodic control of waste package integrity and also facilitate the subsequent waste management steps (e.g. disposal).

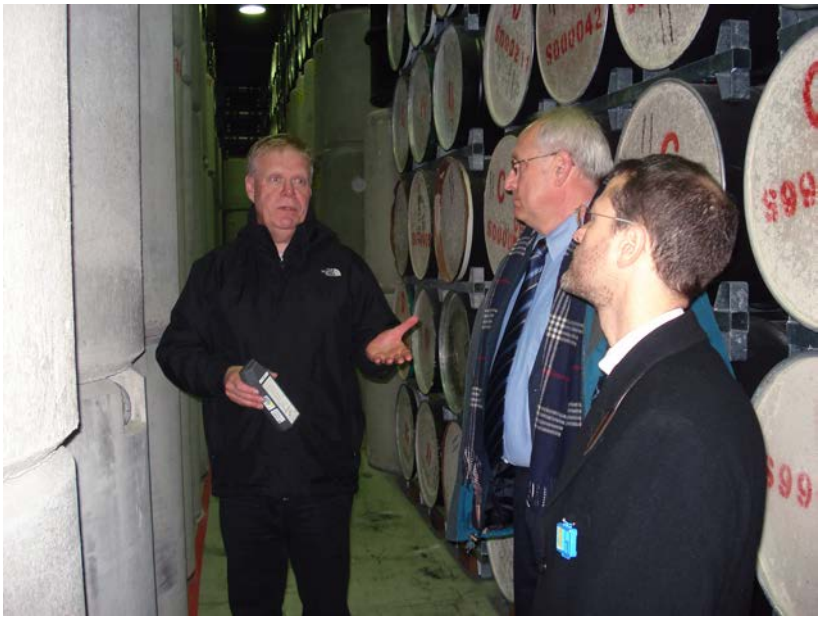

FIG. 8. Control of LILW 200 L drums in the LOG facility.

Conclusions

3.101. Based on the results of the self-assessment, discussions with the counterpart and the on-site visits to LOG and HABOG, it was concluded that there is compliance with this IAEA requirement, and a good practice has been identified as presented above.

RADIOACTIVE WASTE ACCEPTANCE CRITERIA

3.102. Requirement 12: "Waste packages and unpackaged waste accepted for processing, storage and/or disposal shall conform to criteria that are consistent with the safety case" [3].

Summary of the counterpart's response

3.103. The primary responsibility lies with the waste producer to make sure that radioactive waste meets the waste acceptance criteria defined by COVRA. The general conditions for waste acceptance by COVRA are presented to the waste producers each year and include technical conditions for the transfer of 'standard'

waste to COVRA. These conditions specify how the waste of categories A to D is to be delivered to COVRA (separated at the source of origin, type of radionuclides and half-life).

Observations

3.104. As discussed earlier, there are three main radioactive waste categories, namely LILW, HLW (non-heat-producing) and HLW (heat producing). Waste acceptance criteria (WAC) are defined for each of them:

— For LILW, the WAC for storage (with intended subsequent disposal) are based on mass, dose rates, and half-life (only C and D classes of waste);
— For HLW, from the spent fuel processing, the WAC is based on the technical specifications that were approved by the Parliament of the Netherlands.

Findings

3.105. Measures to verify/control the radiological characteristics of the waste packages intended for storage can be considered sufficient if all waste is going to be disposed in geological disposal. These measures are based on the confidence built between COVRA and the radioactive waste producers. For example, after incineration of carcasses and organic liquid waste the resulting ashes are cemented without measurements of the radioactivity by COVRA. Such measurements could be regularly performed because they can provide additional information and confidence in the radiological characteristics of the waste package for storage at COVRA and the subsequent waste management (e.g. disposal).

3.106. The current practice may preclude future radioactive waste management options if the national policy changes in the future. Also, some of the radioactive waste of D category could be cleared in the future after demonstration of compliance with the clearance values. In addition and in accordance with national policy, other radioactive waste types could be processed/disposed of in other countries where detailed information on the waste characteristics will be required, e.g. a shared disposal facility [18].

3.107. Suggestion: It is suggested to review the current control measures for compliance with the waste acceptance criteria for LILW during the waste processing steps.

Conclusions

3.108. Based on the results of the self-assessment, discussions with the counterpart and the on-site visits to LOG and HABOG facilities, it was concluded that there is compliance with this IAEA requirement, taking into consideration the suggestion presented above.

PREPARATION OF THE SAFETY CASE

3.109. Requirement 13: "The operator shall prepare a safety case and supporting safety assessment. In the case of a step-by-step development or in the case of modification of the facility or activity, the safety case and its supporting safety assessment shall be reviewed and updated as necessary." [3]

Summary of the counterpart's response

3.110. In accordance with the Environmental Act [33], the Safety Report is developed as part of the Environmental Impact Assessment (EIA) for the COVRA site. The first EIA was developed in 1985 and included a Safety Report that was not specific to the site. It was followed by site specific Safety Reports in 1987 and 1989, which were developed for the application for an operational licence by COVRA. The Safety Report of 1995 [31] is the present safety document that is applied to all activities and facilities at the COVRA site.

3.111. At present, COVRA performs radioactive waste management activities in accordance with the licence issued by the Ministry in 1998. The Safety Report is an appendix to the licence and was last reviewed in 2005. At present, COVRA is performing the first ten year periodic review that includes review of the Safety Report.

3.112. During the mission, the guidelines for a probabilistic safety assessment (PSA) [32], the technical requisition file for the depleted uranium storage building [34] and the Safety Report of 1995 [31] were presented and discussed.

Observations

3.113. The information presented during the mission and the follow-up discussions provided the basis for the following observations:

(a) As mentioned in Requirement 1 (see paras 3.05–3.08), the Safety Report corresponds to the safety case for predisposal waste management. The Safety Report is developed for the whole site and safety assessments are developed for the individual facilities. Whenever the Safety Report needs to be updated, it is necessary for COVRA to apply for an amendment to the licence, which can be a long legal process. The current licence is for operation of all facilities at the site. A new licence will be needed for the extension of existing HLW treatment and storage building (HABOG) and also for the future decommissioning of the facilities at the end of their lifetime.

(b) At present, Refs [35, 36] define the general purpose and scope of a Safety Report. There are two additional legal documents currently in place in the Netherlands, i.e. the Guidance for PSA for nuclear power plants [37] and the Ordinance for Dose Calculations for Small Users of Radioactive Material (DOVIS) [38]. However, to date there are no specific requirements for the scope and content of a safety assessment for predisposal waste management facilities.

Since there are no specific legal requirements for safety assessment for predisposal waste management in the Netherlands, the following approach is currently followed by COVRA:

— The guidance for a PSA for nuclear power plants (PSA level 3) is applied [36] for calculations through the use of the graded approach.
— The terms of reference and specifications for the Safety Report (including the safety assessment) are developed on the basis on consultation by COVRA with the regulatory body (the Ministry), the public and other stakeholders (through a specially designated committee). On that basis, COVRA develops the safety case that is required as part of the licence application submission (Table 14 of Ref. [10]). This licensing process (including the various consultations) is very long and applies to all nuclear and non-nuclear facilities.

(c) The Safety Report is based on three main layers of documentation: (a) a Safety Report (general document that summarizes the main approaches and conclusions); (b) eight volumes of supporting documentation that describe the facility, scenarios, etc., which are submitted to the regulatory body (the Ministry) in support of the license application, and (c) detailed technical reports (some of which are developed by contractors, e.g. modelling and calculation of accidental exposure). The latter is not part of the Safety Report.

(d) The periodic review of a Safety Report is performed every five and ten years in accordance with the licence conditions. The five year review is aimed at the review of the Safety Report in accordance with current knowledge and practice, and the ten year review is aimed at the review of

the underlying assumptions used in the Safety Report. The basis for the ten year safety is a proposal from COVRA that has been discussed and agreed with the regulatory body (the Ministry) (see also Requirement 16, paras 3.130–3.137).

Finding

3.114. Suggestion: It is advisable to develop a procedure that provides guidance on the methodology and approaches to be applied in the development and review of the safety assessment and safety case for predisposal waste management in order to:

— Facilitate the future consistent and transparent development (by COVRA and/or external experts) and reviews of safety assessments (internal and external) and Safety Reports; and
— Ensure transfer of knowledge on the facility, assumptions made, and consequences evaluated.

Conclusions

3.115. With respect to this requirement, COVRA is in compliance. The current practice can be improved with the suggestion presented above.

SCOPE OF THE SAFETY CASE AND SAFETY ASSESSMENTS

3.116. Requirement 14: "The safety case for a radioactive waste predisposal management facility shall describe how all the safety aspects of the site, the facility design and the managerial controls satisfy the regulatory criteria. The safety case and its supporting safety assessment shall demonstrate the level of protection provided and shall provide assurance to the regulatory body that safety requirements will be met." [3]

Summary of the counterpart's response

3.117. The Safety Report of 1995 is intended to be reviewed soon by COVRA soon with respect to the assumptions, consideration of new modelling codes, etc. The safety assessments for the LILW (AVG facility) and the storage facility for depleted uranium (VOG facility) will be an input to the Safety Report that will be further developed to include the planned extension of the HABOG facility. The

updated Safety Report for the whole site will then be submitted to the regulatory body (the Ministry) for application of a licence for the extension of the HABOG.

Observations and findings

3.118. The discussions during the missions led to the following observations and findings:

(a) The methodology used in the Safety Report of 1995 is intended to be applied by COVRA in the forthcoming review and revision of the Safety Report (e.g. 2010). However, the current Safety Report of 1995 does not discuss uncertainties explicitly, engineering analysis, modelling assumptions, or independent review. At present, this information is distributed in a number of documents, which does not facilitate the traceability of information, assumptions and modelling data.
(b) Defence in depth and ALARA principles are applied in the radioactive waste management practice but they are not emphasized in the safety assessment and safety case. Acceptable annual risk is considered to be less than 10^{-6}/a (that corresponds to 40 μSv/a at the fence of the COVRA site) with the intention to reduce the risk by applying ALARA principles (i.e. reaching 10^{-8}/a).
(c) Good engineering practice is applied in practice through: (a) the conduct of working meetings and interaction between COVRA and specialists (engineers, architects, etc.); (b) the specialists' involvement in the HAZOP (hazard and operability) process, and (c) the steps of the facility development (e.g. design and construction). The Technical Requisition File of a project (i.e. terms of reference) addresses the main provisions and requirements for good engineering and is also submitted to the regulatory body (the Ministry). However, there needs to be a clear interface between the Technical Requisition File and the safety assessment/safety case.
(d) The graded approach is applied in practice, e.g. in the safety assessment, design and operation of the LILW storage and processing facility (AVG) and the HLW storage facility (HABOG). It has also been demonstrated in the safety assessment through the selection of scenarios according to the existing radiological hazards (e.g. earthquake and plane crash for the HABOG facility but not for the LILW storage facility).

Conclusions

3.119. With respect to this IAEA requirement, COVRA is in compliance (see also paras 3.123–3.129).

DOCUMENTATION OF THE SAFETY CASE AND SAFETY ASSESSMENTS

3.120. Requirement 15: "The safety case and its supporting safety assessment shall be documented at a level of detail and quality sufficient to demonstrate safety and support the decision at each step and to allow for their independent review and approval. The documentation shall be clearly written and shall include arguments justifying the approaches used in the safety case based on information that is traceable." [3]

Summary of the counterpart's response

3.121. As discussed earlier, the Safety Report is developed for all facilities and activities of COVRA, and the maximum inventory estimated to be processed and stored on the site. At present, there are no specific legal and regulatory requirements on the documentation of the Safety Report and Safety Assessment; therefore, the regulatory expectations are based on the Nuclear Energy Act [11] and the Environmental Law [30].

3.122. The Safety Report [31] is currently documented as follows:

— Description of the 'old' licence (Chapter 1);
— Description of facility (Chapter 2);
— Geographical, geological, seismological, hydrological and meteorological description of the site (Chapter 3);
— Nuclear safety philosophy (Chapter 4);
— Design of facility (Chapters 5–7);
— Structure of the organization (Chapter 8);
— Radiation protection (Chapter 9);
— Discharges during operations (Chapter 10);
— Incident and accident analysis (Chapter 11);
— Non-radiological aspects (Chapter 12);
— Decommissioning (Chapter 13);
— Quality assurance (Chapter 14).

3.123. The Safety Report has to be approved by the Dutch authorities, and hard copies of all underlying reports (Technical Information Package) are stored by COVRA in a dedicated archive.

Observations

3.124. The documentation for the Safety Report developed in 1995 and the recent update (2007) of the calculations of the radiological consequences to the public using a new code have resulted in a number of documents that do not facilitate the traceability of assumptions made, the selection of models and the treatment of uncertainties.

Findings

3.125. Suggestion. As COVRA is performing the periodic review of its activities, including the development of safety assessment in 2009, it is an appropriate time to update the safety assessment methodology used and the related documentation. It is advised that the international safety standards [23, 24] be considered because they can serve as a good point of reference.

Conclusions

3.126. Based on the results of the self-assessment, discussions with the counterpart and the documentation presented during the mission, it was concluded that there is compliance with this IAEA requirement, taking into consideration the suggestion presented above.

PERIODIC SAFETY REVIEWS

3.127. Requirement 16: "The operator shall carry out periodic safety reviews and any safety upgrades required by the regulatory body following this review. The results of the periodic safety review shall be reflected in the updated version of the safety case for the facility" [3].

Summary of the counterpart's response

3.128. According to the Licence to Operate, COVRA has to evaluate periodically the Technical, Organizational, Personnel and Administrative (TOPA) infrastructure with respect to safety and radiation protection. Every five years, the TOPA infrastructure has to be compared with the assumptions of the Licence to Operate and every ten years with the present state of the art developments in radioactive waste requirements and management (e.g. IAEA safety standards and supporting documents).

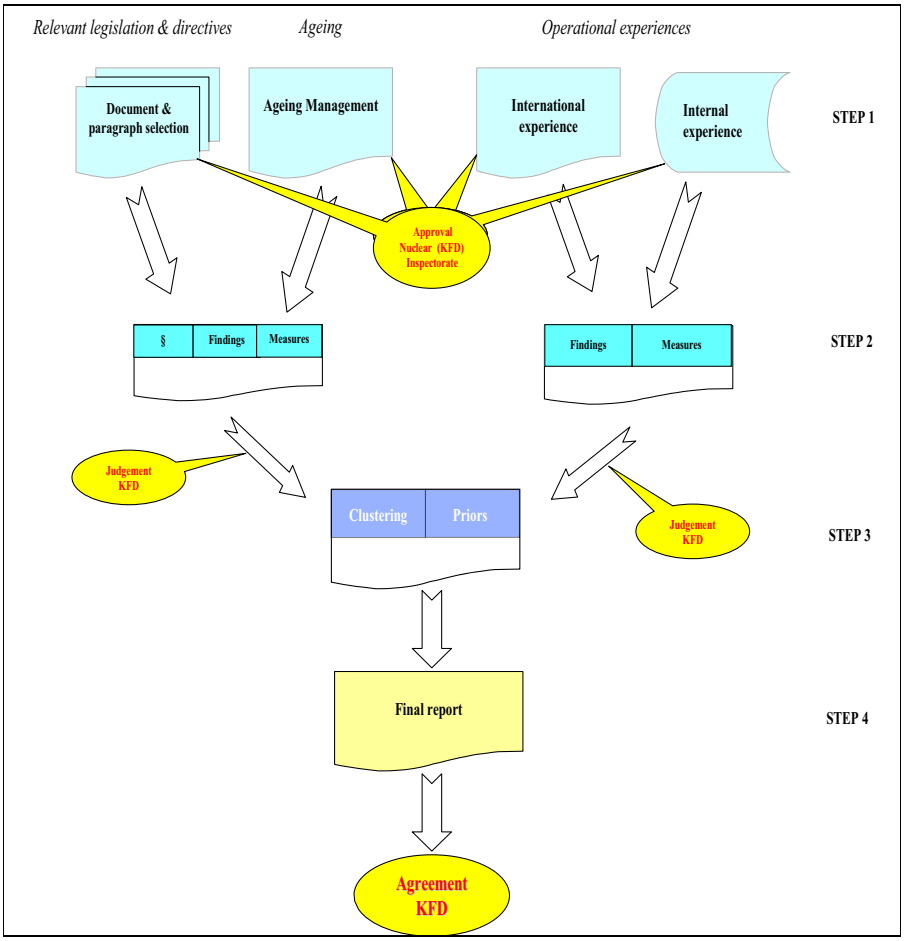

FIG. 9. Involvement of stakeholders in the periodic review.

3.129. The results of the evaluations (e.g. deviations, non-conformances) are transferred into actions that must be executed within a reasonable time (agreed with the national authorities).

Observations and findings

3.130. The periodic safety review is performed by COVRA following a procedure that involves the regulatory body (see Fig. 9). For example, the programme for periodic review is submitted to the Ministry for approval prior implementation. COVRA then informs the Ministry about the outcomes and the proposed corrective actions. These actions and the timeframe for their

implementation are agreed between COVRA and the Ministry, and COVRA reports to the Ministry on the status of implementation of each measure.

3.131. COVRA also applies a transparent approach with respect to its interaction with the regulatory body (the Ministry) and makes use of lessons learned from audits and international reviews performed at the site. For example, in five years, COVRA will need to complete the actions that will be defined and agreed with the Ministry as a result of the first ten year review to be completed at the end of 2009.

3.132. Recently, COVRA has developed and is implementing an ageing management plan, which has resulted in an evaluation of the existing buildings on the site and a number of improvement measures currently being implemented.

3.133. Knowledge transfer is achieved mainly through incorporation of lessons learned from the radioactive waste management activities in the COVRA procedures and through on the job training of personnel (e.g. new staff members are required to undergo one year of on the job training with a senior staff/operator).

Conclusions

3.134. Based on the results of the self-assessment, discussions with the counterpart and the documentation presented during the mission, it was concluded that there is compliance with this IAEA requirement.

FACILITY SITING AND DESIGN

3.135. Requirement 17: "Radioactive waste management facilities shall be located and designed so as to ensure safety for the expected operating lifetime under both normal and possible accident conditions, and for their decommissioning" [3].

Summary of the counterpart's response

3.136. For the selection of potentially suitable locations for COVRA's facilities, a commission of high ranking officials from the domain of public administration was established. The first step in the procedure was the site selection criteria. The selection criteria were mainly based on considerations of adequate infrastructure, direct availability, size, location in an industrial area not adjacent to residential area and access to water. As a result, 12 sites were considered by the commission

as suitable. None of the investigated sites had features that were prohibitive for the planned development of the COVRA radioactive waste management facilities.

3.137. For the selection of the preferred site, the cooperation of the local authorities was sought. In order to facilitate the negotiations with the local authorities, a site independent EIA was performed. As expected, this essentially demonstrated the absence of any adverse effect on the environment.

3.138. Although there are, in principle, legal procedures for overruling a refusal of a local or regional authority to accept a potentially suitable radioactive waste management site, as a rule, the consensus model was followed for the selection of the COVRA site. In practice, this limited the number of available sites to just two, since most municipalities considered the presence of radioactive waste management facilities as undesirable. Consequently, the preferred site was selected on the basis of willingness of local authorities to host the COVRA facilities. Only two municipalities were willing to accommodate facilities for management 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 Borssele Nuclear Power Plant), where its facilities for processing and storage of radioactive waste and spent fuel have been built and are being operated.

Observations and findings

3.139. The selection of a site for the radioactive waste management facilities was implemented during the 1980s and the final site was selected in 1986. As mentioned, a list of site selection criteria was established that included the location in an industrial area (radioactive waste management being considered a normal industrial operation in the Netherlands), location not directly adjacent to a residential area, presence of surface water for discharge and cooling, and good access infrastructure.

3.140. Any criteria concerning external hazards were not originally taken into account in the site selection process. However, the Safety Report [32] has evaluated the potential consequences of all relevant external events (e.g. flooding, fire, extreme wind) and human induced events (e.g. plane crash). The COVRA facilities were designed in accordance with the outcome of the safety assessment and the Safety Report.

3.141. The quality of the design of the existing facilities and their compliance with relevant standards were achieved through the use of independent, certified companies. At present, it is expected that a new EUROCODE No. EC1 [39] will be put in force that could have an impact on the planned extension of the existing buildings on the site. COVRA is following ongoing developments that are of significance to safety.

Conclusions

3.142. The IAEA team concluded that there is compliance with this IAEA requirement.

FACILITY CONSTRUCTION AND COMMISSIONING

3.143. Requirement 18: "The radioactive waste management facility shall be constructed according to the design described in the safety case and approved by the regulatory body. Commissioning of the facility shall be carried out to verify that the equipment, systems, structures and the plant as a whole perform as planned." [3]

Summary of the counterpart's response

3.144. For each radioactive waste management facility, the general starting point for construction is the development of a technical requisition file by COVRA (supported by a dedicated committee) and its approval by the regulatory body (the Ministry). The programme is based on the licence application for operation. For example, the Technical Requisition File for the planned extension of the storage building for LILW stated that for construction of this facility, the licence to operate, the construction licence and Dutch construction norms apply in hierarchical order. For the extension of the storage of HLW and spent fuel in the HABOG facility, the licence to operate is an integral part of the technical requisition file for that facility.

3.145. The beyond design basis accidents (e.g. storm, flooding, gas cloud explosion, airplane crash and earthquake (category 4)) for AVG, LOG, COG and VOG facilities have been evaluated and presented in Chapter 11 of the Safety Report. For the HABOG facility, all of these possible events are part of the design basis. For the HABOG facility, accidents with a lower frequency of occurrence, such as a crash of an aircraft with a higher speed and greater mass than the one used in the design basis accident were also considered. However, COVRA concluded that the risk is so low that modification of the design was not justified.

3.146. The defence in depth principle to minimize the possible consequence of an accident is also applied through the following measures:

— Prevention of incidents by the quality of design;
— Quality assurance for construction and operations;
— Control of safety culture.

3.147. The defence in depth principle is detailed for different facilities in the Safety Report. In general, incidents are prevented as much as possible by timely detection of abnormal situations with proper response and active and passive safety precautions. In addition, there are a number of measures in place to reduce consequences to staff, co-workers of neighbouring industry, the local population and the environment should incident and accidents occur.

3.148. The Safety Report of 1995 defines the policy of COVRA regarding the quality of construction and commissioning that is based on the Dutch nuclear safety rules NVR 1.3 [40]. The latter is a translation of IAEA Safety Series No. 50-C-QA. Chapter 2 of the Safety Report deals more specifically with quality control programmes of construction and commissioning of a nuclear facility.

3.149. According to the technical requisition file and the quality plan of COVRA, a quality handbook from the constructor (as per ISO 9000 [41]) is required, which needs to include an independent test (plan).

3.150. An architect is also involved by COVRA for independent control over the construction activities at the site and details are presented in Chapter 8 of the Technical Requisition File for LOG, COG and VOG facilities. The operator (COVRA) carries out verifications (e.g. pre-inspection meetings and control in accordance with part VI of the Technical Requisition File for the HABOG facility) using third party expertise.

3.151. Radioactive waste treatment facilities are taken into operations only after completion of successful pre-operation tests carried out by the operator (COVRA). According to the licence to operate (General Requirement V), the results of the test are also sent to the competent authorities.

Observations and findings

3.152. As mentioned earlier, the construction of a radioactive waste management facility starts with the development of a technical requisition file (term of reference), which is approved by the regulatory body (the Ministry). This

FIG. 10. Fitting of a storage pit during the construction of the HABOG facility [10].

programme provides the technical specification that is further used in the tendering process for the selection of a certified company that will carry out the construction works.

3.153. During construction of the radioactive waste management facilities (e.g. incorporating manufacturing and fitting of equipment), control and verifications measures are implemented by COVRA and specialized third parties. As an example, the IAEA team discussed the control of the quality of the storage pits for heat generating waste (HABOG, see Fig. 10) and was provided with the relevant information and answers.

3.154. Some tests that were performed during commissioning of the HABOG facility related to the natural convection cooling system, and removable radiological shielding interlock system were also discussed.

3.155. There seems to be a good record system at the COVRA site that maintains and preserves information about the types and results of test, as well as other controls over the material used for the construction of the facilities on the site.

Conclusions

3.156. The conclusion of the IAEA team is that there is compliance with this requirement.

FACILITY OPERATION

3.157. Requirement 19: "Radioactive waste management facilities shall be operated in accordance with national regulations and with the conditions imposed by the regulatory body. Operation shall be based on documented procedures. Due consideration shall be given to the maintenance of the facility to ensure its safe performance. Emergency preparedness and response plans, if developed by the operator, are subject to the approval of the regulatory body." [3]

Summary of the counterpart's response

3.158. The requirements for operation of radioactive waste management facilities and the associated management system (Fig. 11) are laid down in the legislation and the operating licence of COVRA. COVRA applies a management system based on the Safety Report of 1995 and EIA aiming at compliance with the national regulations and licence conditions.

3.159. COVRA regularly reviews its operations, infrastructure and the associated management system in line with the international best practice. On the basis of meetings between COVRA and the competent authorities (Nuclear Inspectorate, VROM-KFD), a licence application is indicated. The operational limits, conditions and controls are derived from the licence to operate (which includes the Safety Report) and are declared as pre-conditions for operation. After a licence to operate is granted, regular inspections are implemented by the regulatory body (the Ministry).

3.160. As presented earlier, processing of LILW occurs in the waste processing building (AVG). Drums of radioactive waste collected from licensees from all over the country are sorted with respect to type and/or processing method to be applied. The following types of standard waste are distinguished:

FIG. 11. Control of waste drums at the LILW facility.

— Compactable waste (most of the volume of radioactive waste collected by COVRA);
— Liquid waste (organic or inorganic);
— Vials containing scintillation liquid;
— Animal carcasses;
— Sources and other radioactive waste.

3.161. After treatment (e.g. compaction, incineration, chemical or electrochemistry separation and drying), the radioactive waste is placed in 200 L or 1000 L drums and consolidated with cement. The conditioned radioactive waste is transferred to the LILW storage building (LOG).

3.162. The building for storage of conditioned LILW (LOG) is a robust concrete building with floors capable of carrying the heavy load of drums stacked in nine layers. The moisture content in the air of the LOG is controlled to prevent condensation and thus corrosion of the metal surfaces of the stored drums. In order to minimize occupational exposure, the drums with lower activity and dose rates are used as a shielding of the LILW drums with higher activity and dose rates.

3.163. Containers with large volumes of NORM from the phosphate producing industry are stored in the COG building. The building is constructed of

lightweight materials in view of the relatively low radiation levels. Again, air humidity is controlled in order to prevent corrosion.

3.164. Depleted uranium from the uranium enrichment plant in the form of uranium oxide (U_3O_8) is stored in containers in the VOG building. A concrete structure is needed in order to obtain the required shielding of the building. Air humidity control is applied as well.

3.165. The HABOG is a vault type storage facility divided in three separate compartments. The first compartment is used for reception and unloading of the transport casks with HLW and spent fuel. The second is used for the storage of packages containing HLW that does not need to be cooled (e.g. hulls, cemented reprocessing waste). The third compartment is used for the storage of vitrified HLW from reprocessed spent fuel originating from the nuclear power plants and for spent fuel originating from the two research reactors (placed in containers).

3.166. The transport casks, removable gates and wall of the cells provide an efficient radiological shielding. Containers of spent fuel and vitrified HLW are stacked on five levels in vertical air cooled storage wells. The storage wells are filled with an inert gas to prevent corrosion of the canisters and are equipped with a double jacket to allow passage of cooling air. The double jacket ensures that there is no direct contact between spent fuel or radioactive waste canisters and the cooling air. The cooling system is based on the natural convection concept.

Observations and findings

3.167. The operation of the COVRA facilities is based on the Safety Report of 1995 and the defined limits, controls and conditions. The IAEA team visited several of the COVRA facilities (HABOG, LOG and AVG). These visits showed a good level of maintenance and housekeeping (including low dose rates) of these facilities and premises.

3.168. The management of COVRA activities and facilities is also carried out through the application of a management system based on an overall quality assurance plan (KAM) and supporting procedures and instructions for both normal and accidental situations.

3.169. COVRA also has an internal emergency plan that is tested every two years on a large scale, including the interactions with local and national authorities. In addition, it has an emergency plan for off-site transport of radioactive waste to the COVRA site. This off-site plan is also tested on a regular basis together with the

relevant national competent authorities. Lessons learned from these tests are analysed and taken into account in the revision/update of the emergency plans. The current on-site emergency plan for COVRA was revised [42] in October 2009 and is expected to be approved and implemented soon.

Conclusions

3.170. Based on the results of the self-assessment, discussions with the counterpart, the on-site visits and the documentation presented during the mission it was concluded that there is compliance with this IAEA requirement.

FACILITY SHUTDOWN AND DECOMMISSIONING

3.171. Requirement 20: "The operator shall develop, in the design stage, an initial plan for the shutdown and decommissioning of the predisposal waste management facility and shall periodically update it throughout the operational period. Decommissioning of the facility shall be based on the final decommissioning plan, as approved by the regulatory body. In addition, assurance shall be provided that sufficient funds will be available to carry out shutdown and decommissioning." [3]

Summary of the counterpart's response

3.172. Decommissioning plans for the COVRA facilities have not been developed yet.

3.173. However, simple yet robust and modular constructions were used in the design of the radioactive waste management facilities. This type of design also facilitates dismantling and decommissioning. Central in the design and operation of these facilities is the objective to dismantle the facilities in a conventional (i.e. non-nuclear) manner to the extent possible.

3.174. During operation, measures for preventing contamination of the buildings and equipment are applied. All unconditioned 'standard' waste received by COVRA, as well as all conditioned waste packages, must be in accordance with the transport requirements. As a result, contamination is minimized inside the storage and treatment buildings. In case of any possible contamination, compartmentalization and regular inspection and monitoring are performed in combination with direct decontamination actions in order to mitigate the consequences.

Observations

3.175. As stated above, preliminary decommissioning plans for the COVRA radioactive waste management facilities have not been developed to date. Nevertheless, measures have been put in place by COVRA at the design stage to facilitate the future decommissioning of the radioactive waste management facilities on the site. For instance, piping in the facilities was designed in such a way as to minimize the penetration of tubes for transport of liquid radioactive waste in the walls of the facilities (i.e. there are no embedded tubes in these walls).

3.176. Measures are also put in place during the operation of COVRA facilities. For instance, decontamination actions (if needed) are implemented after every waste management campaign in the COVRA facilities. These actions will also facilitate future decommissioning of these facilities.

3.177. Since COVRA will manage decommissioning waste from various facilities in the Netherlands, it is maintaining an estimate of future radioactive waste inventory that is updated every five years. COVRA is also conducting meetings with the large operators (e.g. nuclear power plants) that are expected to generate decommissioning waste in the future. For example, COVRA is directly involved in the cost estimate of the Dodewaard Nuclear Power Plant that is currently in a safe store condition.

Findings

3.178. Recommendation: Although currently there is no specific legislation related to the planning for decommissioning of radioactive waste management facilities, initial decommissioning plans for the existing facilities needs to be developed in line with international standards [3, 43].

Conclusions

3.179. Based on the results of the self-assessment and discussions with the counterpart, it was concluded that there is not full compliance with this requirement, taking into consideration the recommendation presented above.

3.180. Requirement 21: “Nuclear safeguards requirements shall be considered in the design and the operation of waste predisposal management facilities to which nuclear safeguards apply, and shall be implemented in such a way as not to compromise the safety of the facility.” [3]

Summary of the counterpart’s response

3.181. All information is provided by the report of IPPAS mission in 2008.

Observations and findings

3.182. Taking into account that an IPPAS mission was carried out by the IAEA in 2008, the team discussed a few questions with a view to clarify the overall approach applied by COVRA that has relevance to radioactive waste management activities.

3.183. Safeguards measures applied by COVRA are relevant to the following radioactive waste streams:

— Depleted uranium (stored in the VOG facility);
— Spent fuel and filters from molybdenum production (stored in the HABOG facility);
— LILW from the enrichment plant URENCO (processed in the AVG facility and stored in LOG facility).

3.184. The inventory of nuclear material data is based on the information provided on the completed forms by the customers and no additional measurements are made by COVRA. The main information provided to COVRA is the following:

— Containers of depleted uranium: for example, mass of U and residual amount of ^{235}U;
— Spent fuel from research reactors: for example, initial characteristics, burnup and cooling time;
— Filters from molybdenum production: for example, mass of U and amount of ^{235}U;
— Drums and packages of LILW from the enrichment plant: for example, mass of U and amount of ^{235}U.

3.185. There is a discussion between COVRA, EURATOM and the IAEA regarding the inclusion of gas mantles and a small amount of other radioactive waste in the system of account and control.

Conclusions

3.186. Based on the results of the self-assessment, and discussions with the counterpart. It was concluded that there is compliance with this IAEA requirement.

4. SUMMARY

4.1. Overall, the team observed a high level of safety and commitment of COVRA to manage all radioactive waste management facilities and activities in accordance with the national legislation, regulatory requirements and international safety standards. On the basis of the self-assessment and the mission conducted at the COVRA site, the following good practices, recommendation and suggestions were recorded.

GOOD PRACTICES

4.2. The measures implemented by COVRA (presenting its activities through art, open days, etc.) to facilitate the communication of radioactive waste management activities to the public have led to increasing transparency and confidence building of the public. They have also has contributed positively to team building within COVRA.

4.3. The measures applied in the design and operation of the LOG and HABOG storage facilities provide passive features that minimize the reliance on maintenance, facilitate the periodic control of waste package integrity and also facilitate the subsequent waste management steps (e.g. disposal).

RECOMMENDATION

4.4. Although currently there is no specific legislation related to the planning for decommissioning of radioactive waste management facilities, initial decommissioning plans for the existing facilities need to be developed in line with international standards.

SUGGESTIONS

— It is suggested that the management system at COVRA includes measures for control of the development, review and update of the safety assessment and safety case.
— Taking into account that each staff member has more than one duty, it is suggested that the management system also includes measures for independent internal review of all activities within the scope of COVRA.
— It is suggested that the classification system for radioactive waste be adapted to allow the separation of short lived and long lived waste that would facilitate further radioactive waste minimization through storage for decay. (This could apply to future radioactive waste that will come from decommissioning of nuclear power plants, research reactors, etc.)
— It is alo suggested that COVRA provide sufficient confidence in the radiological characteristics of LILW packages before waste acceptance for storage in the LOG facility.
— It is suggested that the current control measures for compliance with the waste acceptance criteria for LILW during the radioactive waste processing be reviewed.
— It is advisable that a procedure be developed that provides guidance on the methodology and approaches to be applied in the development and review of safety assessment and safety case for predisposal waste management in order to:
  • Facilitate the future consistent and transparent development (by COVRA and/or external experts) and reviews of safety assessments (internal and external) and Safety Reports;
  • Ensure transfer of knowledge on the facility, assumptions made and consequences evaluated.
— As in 2009, COVRA is performing the periodic review of its activities, including the development of safety assessment. It is thus an appropriate time to update the safety assessment methodology used and the related documentation. It is advisable to consider international safety standards such as Refs [23, 24] since they can serve as a good point of reference.

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Appendix I

MISSION AGENDA AND REVIEW OF TASKS PERFORMED

23–27 November 2009	Review of questionnaires and identification of issues for specific review (before visit).
29 November Sunday	Team assembles and holds final mission planning meetings — together and with counterparts.
30 November Monday	Welcome. Orientation. Site visit. Requirement 1: Legal and regulatory framework. Requirement 2: National policy and strategy on radioactive waste management. Requirement 3: Responsibilities of the regulatory body. Team evaluation and drafting of assessment sheets.
1 December Tuesday	Requirement 4: Responsibilities of the operator. Requirement 5: Requirements in respect of security measures. Requirement 6: Interdependences. Requirement 7: Management systems. Issues from previous day review sheets. Team evaluation and drafting of assessment sheets.
2 December Wednesday	Requirement 8: Radioactive waste generation and control. Requirement 9: Characterization and classification of radioactive waste. Requirement 10: Processing of radioactive waste. Requirement 11: Storage of radioactive waste. Requirement 12: Radioactive waste acceptance criteria. Issues from previous day review sheets. Team evaluation and drafting of assessment sheets.
3 December Thursday	Requirement 13: Preparation of the safety case and supporting safety assessment. Requirement 14: Scope of the safety case and supporting safety assessment. Requirement 15: Documentation of the safety case and supporting safety assessment. Requirement 16: Periodic safety reviews. Requirement 17: Location and design of facilities. Issues from previous day review sheets. Team evaluation and drafting of assessment sheets.

4 December Friday	Requirement 18: Construction and commissioning of the facilities. Requirement 19: Facility operation. Requirement 20: Shutdown and decommissioning of facilities. Requirement 21: System of accounting for and control of nuclear material. Issues from previous day review sheets. Team evaluation and drafting of findings plus development of final conclusions.
5 December Saturday	Presentation of provisional results of review mission.

Appendix II

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The Centrale Organisatie Voor Radioactief Afval (COVRA) is a State owned organization responsible for the predisposal management of all types of radioactive waste, as well as the siting and design of a planned deep geological disposal facility. As it is a vital entity in the management of radioactive waste, an understanding was reached in the country on the necessity of a peer review of COVRA activities in an effort to improve public confidence and acceptability for the management of such waste in the Netherlands. Accordingly, the Government of the Netherlands requested the IAEA to conduct a peer review of the activities of COVRA. This report presents the consensus view of an international group of experts convened by the IAEA to carry out this peer review.

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