



Strålsäkerhetsmyndigheten

Swedish Radiation Safety Authority

Rapport

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Sweden's first national report on implementation of Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste



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Foreword

This report has been prepared to meet the requirement of Article 14.1 of Council Directive 2011/70/Euratom, establishing a Community Framework for the responsible and safe management of spent fuel and radioactive waste. Article 14.1 requires that Member States shall submit a report to the Commission on the implementation of this Directive for the first time by 23 August 2015, and every three years thereafter, taking advantage of the review and reporting under the Joint Convention. Sweden has previously transposed 2011/70/Euratom into legislation in accordance with Article 15.1.

The report has been prepared by the Swedish Radiation Safety Authority, SSM.

List of abbreviations

Clab	Central Interim Storage Facility for Spent Nuclear Fuel
CNRA	Committee on Nuclear Regulatory Activities
DBA	Design Basis Accident
ENSREG	European Nuclear Safety Regulators Group
EIA	Environmental Impact Assessment
ESS	European Spallation Source
HERCA	Heads of European radiation Control Authorities
IAEA	International Atomic Energy Agency
IRRS	IAEA Integrated Regulatory Review Service
NPP	Nuclear Power Plant (including all nuclear power units at one site)
OKG	OKG AB (licence holder of Oskarshamn NPP)
OLC	Operational Limits and Conditions
PSAR	Preliminary Safety Analysis Report
PSR	Periodic Safety Review
RD&D	Research, Development and Demonstration
SAR	Safety Analysis Report
SFL	Final repository for long-lived radioactive waste
SFR	Final repository for short-lived radioactive waste
SKB	Svensk Kärnbränslehantering AB (the Swedish Nuclear Fuel and Waste Management Company)
SSM	Strålsäkerhetsmyndigheten (Swedish Radiation Safety Authority)
SSMFS	Strålsäkerhetsmyndighetens författningssamling (the SSM Code of Statutes)
STF	Säkerhetstekniska driftförutsättningar (technical specifications, operational limits and conditions)
SVAFO	Swedish company engaged in management of radioactive waste
SWEDAC	Swedish Board for Accreditation and Conformity Assessment
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulator's Association

A. Introduction

A.1. Background

The Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste [1] (hereinafter referred to as the “waste directive”), entered into force 22 August 2011. The Directive contains in essence four basic requirements;

1. Transposition in national legislation by 23 August 2013 (Article 15),
2. Notification to the Commission of (the content of) a national program for the first time by 23 August 2015 and any sub-sequent significant changes thereafter (Articles 13.1 and 15.4),
3. Submission to the Commission of a report on the implementation of the Directive for the first time by 23 August 2015, and every 3 years thereafter, taking advantage of the review and reporting under the Joint Convention (Article 14.1).
4. Arrange for self-assessment of the national framework, competent regulatory authority, national programme and its implementation, and invite international peer review of the national framework, competent regulatory authority and/or national programme at least every 10 years (Article 14.3).

A.2. Objective

This report has been prepared to meet the requirements for reporting on the implementation of the waste directive. The report thus serves the two basic purposes; i) reporting on the implementation of the directive for the first time by 23 August 2015, and ii) reporting on the status for implementation of management and disposal of spent fuel and radioactive waste.

A.3. Scope

This report addresses the implementation of the obligations of the waste directive.

It focusses on describing how specific measures are taken at the national level that corresponds to specific requirements in the waste directive, using an article-by article approach.

A.4. Structure

The structure of the report follows the ENSREG guidelines [2].

Section A.5 contains a high-level national overview of management of spent fuel and radioactive waste. The section includes an overview of current sources for spent fuel and radioactive waste including historical and legacy wastes. In a general sense, it discusses potential future sources for spent fuel and radioactive waste. On a principle level it also addresses i) policies governing management of spent fuel and radioactive waste, ii) the legal and regulatory framework and iii) established activities for management of spent fuel

and radioactive waste as well as remaining activities yet to be established. In addition, an account is provided for the current status of the most recent self-assessment and peer review activities, section A.5.9.

The purpose with section B is to serve as a major information source on the progress made in the management of spent fuel and radioactive waste by summarising the developments since the previous National Report. For this first report, section B contains mainly an account for ongoing activities and recent achievements in a general sense as well as for expected developments.

Section C addresses in due detail all aspects of the implementation of the obligations in Articles 4 to 12 of the waste directive. The report is structured in accordance with the given articles and sub-paragraphs of the directive, as proposed in the guidelines.

A.5. The national context

A.5.1. Basic prerequisites

Radioactive waste management policies and practices

Spent fuel is destined for direct disposal in a geological disposal facility. Spent fuel is currently stored in a central interim storage facility for spent nuclear fuel (Clab), in operation since 1985.

Long-lived low- and intermediate level waste is destined for disposal in a geological disposal facility at a depth of about 300 meters. The facility is planned to be taken into operation in the mid 2040's.

Short-lived low- and intermediate level waste is disposed of in the disposal facility for short-lived radioactive waste (SFR), in operation since 1988.

Very low-level waste is disposed of in shallow land burials or cleared for unrestricted use or for disposal as conventional non-radioactive waste.

The main implementing organisations

The four nuclear power plant (NPP) utilities (Barsebäck Kraft AB, Ringhals AB, Forsmarks Kraftgrupp AB and OKG AB) are responsible for the safe management and storage of spent fuel and nuclear waste at the NPP sites, as well as decommissioning of the NPPs and associated facilities at the NPP sites. The NPP utilities have formed a special company, the Swedish Nuclear Fuel and Waste Management Co (SKB), to assist them in executing their responsibilities.

The Swedish Nuclear Fuel and Waste Management Co (SKB), is jointly owned by the NPP utilities and is responsible for management, including transports, and disposal of spent fuel and nuclear waste. SKB is responsible for organising and performing necessary research and technical development in order to accomplish safe disposal of spent fuel and nuclear waste from the NPPs. SKB owns and operates the Clab and SFR facilities as well as the transport system.

Studsvik Nuclear AB is tasked with managing institutional waste from medicine, research and non-NPP utilities and activities. Institutional waste is when applicable disposed of in disposal facilities for nuclear waste, operated by SKB.

AB SVAFO is jointly owned by the NPP utilities and is responsible for decommissioning of old research and development facilities and for management and disposal of legacy

waste. Legacy waste is when applicable disposed of in disposal facilities for nuclear waste, operated by SKB.

Main organisations as regards regulatory activities and responsibilities

The Parliament adopts acts, which usually contain basic requirements and mandate to the Government or the authority appointed by the Government to issue more detailed requirements

The Government grants licences for facilities and activities. The Ministry of the Environment and Energy has the overall responsibility for compliance of operations with legislation and regulations related to management and disposal of spent fuel and radioactive waste. If the government wants to transfer regulatory powers to an authority, this is done by an ordinance.

The Swedish Radiation Safety Authority (SSM) is the responsible regulatory authority and mandated to issue regulations as regards nuclear safety and radiation protection. SSM also has the mandate to decide on additional conditions or sanctions on licensed nuclear activities.

A.5.2. Generation of spent fuel and radioactive waste

Current sources for spent fuel and radioactive waste

Spent fuel emanates mainly from ten reactors in operation at three sites as well as from two reactors at the Barsebäck site permanently closed down in 1999 and 2005 respectively.

Radioactive waste originates from the nuclear power industry as well as medical use, industry, research and consumer products. In addition nuclear waste is produced at the Studsvik site (closed research reactor, hot-cell and waste treatment facilities) and, to a limited extent, at Westinghouse Electric Sweden AB's fuel fabrication plant. Disused sources that are not returned to out of country producers, are sent to Studsvik Nuclear for treatment and storage prior to disposal. SSM facilitates the collection and transport of orphan sources to Studsvik for treatment and storage.

Past research activities have also generated some waste, which are either stored awaiting disposal or have already been disposed of. In total the Swedish nuclear power programme will generate approximately 20 000 m³ (12,600 tonnes) spent fuel, 155 000 m³ short-lived LILW from operation and decommissioning and 15,000 m³ long-lived LILW (based on 60-years operation of the reactors except for Ringhals 1 and 2 which will be operated for 50 years). The typical total annual production of LILW at the nuclear facilities is 1 000-1 500 m³.

Figure A.1 illustrates the geographical location of nuclear facilities where spent fuel and/or radioactive waste is generated, managed or disposed of.

Nuclear Facilities in Sweden

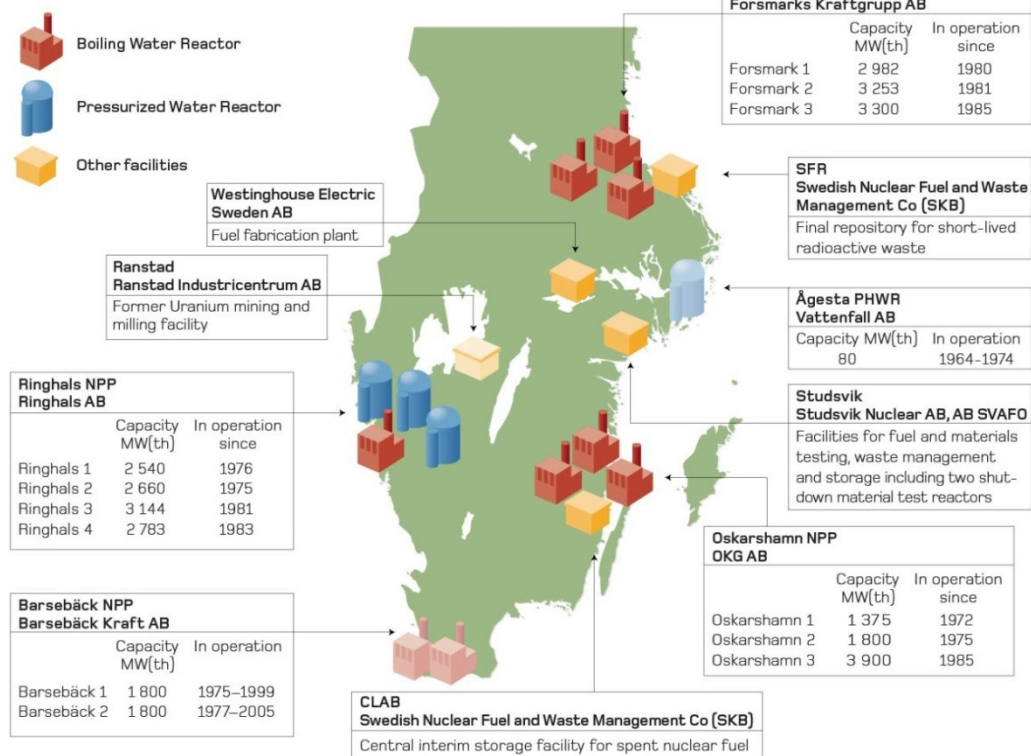


Figure A.1: Nuclear facilities in Sweden

Historical and legacy wastes

Early research and development activities

Early activities generating spent fuel and radioactive waste were:

- Operation of the research reactor R1 in Stockholm 1954–1970.
- Research activities at the Studsvik site including operation of research reactors between 1958 and 2005.
- Operation of the Ågesta district heating reactor between 1964 and 1974.
- Uranium mining and milling facilities in Ranstad operated in the 1960s.

Early reprocessing contracts

Swedish policy was originally based on the assumption that reprocessing and plutonium recycling would form attractive and desirable elements of the nuclear fuel cycle. As commercial nuclear power plants were built in the early 70's, arrangements were made to send the spent nuclear fuel abroad for reprocessing.

In 1969 the Swedish nuclear power company, OKG, signed a contract with the United Kingdom Atomic Energy Agency, which was later taken over by The British Nuclear Fuel Limited (BNFL), for the reprocessing of spent nuclear fuel from OKG in Windscale (later Sellafield). In all 140 tons of fuel was shipped to Sellafield between 1972 and 1982. The fuel was reprocessed in 1997 and resulted in 136 tons of uranium and 833 kilograms of plutonium. In 2014 the ownership was transferred from OKG to the UK Nuclear Decommissioning Authority, NDA.

Between 1978 and 1982 an agreement was made between the Swedish Nuclear Fuel Supply Company (SKBF, later renamed SKB) and Compagnie Générale des Matières

Nucléaires (COGEMA) regarding the reprocessing of 672 tons of spent nuclear fuel from the Barsebäck, Ringhals and Forsmark NPPs. A total of 55 tons was shipped to La Hague before the contracts were cancelled. The fuel was then exchanged for 24 tons of used MOX-fuel from Germany. The exchange meant that Sweden did not have to build a disposal facility for vitrified waste and Germany did not have to build a disposal facility for used MOX-fuel. The used MOX-fuel from Germany is now stored in the Clab facility.

Potential future sources for spent fuel and radioactive waste

In 2012, Vattenfall AB submitted a licence application seeking permission to replace up to two of its current reactors with new ones. However, due to the current market situation, it is at the present time unclear whether the company will continue its planning for a new generation of reactors.

New reactors, if they were constructed, would imply that the total volumes of waste will become larger than anticipated within the current program for management and disposal of spent fuel and radioactive waste. Waste inventories in this report addresses only spent fuel and waste from currently existing reactors.

A.5.3. The system for management and disposal of spent nuclear fuel and radioactive waste

Under Swedish law, the holder of a licence to operate a nuclear facility is primarily responsible for the safe handling and disposal of spent nuclear fuel and radioactive waste, as well as decommissioning and dismantling of the facility. The nuclear power plant licensees have formed a special company, the Swedish Nuclear Fuel and Waste Management Co (SKB), to assist them in executing their responsibilities.

SKB has been tasked with the responsibility for all handling, transportation and storage of spent fuel and radioactive waste outside the nuclear power plants, as well as for disposal of spent nuclear fuel and nuclear waste. This includes the responsibility to carry out necessary research and development activities and the compilation of the RD&D-program required to be submitted to the Government for review every three years. Since 1986, SKB, on behalf of the nuclear power plant licensees, has reported an up-dated research, development and demonstration (RD&D) programme every three years. The most recent RD&D programme was published by SKB and submitted to SSM in September 2013.

SKB is the licensee and the operator of the central interim storage for spent fuel (Clab) and the disposal facility for operational waste (SFR). SKB also owns and operates the transport ship, M/S Sigrid, a custom-made ship to transport spent fuel and radioactive waste from nuclear power plants to Clab and SFR.

SKB is also tasked with the responsibility to perform the nuclear industries cost estimates for management and disposal of spent fuel and nuclear waste, as well as for decommissioning of NPPs and other nuclear facilities.

There are no plans to establish specific disposal facilities for radioactive waste from industry, medical care and research (institutional waste). Institutional waste will, as appropriate, be disposed of in disposal facilities for nuclear waste from the nuclear power program. Institutional waste that is to be disposed of is sent to Studsvik Nuclear AB for treatment and storage prior to disposal.

Figure A.3 illustrates schematically the system for management of spent fuel and radioactive waste as presented in SKB's RD&D-programme 2013. Facilities that remain to be realised are an encapsulation plant for spent fuel and repositories for spent fuel, long-lived low and intermediate level waste, and for decommissioning waste. SKB's RD&D programme is focused on these matters.



Clearance

Material may be cleared for unrestricted use or for disposal as conventional non-radioactive waste according to approved procedures as prescribed in SSM code of statutes.

Very Low Level Waste (VLLW)

The nuclear power plants at Ringhals, Forsmark and Oskarshamn as well as the Studsvik site have shallow land burials for solid short-lived low-level waste (<300 kBq/kg). Each burial is licensed for a total activity of 100 - 200 GBq (the highest level according to the legislation is 10 TBq, of which a maximum of 10 GBq may consist of alpha-active substances).

Short-lived low- and intermediate level waste (LILW-SL)

Radioactive operational waste from nuclear reactors, medical and research institutions and industrial radioactive waste is disposed of in an underground disposal facility for low- and intermediate level waste (SFR).

Waste from decommissioning of the nuclear power plants is planned to be disposed of in SFR. SKB in December 2014 submitted a license application for an extension of the facility in order to increase the storage capacity by an estimated 140,000 m³ from today's capacity of 63 000 m³.

Long-lived low- and intermediate level waste (LILW-LL)

The origin of this waste is primarily research, industry and medical applications as well as from operation and decommissioning of nuclear power reactors. The waste is currently stored at Studsvik, the nuclear power plants and Clab or, when appropriate, in SFR. According to current plans, a license application to build a disposal facility for long-lived low and intermediate level waste (SFL) will be submitted in 2030 and operation is planned to commence in 2045. The volume of SFL will be relatively small compared to SKB's other disposal facilities. The total storage volume is estimated to 10 000 m³.

Spent nuclear fuel

Spent nuclear fuel from the nuclear power reactors is temporarily stored in water-filled fuel pools for at least nine months, before being transported to the central interim storage for spent nuclear fuel (Clab), where it will be stored for at least another 30 years before being encapsulated and deposited in a disposal facility.

Legacy wastes

Legacy wastes vary with regards to categorization, measurements accuracy and conditioning. Treatment and conditioning of these wastes have been managed on a case-by case basis and the regulatory authority has opted to have early in-sight in these projects and to handle them, both their regulation and control, on a case-by-case basis. The final waste packages, however, must fit into the available waste streams of the disposal program and, to the extent possible, fulfill the general requirements of the regulations.

Transport system

All transportation of spent nuclear fuel and radioactive waste is by sea, since all the nuclear facilities are situated on the coast. The transportation system has been in operation since 1982 and consists of a dedicated ship, transport casks and containers, and terminal vehicles for loading and unloading.

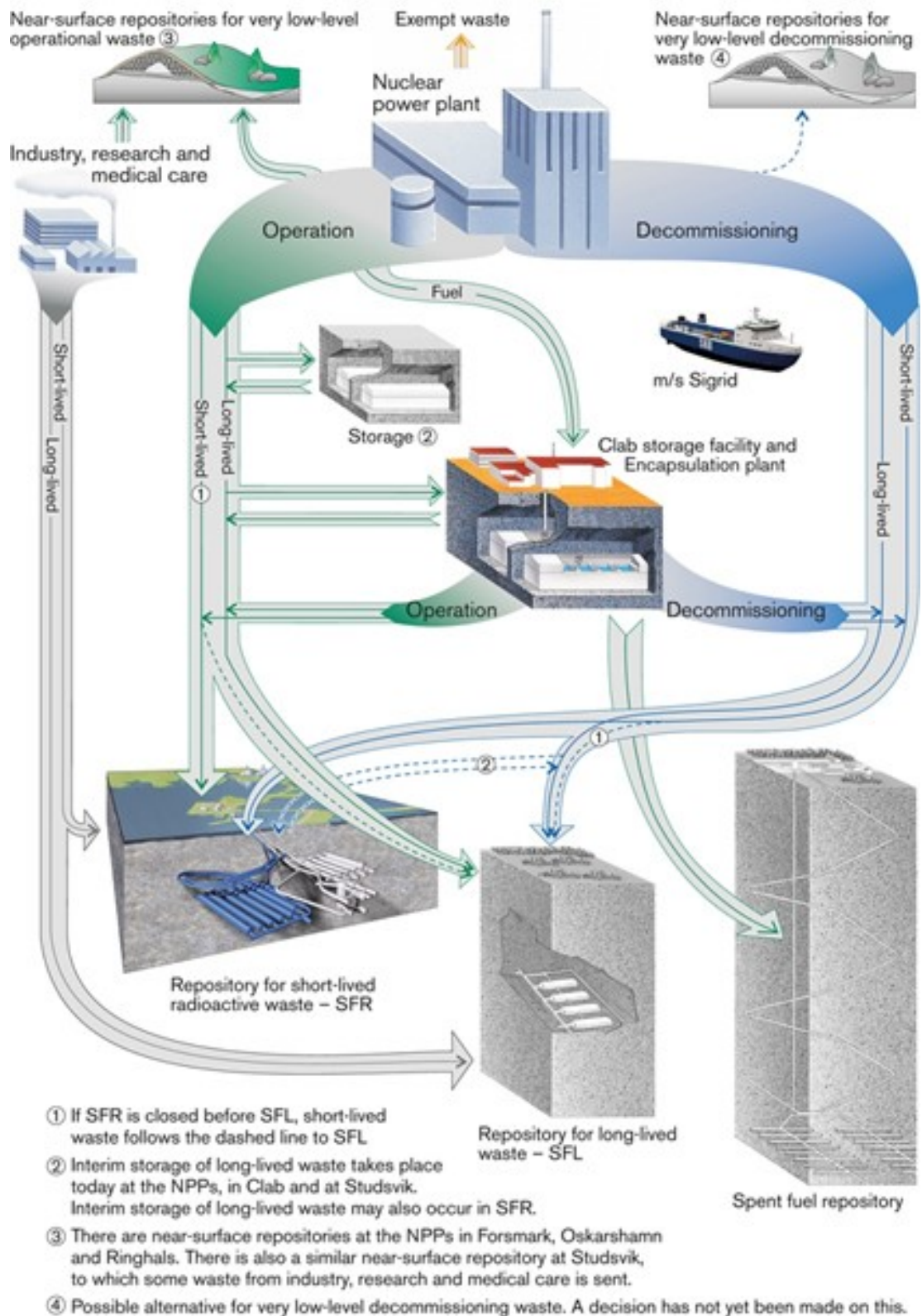


Figure A.3: System for management for spent nuclear fuel and radioactive waste as presented in the RD&D programme 2013.

A.5.4. National policies and framework

Current principles in the national framework governing management and disposal of spent nuclear fuel and radioactive waste was formally established in the early 1980's, as a consequence of a political decision to phase out nuclear power generation by 2010.

The framework and its implementation encompasses in essence all the elements required by the EC Directive 2011/70/Euratom, i.e.;

- an adequate legislative, regulatory and organizational framework allocating responsibilities between different bodies involved,
- national arrangements for safety,
- an independent regulatory function,
- a system for licensing of spent fuel and radioactive waste management activities including requirements for public information and participation,
- a system of appropriate regulatory inspections and control as well as requirements for documentation and reporting to the regulatory function,
- requirements for adequate human and financial resources for operating a nuclear activity or activities involving radiation, and
- a system for financing of management and disposal of spent fuel and radioactive waste.

A.5.5. Development of a national policy

The fundamental policies for management of spent nuclear fuel and radioactive waste have evolved in pace with the emergence of the nuclear energy programme.

The principles for the management of spent fuel and radioactive waste were established as a result of extensive discussions that took place in the parliament (Riksdag) during the 1980s and 1990s.

The national policy and strategy for the management system for spent fuel and nuclear waste are based on the following four basic principles¹:

1. Costs for the treatment and disposal of spent fuel and radioactive waste from nuclear activities shall be covered by fees that licensees are required to pay.
2. The licensees are to safely dispose of spent nuclear fuel and radioactive waste from nuclear activities.
3. The state has the ultimate responsibility for spent nuclear fuel and radioactive waste from nuclear activities.
4. Each country is to be responsible for the spent nuclear fuel and radioactive waste generated from nuclear activities in that country. The disposal of spent nuclear fuel and nuclear waste from nuclear activities in a foreign country is not allowed in Sweden other than in exceptional cases.

The policy and strategy for the management of spent fuel and nuclear waste as required by the EC Directive 2011/70/Euratom are currently codified in the legislation.

The state, through the Government and the regulatory authority, is responsible for the regulatory supervision of the implementers' activities and operations.

¹ The Swedish parliament has supported four basic principles for the management of spent nuclear fuel and nuclear waste (bill 1980/81:90, Appendix 1, p. 319, bill 1983/84:60, p. 38, bill 1997/98:145, p. 381, bill 1992/93:98, p. 29 as well as the final reports of the Standing Committee on Industry and Trade, 1988/89:NU31 and 1989/90:NU24).

A.5.6. Legislative and regulatory framework

Legislative framework

The framework of Sweden's legislation in the field of waste management, nuclear safety and radiation protection, is to be found in following Acts:

- The Act (1984:3) on Nuclear Activities, which defines the licensing requirements for the construction and operation of nuclear facilities and for handling or using nuclear materials (including radioactive waste).
- The Radiation Protection Act (1988:220), which defines the licensing requirements for radiation protection and for radiological work.
- The Act (2006:647) on Financial Measures for the Management of Residual Products from Nuclear Activities which deals with the main financial aspects, and defines the responsibilities pertaining to the management and disposal of spent nuclear fuel and radioactive waste.
- The Act (1988:1597) on Financing of Certain Radioactive Waste etc., which deals with covering of expenses for management of nuclear waste from older experimental activities.
- The Environmental Code (1998:808) is also of importance, in particular for the siting and construction of new facilities.

The Acts are supplemented by a number of ordinances and other secondary legislation, which contain more detailed provisions for particular aspects of the legal framework.

Details on the legislative and regulatory framework are found in section C.2.

Organisational structure

Figure A.2 shows the basic characteristics of the legislative system. The Parliament adopts the laws, which usually contain basic requirements and mandate to the Government or the authority appointed by the Government to issue more detailed requirements. If the government wants to transfer regulatory powers to an authority, this is done by an ordinance. Regulations are often the basis for supervision as they in more detail specifies the level of requirements.

SSM is in Governmental Ordinances mandated to issue regulations under the Act (1984:3) on Nuclear Activities and under the Radiation Protection Act (1988:220). SSM also has the mandate to decide on additional conditions or sanctions on licensed nuclear activities.

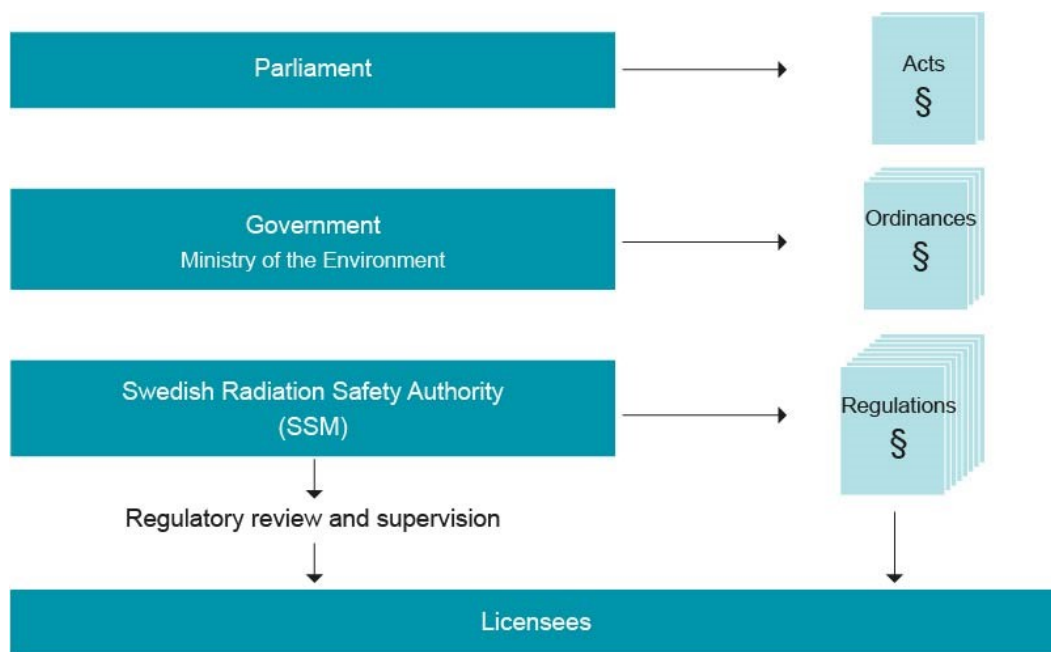


Figure A.2: Swedish legislative system.

A.5.7. Regulatory control and supervision

Roles and responsibilities

SSM supervises the Swedish Nuclear Fuel and Waste Management Co (SKB), the power plant operators and other licensees of nuclear activities in fulfilling their responsibilities for safe operation of facilities and transports as well as in planning for decommissioning and disposal. SSM is provided with the adequate level of authority, competence and financial and human resources to fulfil its assigned responsibilities.

Independence of the regulator

The regulatory body's independence is of a fundamental importance in the Swedish constitution, and codified in Chapter 12 Section 2 of the Instrument of Government (1974:152). Although the Government has substantial scope for steering the operations of government agencies, it has no power to intervene in an agency's decisions in specific matters relating to the application of the law or the due exercise of its authority, i.e. authorization, supervisions etc.

A.5.8. Waste categorization

There is an established waste classification scheme used by the nuclear industry derived from existing and future repositories (end points). Thus, a tailor-made management system for management and disposal of radioactive waste has been developed where waste categorisation is strictly operational and depends on the origin of the waste and of the disposal option. The classification scheme is presented in Table A.1.

The waste classification scheme used by the industry would be converted to the scheme used by IAEA (GSG-1) according to the matrix below, Table A.2.

Table A.1: Waste classification scheme used by the nuclear industry.

Waste Class	Definition	Specific requirements	Disposal route
Cleared Material	Material with so small amounts of radioactive nuclides that it can be released from regulatory control	-	Disposal not required
Very low level waste, short-lived (VLLW-SL)	Contains small amounts of short lived nuclides with a half-life less than 31 years, dose rate on waste package is less than 0,5 mSv/h. Long lived nuclides with a half-life greater than 31 years can be present in restricted quantities.	-	Shallow land burial
Low level waste, short-lived (LLW-SL)	Contains small amounts of short lived nuclides with a half-life less than 31 years, dose rate on waste package (and unshielded waste) is less than 2 mSv/h. Long lived nuclides with a half-life greater than 31 years can be present in restricted quantities.	-	Final repository for short-lived radioactive waste (SFR)
Intermediate level waste, short-lived (ILW-SL)	Contains significant amounts of short lived nuclides with a half-life less than 31 years, dose rate on waste package is less than 500 mSv/h. Long lived nuclides with a half-life greater than 31 years can be present in restricted quantities.	Requires radiation shielding during transport	Final repository for short-lived radioactive waste (SFR)
Low and intermediate long-lived, waste (LILW-LL)	Contains significant amounts of long lived nuclides with a half-life greater than 31 years, past the restricted quantities for short lived waste	Requires special containment during transport	Final repository for long-lived radioactive waste (SFL)
Spent fuel/ High level waste (HLW)	Typical decay heat >2kW/m ³ and contains significant amounts of long lived nuclides with a half-life greater than 31 years, past the restricted quantities for short lived waste	Requires cooling and radiation shielding during intermediate storage and transport	Final repository for spent fuel

Table A.2: Comparison between the classification scheme and the IAEA definition.

Sweden	IAEA Distribution (%)			
	VLLW	LLW	ILW	HLW
VLLW-SL	100			
LLW-SL		100		
ILW-SL		100		
LILW-LL			100	
HLW				100

A.5.9. Status of international peer reviews

In the Ordinance (2008:452) with instructions for the Swedish Radiation Safety Authority it is stated that SSM shall propose to the Government the appropriate time for the evaluations and international peer reviews to be performed at least every ten years according to the Council directives 2009/71/Euratom (Nuclear Safety Directive) and 2011/70/Euratom (Waste Directive). SSM is also tasked with reporting on the results of these evaluations and reviews and, if necessary, to propose measures.

A full scope IRRS mission was performed in 2012 and a follow-up mission is planned for 2016.

Details on recently performed and planned international peer reviews are further described in section B.2.6.

B. Summary of recent developments

B.1. Background

As described in section A.5, Sweden has over the years established a well-developed system for management and disposal of spent fuel and radioactive waste.

One key feature in the Swedish approach is that it is based on national cooperation between reactor operators. This started already when nuclear power was introduced by means of coordinated efforts to ensure supply of uranium for spent fuel manufacturing through a jointly owned company.

The cooperation activities were later expanded to encompass also necessary activities to manage and dispose of spent fuel and nuclear waste. Early accomplishments in the reactor operators' joint program for management and disposal of spent fuel and radioactive waste as described in section A.5.7 were:

- establishment of the disposal facility for short-lived operational waste, SFR, taken into operation in 1988,
- establishment of the central interim storage facility for spent fuel, Clab, in 1985. and,
- establishment of the transportation system which has been in operation since 1982 and consists of a dedicated ship, transport casks and containers, and terminal vehicles for loading and unloading.

The section below presents the main recent achievements as regards management and disposal of spent fuel and radioactive waste.

B.2. Recent developments

B.2.1. Licensing review of spent nuclear fuel repository

Since March 2011, the Swedish Radiation Safety Authority (SSM) is reviewing the Swedish Nuclear Fuel and Waste Management Company's (SKB's) license applications for an encapsulation plant in Oskarshamn and a geological repository for the final disposal of spent nuclear fuel in Forsmark. SSM has completed a review of the quality and completeness of SKB's applications and is now carrying out an in-depth review with resolution of the safety critical review issues. To promote a broad societal involvement in the licensing review, SSM has arranged for two national consultations of SKB's license applications. The aim of SSM's review is to submit a statement to the Land and Environment Court in early 2016, as a basis for a public hearing, and a final review statement with recommendations to the Government in early 2017.

B.2.2. License application for extension of the SFR disposal facility

SKB in December 2014 submitted a license application for an extension of the final repository for short lived low and intermediate level waste in Forsmark (SFR), to also accommodate decommissioning waste.

B.2.3. Review of SKB's tenth RD&D programme

SKB's tenth tri-annual research, development and demonstration programme (RD&D programme 2013) report was submitted to SSM in September 2013 for evaluation and a public consultation. In December 2014 the Government approved of SKB's programme, after review and a public consultation carried out by SSM. The approval was conditioned so that SKB and the reactor operators must consult with the authority on the development of a more detailed planning on decommissioning activities.

B.2.4. Review of SKB's estimation of costs of the future programme

SKB in January 2014 submitted cost estimates for the future management and disposal of spent nuclear fuel and nuclear waste and the decommissioning and dismantling of nuclear facilities. Based on SSM review recommendations and calculations, the Government in December 2014 decided on the guarantees to be set and the fees to be paid by the power plant licensees to the Nuclear Waste Fund for the years 2015 through 2017. The fees payable to the Nuclear Waste Fund were increased from an average rate of 2.2 öre per kilowatt hour (kWh) of nuclear power produced to 4.0 öre per kWh for the period 2015–2017.

B.2.5. Transposition of EC Directive 2011/70/Euratom

At the time for entry into force of the EC Directive 2011/70/Euratom, most provisions in the directive were already implemented in the legislative and regulatory framework. The necessary additional adjustments and clarifications have been implemented in the framework and the European Commission has been informed thereof.

The main element to be addressed was the provisions under Article 4 (4) of the directive. Adjustments were made in the legislation to clarify that export of spent fuel and nuclear waste for disposal in other countries is prohibited unless certain conditions as specified in the directive are fulfilled.

B.2.6. International peer reviews

In 2012, an international group of experts performed a review of Sweden's compliance with IAEA standards in the form of a full scope IRRS (Integrated Regulatory Review Service) in the fields of nuclear safety and radiation protection. The review addressed facilities and activities regulated by SSM including the ten nuclear power units, the fuel fabrication facility, spent fuel and waste management facilities and users of radioactive sources.

The review demonstrated that the system for nuclear safety and radiation protection is stable and well-developed, with an independent supervisory authority that is open and transparent, learns from experience and is open to feedback. The IRRS review team identified a number of good practices and made recommendations and suggestions where

improvements will enhance the effectiveness of the regulatory framework and functions in line with the IAEA Safety Standards.

An IRRS follow-up mission is planned for 2016.

In addition, an international team organised by OECD/NEA in 2012 reviewed the post-closure safety case in the licence application submitted by SKB in 2011 for a spent fuel repository. The peer review has been a valuable contribution to SSM's licensing review process as an independent international assessment on the maturity of SKB's programme and to determine if it is on a par with global state-of-the-art and good practices.

On the implementer side, SKB became a member of World Association of Nuclear Operators (WANO) in 2011. A WANO review mission of SKB and its operation of SFR and Clab was carried out in 2013, with a follow-up review in January 2015.

B.2.7. Review and updating of regulations

A revision of SSM's regulatory framework was initiated in 2012, based on both the IAEA IRRS team's peer review recommendations and SSM's own application experience on the need to clarify and supplement its regulations in order to create more predictability for the licensees and to improve the regulatory framework. A comprehensive oversight project is ongoing and is since 2014 coordinated with assignments from the Government to propose the necessary changes in national legislation on the implementation of the Council directives 2013/59/Euratom (basic safety standards) and 2014/87/Euratom (amended nuclear safety directive).

B.2.8. Post-Fukushima stress tests

As a follow-up to the TEPCO Fukushima Dai-ichi nuclear power plant accident, the power plant licensees, as part of the European stress tests, have revised their safety assessments with the aim to assess the robustness of the facilities beyond design basis. SSM in April 2012 required all licensees to present action plans for dealing with the deficiencies identified during these stress tests. The NPP stress tests resulted in areas of improvement also for on-site spent fuel pools. The most important actions identified are new earthquake analyses, improvements to deal with the loss of electrical power, spent fuel cooling and residual heat removal.

In addition, SSM demanded that SKB conducted a renewed safety assessment for the interim storage facility for spent nuclear fuel at Clab, Oskarshamn. This was a decision on the national level and has not been subject to EU reporting or peer reviews. SKB's action plan for Clab, with improvements on the safety back-up systems for power and water supply, is monitored through SSM's ordinary regulatory supervision.

B.2.9. The European Spallation Source

The Swedish Radiation Safety Authority decided on 17 July 2014 to grant European Spallation Source AB (ESS AB) authorisation to begin construction of the ESS research facility in Lund. ESS is an intergovernmental research project in which 17 European countries currently are engaged with the aim of constructing and operating a new neutron source based on a large accelerator. According to the current plan, the ESS facility should be operational in 2025 and it is envisaged that the facility will be in operation for about 40 years. Further permission will be required from the Authority before this facility may be commissioned. In SSM's review of the company's application the handling and final disposal of the radioactive wastes generated at the facility has been an important issue.

C. Reporting article by article

C.1. Article 4 – General principles

C.1.1. National policies

Article 4.1

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

Policies for the management and disposal of spent fuel and radioactive waste are established on the platform of basic principles derived from extensive discussions that took place in the parliament (Riksdag) during the 1980s and 1990s.

The policy for the management of spent fuel and nuclear waste is based on the following four basic principles:

1. Costs for the treatment and disposal of spent fuel and radioactive waste from nuclear activities shall be covered by fees that licensees are required to pay.
2. The licensees are to safely dispose of spent nuclear fuel and radioactive waste from nuclear activities.
3. The state has the ultimate responsibility for spent nuclear fuel and radioactive waste from nuclear activities.
4. Each country is to be responsible for the spent nuclear fuel and radioactive waste generated from nuclear activities in that country. The disposal of spent nuclear fuel and nuclear waste from nuclear activities in a foreign country is not allowed in Sweden other than in exceptional cases.

The national policy and basic principles for the management system for spent fuel and nuclear waste as required by Article 4 of the EC Directive 2011/70/Euratom are codified in national legislation or adopted by parliament.

The first principle is stated in the Act (2006:647) on Financial Measures for the Management of Residual Products from Nuclear Activities, and the second and fourth principles in the Act (1984:3) on Nuclear Activities (sections 10–12 and 5 a). As far as concerns the third principle, the Government has in a statement accepted by the Parliament declared that the State has the ultimate responsibility for operations as a consequence of the provisions of the Act (1984:3) on Nuclear Activities, also in the very long term.²

² Bill 1980/81:90, Appendix 1, p. 319, bill 1983/84:60, p. 38, bill 1997/98:145, p. 381, bill 1992/93:98, p. 29 as well as the final reports of the Standing Committee on Industry and Trade, 1988/89:NU31 and 1989/90:NU24.

C.1.2. Ultimate responsibility

Article 4.2

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

The requirement on ultimate responsibility for the safe and responsible disposal of radioactive waste or spent fuel is fulfilled in the following paragraphs.

The disposal of radioactive waste and radioactive material is regulated in Section 20–20c in the Radiation Protection Act (1988:220) and stipulates that a license is required for depositing radioactive substance or a material containing radioactive substances in Sweden. Section 5a first paragraph and Section 5b third paragraph of the Act (1984:3) on Nuclear Activities prohibits disposal of radioactive waste in a repository in Sweden without a specific licence. See also text under Article 4.4 below.

Section 20 second paragraph in the Radiation Protection Act regulates radioactive substance and radioactive material that originates from another country and has been processed or reprocessed in Sweden. Similarly Section 5a second paragraph part 1 in the Act on Nuclear Activities regulates radioactive waste and radioactive material that originates from another country and has been processed or reprocessed in Sweden. According to these provisions the radioactive waste, substance or material shall be disposed of in the Member State or third country from which the radioactive material originated.

C.1.3. Principles

Article 4.3

National policies shall be based on all of the following principles:

As mentioned above in sections A 5.5 policies on spent fuel and radioactive waste management have evolved in pace with the emergence of the nuclear energy programme.

The national requirements implementing the principles in Article 4.3 are accounted for in the following sections.

Interdependencies in waste management and minimisation of radioactive waste

Article 4.3 (a)

the generation of radioactive waste shall be kept to the minimum which is reasonably practicable, both in terms of activity and volume, by means of appropriate design measures and of operating and decommissioning practices, including the recycling and reuse of materials;

The general principles on natural cycles and conservation are defined in Chapter 2, Section 5 of the Environmental Code (1998:808).

Sections 13–14 in the Radiation Protection Act (1988:220) and Section 10 in the Act (1984:3) on Nuclear Activities regulates management and disposal of decommissioning waste.

Also, Section 1 of Chapter 6 in SSMFS 2008:1 contains specific provisions addressing that:

- The handling of nuclear material at the facility shall, as far as is reasonable and possible be adapted to the requirements for its continued handling and use.
- For nuclear materials that are no longer intended to be used, and for nuclear waste, management activities at the plant should be adapted to requirements for their continuing care, including subsequent transport and disposal.
- Nuclear activities shall be carried out so as the amount of nuclear waste and its content of radioactive substances is limited as far as reasonably possible.

Article 4.3 (b)

the interdependencies between all steps in spent fuel and radioactive waste generation and management shall be taken into account;

The fact that the license holders are responsible for the handling and disposal of the radioactive waste they generate provides an incentive to consider all steps from waste generation to disposal.

The general obligations on a licensee are prescribed in Section 10 in the Act (1984:3) on Nuclear Activities. Subsections 2 and 3 specify that a party that holds a license for nuclear activities is responsible for ensuring that all the necessary measures are taken for safe management and disposal of radioactive waste until the waste has been placed in a permanently sealed repository.

Sections 13–14 in the Radiation Protection Act (1988:220) also regulate the responsibilities concerning radioactive waste.

In addition, Section 3 of Chapter 6 SSMFS 2008:1 contains specific requirements on license holders for nuclear activities where waste arises to establish waste plans for the further management, including disposal.

Long term safety based on passive safety features

Article 4.3 (c)

spent fuel and radioactive waste shall be safely managed, including in the long term with passive safety features;

Chapter 2, Section 3 in the Environmental Code (1998:808) regulates safety measures.

Safe management of spent fuel and radioactive waste from nuclear activities is primarily regulated in Sections 4, 5–5b and Section 10 of the Act (1984:3) on Nuclear Activities. Correspondingly, safe management of radioactive waste from non-nuclear activities is primarily regulated in Sections 6–8 and 13–14 of the Radiation Protection Act (1988:220). Section 1 of the Ordinance (2008:452) with instructions for the Swedish Radiation Safety Authority, regulates SSM's responsibilities including issues concerning safety.

Section 2 of Chapter 6 in SSMFS 2008:1 contains general requirements on the design of nuclear facilities to be based on passive safety features as far as possible and reasonable. More specific requirement are found in Section 2 of The Swedish Radiation Safety Authority's regulations concerning safety in connection with the disposal of nuclear

material and nuclear waste (SSMFS 2008:21) where it is explicitly stated that safety after the closure of a repository shall be maintained through a system of passive barriers.

Application of a graded approach

Article 4.3 (d)

implementation of measures shall follow a graded approach;

The main rule is that licenses are required for activities involving radiation and nuclear activities according to the Radiation Protection Act (1988:220) and the Act (1984:3) on Nuclear Activities. Licenses are also required for certain types of activities under the Environmental Code (1998:808). The law is, however, designed so that it provides the ability to customize the licensing and regulatory process according to the type of nuclear and radioactive activity.

For example, the general obligations under Section 6 of the Radiation Protection Act shall be fulfilled taking into account the nature of the activity and the conditions under which it is conducted. Likewise, the general obligations for licensees under Section 10 in the Act on Nuclear Activities take into the nature of the operation and the circumstances in which it is conducted.

Furthermore the general consideration rules under Chapter 2 Section 2 and 3 of the Environmental Code should be applied in view of the scope and nature of the activity at hand. In Chapter 2, Section 7 of the Environmental Code, it is stated that rules shall be applicable where compliance cannot be deemed unreasonable, and that particular importance shall be attached in this connection to the benefits of protective measures and other precautions in relation to their cost. The Act on Nuclear Activities and the Radiation Protection Act refers explicitly to Chapter 2 of the Environmental Code.

According to the principle of graded approach the implementation of measures can be adjusted by making exemptions from the requirements in regulations that are not required when considering radiation safety (se for example Chapter 16 of the Environmental Code, Section 14 Act on Nuclear Activities and Section 4 of the Ordinance (1988:293) on Radiation Protection).

SSM also has the possibility to make exemptions from legislation (se Section 3 Radiation Protection Act and Section 2 a Act on Nuclear Activities).

Other tools for using a graded approach include the possibility to add conditions to a license with respect to radiation protection (se for example Section 2 a Act on Nuclear Activities and Section 26 Radiation Protection Act).

The concept of graded approach is also addressed in the general regulation SSMFS 2008:1. Section 1 of Chapter 2 in SSMFS 2008:1 specifies that radiological accidents shall be prevented through a facility specific and fundamental design which shall incorporate multiple barriers as well as a facility-specific system for defense in depth. There are also provisions for the application of a graded approach by means of references to a “facility-specific” approach as regards construction (Chapter 3, Section 1) and operation (Chapter 3, Section 3) of facilities, as well as for classification of structures, systems and components (Chapter 3, Section 4).

As indicated above, the general regulations in SSMFS 2008:1 also include general advice to those regulations. The general advice indicates in a general sense the practices by which the regulator would consider that the objective with a specific requirement is fulfilled. A licensee may choose an alternative solution to achieve the objective with that specific requirement (with reference to application of graded approach), provided that the regulator approves of it.

Costs to be borne by waste generator

Article 4.3 (e)

the costs for the management of spent fuel and radioactive waste shall be borne by those who generated those materials;

Basic requirements related to obligations to cover the costs for management and disposal of spent fuel and radioactive waste are found in Section 13 of the Act (1984:3) on Nuclear Activities. It is explicitly stated that anyone who has a license to conduct nuclear activities is bound to be responsible for the cost of the measures referred to in Sections 10-12 of the act, i.e. for (subsequent) management and disposal of spent fuel and nuclear waste.

Detailed provisions are found in the Act (2006:647) and Ordinance (2008:715) on Financial Measures for the Management of Residual Products from Nuclear Activities and the Act (1988:1597) and Ordinance (1988:1598) on Financing of Certain Radioactive Waste etc., which deals with covering of expenses for management of nuclear waste from older experimental activities.

With regard to non-nuclear activities where radioactive material is used for example for medical purposes, industry, agriculture, research and education, any party that has produced radioactive waste is, according to Section 13 of the Radiation Protection Act (1988:220), required to ensure the safe management and disposal of the waste, including securing financial resources.

The Ordinance (2007:193) on Producer Liability for certain radioactive products and radioactive sources with no owner also regulates the management of radioactive waste.

See also section C.6 on financial resources.

Evidence-based and documented decision-making process

Article 4.3 (f)

an evidence-based and documented decision-making process shall be applied with regard to all stages of the management of spent fuel and radioactive waste.

The Administrative Procedure Act (1986:223) contains general provisions on authorities in a decision process. According to Section 13 of the Act the authority is obliged to ensure that a case is sufficiently investigated. This means that the Authority should send a file to an external referral when this needed. The documented decision-making process and that the parties shall have the opportunity to comment on information before a matter is determined follows from Section 15–17 of the same Act. Sections 20–25 describe how a decision should be formulated and handled.

Section 7 of the Ordinance (2008:452) with instructions for the Swedish Radiation Safety Authority states that SSM shall, by means of communication and transparency, contribute toward public insight into all operations encompassed by the Authority's mandate.

Chapter 16 regulates the decision-making-process for certain decisions according to the Environmental Code (1998:808).

How the applications should be made and what is needed for a decision is found in the Act (1984:3) on Nuclear Activities and the Radiation Protection Act (1988:220) with associated ordinances and regulations.

Nuclear facilities are licensed under the Act (1984:3) on Nuclear Activities, and the Environmental Code. A Governmental decision related to licensing of a nuclear facility include license conditions, authorizing SSM to approve the construction, the trial

operation including commissioning, the routine operation and the decommissioning of the facility. Hence, SSM has to approve each stage in the lifetime of the facility. Each decision issued by SSM in this regard is founded on the regulatory review of an application from the licensee, based on an appropriate collection of arguments and evidence (safety demonstration) to justify the decision. Details on the system of licensing are found in section C.2.1.

The Safety Analysis Report (SAR) is central in the overall decision-making process. According to Chapter 4, Section 2 SSMFS 2008:1, the SAR shall provide an overall view of how the safety of the facility is arranged in order to protect human health and the environment against nuclear accidents. The report shall reflect the facility as built, analyzed and verified, as well as show how the requirements on its design, function, organization and activities are met. A preliminary SAR shall be compiled before a facility may be constructed and, for an existing facility, before major refurbishing or rebuilding work or major modifications are carried out. The SAR shall be updated before trial operation of the facility may commence so that the report reflects the facility as built. The SAR shall be supplemented, taking the experience of such trial operation into account, before the facility is subsequently taken into operation. The preliminary SAR as well as the updated and supplemented SAR shall at all stages have been reviewed and approved by the Swedish Radiation Safety Authority. The SAR shall subsequently be kept up-to-date. In addition, and as appropriate, SSM examines the organizational, human and administrative capacity to carry out works to the extent and the quality required as well as preliminary plans for decommissioning of the facility.

C.1.4. Disposal of waste in other Member States or third countries

Article 4.4 first paragraph

Radioactive waste shall be disposed of in the Member State in which it was generated, unless at the time of shipment an agreement, taking into account the criteria established by the Commission in accordance with Article 16(2) of Directive 2006/117/Euratom, has entered into force between the Member State concerned and another Member State or a third country to use a disposal facility in one of them.

Prior to a shipment to a third country, the exporting Member State shall inform the Commission of the content of any such agreement and take reasonable measures to be assured that:

- (a) the country of destination has concluded an agreement with the Community covering spent fuel and radioactive waste management or is a party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management ('the Joint Convention');*
- (b) the country of destination has radioactive waste management and disposal programmes with objectives representing a high level of safety equivalent to those established by this Directive; and*
- (c) the disposal facility in the country of destination is authorised for the radioactive waste to be shipped, is operating prior to the shipment, and is managed in accordance with the requirements set down in the radioactive waste management and disposal programme of that country of destination.*

The Radiation Protection Act (1988:220) and the Act (1984:3) on Nuclear Activities contain basic provisions prohibiting export of spent nuclear fuel and nuclear waste for

disposal in other Member States or third countries, unless preconditions as specified in Article 4.4 are fulfilled.

Section 20 of the Radiation Protection Act stipulates that a license is required for depositing radioactive substance or a material containing radioactive substances in Sweden. According to Section 20 a 5 of the Radiation Protection Act a license is also required for disposing radioactive waste or substance in another country. Section 20 b of the Act regulates the requirements for such a license including an agreement between Sweden and the other state regulating conditions for the deposit. Further detailed requirements on the agreement and the license are stipulated in 13 b, 13 c and 13 e of the Ordinance (1988:293) on radiation protection.

The Act on Nuclear Activities specifically regulates nuclear facilities and Section 5 a of the Act prohibits disposal of radioactive waste, from a nuclear facility or from a nuclear activity abroad, in a repository in Sweden without a specific licence. Neither can radioactive waste from a nuclear activity in Sweden be disposed of abroad without a specific licence. The requirements for the license are regulated in 5 b of the same Act and include the requirement of an agreement between Sweden and the other state regulating conditions for the deposit. Detailed requirements on the agreement and license are stipulated in 19 a and 19 b of the Ordinance (1984:14) on Nuclear Activities.

Furthermore, detailed provisions, corresponding to Article 4.4 second paragraph (a), (b) and (c) concerning shipment to a third country, are found in Sections 13 d in the Ordinance on Radiation Protection and Sections 19 c of the Ordinance on Nuclear Activities.

Detailed provisions corresponding to the second paragraph in Article 4.4 (a), (b) and (c) about shipment third country exports in the directive are articulated in Sections 13 d in the Ordinance on radiation protection and Sections 19 c of the Ordinance on Nuclear Activities.

C.2. Article 5 – National framework

C.2.1. Legislative, regulatory and organisational framework

Article 5.1

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

In the following the main acts in the framework of safe management of radioactive waste and spent fuel are listed. Acts are in some cases supplemented by secondary legislation which contain more detailed provisions. The framework also contains legally binding safety and radiation protection regulations issued by SSM.

The following acts and ordinances describe procedures and responsibilities within the government.

- The Instrument of Government (1974:152)
- The Freedom of the Press Act (1949:105)
- The Administrative Procedure Act (1986:223)
- Ordinance (2008:452) with instructions for the Swedish Radiation Safety Authority

The following acts and code constitute the basic nuclear safety and radiation protection legislation:

- The Act (1984:3) on Nuclear Activities,
- The Radiation Protection Act (1988:220)
- The Environmental Code (1998:808)
- The Act (2006:647) on Financial Measures for the Management of Residual Products from Nuclear Activities
- The Act (1988:1597) on Financing of Certain Radioactive Waste etc., which deals with covering of expenses for management of nuclear waste from older experimental activities
- The Nuclear Liability Act (1968:45)

Operation of a nuclear facility can only be conducted in accordance with a licence issued under the Act (1984:3) on Nuclear Activities as well as with a licence issued under the Environmental Code (1988:808). The Act on Nuclear Activities is mainly concerned with issues of safety and security, while the Environmental Code regulates general aspects of the environment and the possible impacts of “environmentally hazardous activities”, to which nuclear activities are defined to belong. The Act and the Code shall be used in parallel and neither of them is superior to the other.

The objective of the Radiation Protection Act (1988:220) is to protect people, animals and the environment from the harmful effects of radiation. The Act applies to radiation protection in general and, in this context, it provides provisions regarding worker’s protection, radioactive waste management, and the protection of the general public and the environment.

The Act (2006:647) on Financial Measures for the Management of Residual Products from Nuclear Activities contains provisions concerning the future costs of spent fuel disposal, decommissioning of reactors and research in the field of nuclear waste. Means for that purpose have to be available when needed.

The Nuclear Liability Act (1968:45) implements Sweden’s obligations as a party to the 1960 Paris Convention on Third Party Liability in the Field of Nuclear Energy and the 1963 Brussels Convention Supplementary to the Paris Convention.

Other relevant acts are the Act on Control of Export of Dual-use Products and Technical Assistance (2000:1064) and the Act (2000:140) on Inspections according to International Agreements on Non-proliferation of Nuclear Weapons. Emergency preparedness matters are regulated by the Civil Protection Act (2003:778) and Ordinance (2003:789).

Examples of some more secondary legislation are for example the Ordinance (1988:293) on Radiation Protection and the Ordinance (1984:13) on Nuclear Activities, the Ordinance (2007:193) on Producer Liability for certain radioactive products and orphan radioactive sources, the Environmental Assessment Ordinance (2013:251) and the Environmental Inspection Ordinance (2011:13) and the Ordinance (2008:463) on certain fees to the Swedish Radiation Safety Authority.

The most important regulatory code issued by SSM in the area of safe management regarding safety is the Regulations and General Advice Concerning Safety in Certain Nuclear Facilities (SSMFS 2008:1). These general regulations are primarily worded to apply to nuclear power reactors, but are in a graded way applicable to all licensed nuclear facilities e.g., facilities for handling and storage of spent nuclear fuel and facilities for handling, storage or disposal of nuclear waste.

For disposal facilities there are two other important regulatory documents; The Swedish Radiation Safety Authority’s Regulations concerning safety in connection with the disposal of nuclear material and nuclear waste (SSMFS 2008:21), and The Swedish



Radiation Safety Authority's Regulations and General Advice Concerning the Protection of Human Health and the Environment in Connection with the Final Management of Spent Nuclear Fuel and Nuclear Waste (SSMFS 2008:37).

National programme

Article 5.1(a)

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

Section 12 of the Ordinance (2008:452) with instructions for the Swedish Radiation Safety Authority, requires SSM to ensure that there is a current national plan for the handling of nuclear material that is not intended for further use, nuclear and other radioactive waste. The plan must include the information that is necessary under Article 12 of Directive 2011/70/Euratom.

National arrangements for safety

Article 5.1 (b)

national arrangements for the safety of spent fuel and radioactive waste management. The determination of how those arrangements are to be adopted and through which instrument they are to be applied rests within the competence of the Member States;

With reference to its legal mandate SSM issues legally binding nuclear safety and radiation protection regulations for nuclear facilities in its Code of Statutes SSMFS and non-legally binding general advice on the implementation of the safety regulations. The Code of Statutes SSMFS, are issued according to established procedures documented in the management system which stipulates technical and legal reviews of the draft. In accordance with governmental rules, a review of the final draft by authorities, licensees, various stakeholders, and industrial and environmental organizations is performed. In preparation/development of SSM's regulations, EU legislation as well as IAEA safety standards, international recommendations, industrial standards and norms, and the rule-making of other authorities are considered.

System of licensing

Article 5.1 (c)

a system of licensing of spent fuel and radioactive waste management activities, facilities or both, including the prohibition of spent fuel or radioactive waste management activities, of the operation of a spent fuel or radioactive waste management facility without a licence or both and, if appropriate, prescribing conditions for further management of the activity, facility or both;

Any nuclear facility must be licensed according to both the Act (1984:3) on Nuclear Activities and the Environmental Code (1998:808). The Government grants the licence according to the Act on the basis of recommendations and reviews of the competent authority. A Government licence is needed for the construction, possession, operation and decommissioning of a nuclear facility. If significant changes are made to a licensed facility or in the case of de-licensing or exemption from responsibilities, a new Government decision is needed. A licence issued by the Government thus covers the

whole lifecycle of the facility. However, the Act (1984:3) on Nuclear Activities requires all licensees to at least every ten years perform a Periodic Safety Review (PSR) to ensure compliance with current regulations. A licence application is reviewed by the regulatory body and the environmental impact assessment is approved by the Land and Environmental Court before the Government's decision. A Government decision related to a nuclear facility includes license conditions, authorizing SSM to approve the construction, commissioning and testing, operation and decommissioning of the facility.

Following Government approval, the regulatory authority (SSM) authorizes the start of construction, the start of trial operations, the start of routine operations, and the decommissioning of the facility. A Government decision is again needed for de-licensing and the exemption from responsibilities. The authority reviews the application to ensure that all obligations and licensing conditions have been fulfilled.

The safety analysis report (SAR) is central in the review process and must be kept up to date throughout all the steps. The SAR should provide an overall view of how the safety of the facility is arranged in order to protect human health and, the environment against nuclear accidents. The report is to reflect the facility as it is built, analysed and verified, as well as show how the requirements on its design, function, organisation and activities are met.

In addition, and as appropriate, SSM examines the organisational, human and administrative capacity to carry out work to the extent and the quality required as well as preliminary plans for decommissioning of the facility. SSM also approves the routine operations at least every ten years through the Periodic Safety Review, PSR. This is to determine whether the necessary conditions exist to operate the facility in a safe manner until the next review.

The step by step licensing process is schematically illustrated in figure C.1 and summarized below.

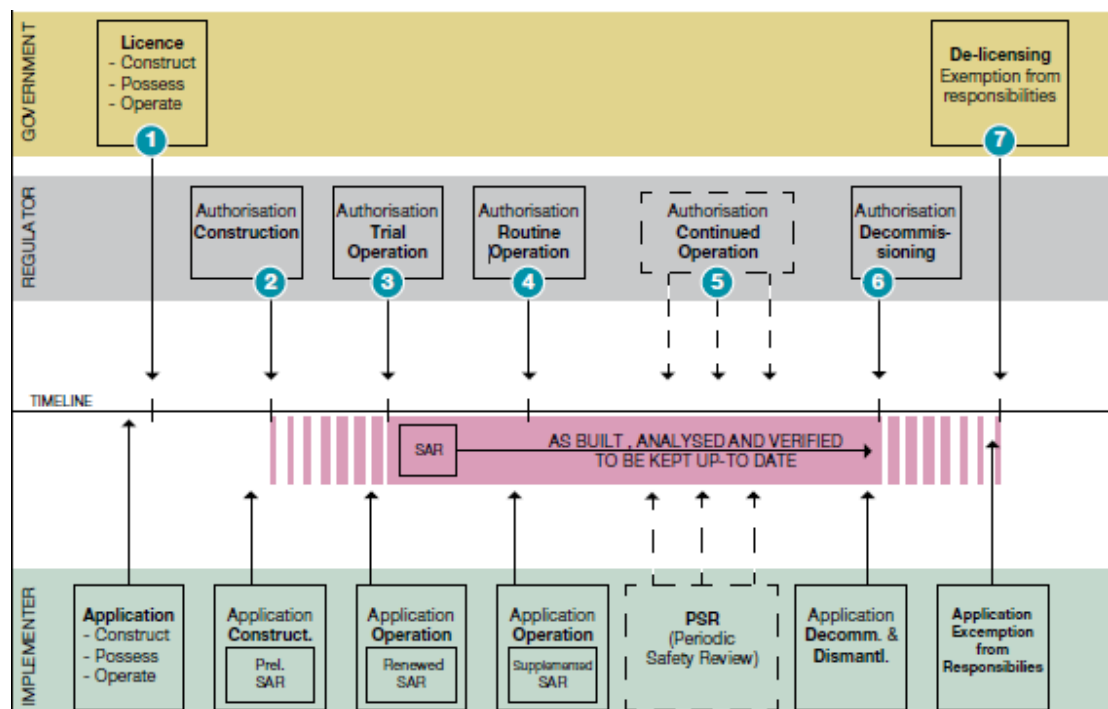


Figure C.1: Licensing system basic principles

1. Government licence to construct, possess and operate a nuclear facility

The licence covers the lifecycle of the facility until the licensee is exempted from responsibilities as regards the facility/site. General obligations as regards management and disposal of spent nuclear fuel and nuclear waste remains until disposal facilities are sealed and closed. Review activities according to the Act (1984:3) on Nuclear Activities focus on feasibility to establish the activities and the facility at the proposed site. A parallel licensing process according to the Environmental Code (1998:808) focuses on permissibility and the site selection process.

2. Regulatory authorization to start construction

The authorization is based on a regulatory review of the preliminary safety analysis report (PSAR). Review activities focus on that the preliminary design is compatible with legal and regulatory requirements and according to licence conditions.

3. Regulatory authorization to start trial operation

The authorization is based on a regulatory review of a renewed SAR. Review activities focus on that the facility as built is in compliance with legal and regulatory requirements and according to licence conditions.

4. Regulatory authorization to start routine operation

The authorization is based on a regulatory review of a supplemented SAR taking into account the experience gained from trial operation. Review activities focus on experiences from the trial operation period and that the operation of the facility is in compliance with the operational Limits and Conditions (OLC) and according to licence conditions.

5. Periodic Safety Review (at least every ten years)

The authorization is based on a regulatory review, an integrated analysis and overall assessment of the safety of the facility, concerning the way in which the facility at the time of analysis complies with the valid safety requirements as well as whether the necessary conditions exist to operate the facility in a safe manner until the next review occasion.

6. Regulatory authorization to start decommissioning

The authorization is based on a regulatory review of that the decommissioning plan has been properly supplemented and incorporated into the facility's safety report.

7. Exemption from responsibilities (for the facility) by the Government

The regulatory review focuses on verifying that the licensee has carried out all duties according to the legal and regulatory requirements and according licence conditions. General responsibilities for management and disposal of spent nuclear fuel and nuclear waste remains until all spent fuel and waste is disposed of and disposal facilities are sealed and closed.

Institutional control, regulatory inspection, documentation and reporting

Article 5.1 (d)

a system of appropriate control, a management system, regulatory inspections, documentation and reporting obligations for radioactive waste and spent fuel management activities, facilities or both, including appropriate measures for the post-closure periods of disposal facilities;

Management system

“management system” is in this context interpreted as the totality of accountabilities and interdependencies as well as coordination between organisations involved in establishing prerequisites for, and implementation of, a system for management and disposal of spent fuel and radioactive waste.

Institutional control

According to regulations on radiation protection the licence-holder shall conduct environmental monitoring. All discharges from facilities for storage or disposal of radioactive waste shall be monitored by a nuclide specific measuring programme. The dose to any individual in the critical group shall not exceed 0.1 mSv/y. The regulations are applicable to facilities in operation, but the plan is to amend these to also deal with the period following closure of a disposal facility for spent nuclear fuel and radioactive waste.

Regulatory inspection

In accordance with its legal authorisation and the mandate defined by the Government, the authority conducts regular inspections and assessments of the nuclear facilities to ascertain compliance with regulations and licence conditions.

The supervision of the compliance with the Act (1984:3) on Nuclear Activities and the Radiation Protection Act (1988:220), as well as conditions or regulations imposed under the acts, is executed by SSM. SSM also fulfils supervision of the compliance with the Environmental Code (1998:808) and conditions or regulations imposed by the Code concerning radiation safety. For other environmental aspects covered by the Code the County Administrative Board conducts supervision.

On request the implementer shall submit to the authority information and provide the documentation required for its supervision. The authority shall also be given access to the installation or site where the activities are conducted, for investigations and sampling, to the extent required for supervision.

Documentation and reporting

In SSM's Code of Statutes SSMFS extensive reporting from licence-holders are required. In this context the following reports can be mentioned:

- Annual integrated report to SSM of activities at the facility with experience gained and conclusions reached with regard to safety.
- Annual report to SSM on the management of nuclear waste.
- Annual report to SSM on the discharge of radioactive substances into air and water, shown as discharge of activity, and doses to individuals in a reference group.
- Annual report to SSM on the results of environment control.
- Annual information to SSM from all licensees of high activity sources (HASS).
- Without delay, a deficiency in any of the repository's barrier functions that is detected during the construction or operational surveillance of the repository, and that can lead to deterioration in safety after closure in addition to that anticipated in the safety analysis report, shall be reported to the SSM without unnecessary delay. The same applies if such a deficiency is suspected to occur or if it is suspected that such a deficiency may possibly occur in the future.
- The NPP licence holders shall annually report to the SSM on the measures that have been taken or are planned to be taken in order to limit the discharge of radioactive substances with a view to reaching the goal values. If the reference values are exceeded, the measures planned with a view to reaching the reference values shall be reported.

Provisions for institutional control and monitoring after closure

The holder of a licence for nuclear activities is responsible for ensuring that all measures are taken that are needed for the safe decommissioning and dismantling of facilities in which nuclear activities are no longer to be conducted. Post-closure safety of geological disposal facilities are required to be achieved through containment and isolation of the waste by passive means for the periods of time suited to its radiological hazards. Thus, post-closure institutional control and monitoring is not required for geological disposal facilities..

SSM has also issued conditions regarding institutional control of existing shallow land disposal facilities. The regulations stipulate that institutional control shall continue until the radioactivity no longer is a "significant" hazard to public health and the environment.

The State has an overall responsibility for activities regulated in the Act (1984:3) on Nuclear Activities. It follows that the State would be responsible for the arrangements and costs of any institutional control or monitoring possibly conducted after the licensee has been exempted from its responsibilities.

Enforcement actions

Article 5.1 (e)

enforcement actions, including the suspension of activities and the modification, expiration or revocation of a licence together with requirements, if appropriate, for alternative solutions that lead to improved safety;

The authorities have extensive legal regulatory and enforcement power according to the Act (1984:3) on Nuclear Activities, the Radiation Protection Act (1988:220) and the Environmental Code (1998:808) (see Chapter 16 and 24 in the Environmental Code, Sections 28, 29, 31–34 in the Radiation Protection Act and Sections 16–18 Act on Nuclear Activities). A licence may be revoked for activities that do not fulfil the obligations set out in the legislation Section 15 Act on Nuclear Activities and Section 28 the Radiation Protection Act).

In conjunction with the granting of a licence or during the period of validity of the licence, the licensing authority may issue conditions relating to the licence as are required with respect to nuclear safety (Section 8 of the Act on Nuclear Activities) or radiation protection (Section 26 of the Radiation protection Act).

If there is an on-going licensed activity that does not comply with regulations or terms of the licence, the supervisory authorities may issue any injunctions and prohibitions required in the specific case to ensure compliance. Injunctions or prohibitions under the Acts may carry contingent fines. If a person fails to carry out a measure that is mandatory according to the Acts, Ordinances, regulations or conditions issued pursuant to the Acts, or under the supervisory authority's injunction, the authority may arrange for the measure to be taken at his expense.

There are criminal penalty provisions in the Act on Nuclear Activities, the Radiation Protection Act and the Environmental Code. If there is reason to suspect that a penalty sanctioned provision has been infringed, SSM must notify the Prosecutor's Office about the violation.

Allocation of responsibilities to the bodies involved

Article 5.1 (f)

the allocation of responsibility to the bodies involved in the different steps of spent fuel and radioactive waste management; in particular, the national framework shall give primary responsibility for the spent fuel and radioactive waste to their generators or, under specific circumstances, to a licence holder to whom this responsibility has been entrusted by competent bodies;

The legal framework allocates a clear division of responsibilities between the bodies involved. As already mentioned, the producer of spent fuel and radioactive waste has the responsibility to safely handle and dispose of the waste produced. All necessary measures and precautions have to be taken by the waste producer and the waste producer remains responsible until all necessary measures and precautions have been fulfilled. The authorities independently supervise, regulate and review existing or planned activities with spent fuel and radioactive waste.

As described in section C 4.1, the ultimate responsibility for ensuring the safety of spent fuel and radioactive waste rests with the State. See also information about long term safety based on passive safety features in section C.1.3 and licence holders' responsibilities under section C.4.

Provisions for public information and participation

Article 5.1 (g)

national requirements for public information and participation;

The legal framework gives provisions for transparency, openness and public participation in the licensing of nuclear activities. There are several procedures that serve the purpose to involve the public in the siting of new spent nuclear fuel and nuclear waste facilities.

An Environmental Impact Assessment (EIA) must according to Chapter 6 of the Environmental Code (1998:808) be performed for any new nuclear facility. The legislation emphasizes the role of the public and other stakeholders in the EIA. The EIA must for instance contain a plan for the formal process on consultation with stakeholders. The developer must initiate early consultations with those parties that might be affected by a new facility. Parties that must be consulted include:

- municipalities that may host the facility,
- regulatory authorities, primarily SSM and County Administrative Boards,
- national environmental organisations,
- local interest groups, and
- affected individuals, e.g. land owners or those living close to a proposed location.

The County Administration Boards have an important function besides participating in the consultations. They are requested to assist the developer in identifying stakeholders and to facilitate consultations and an exchange of information.

Furthermore, the regulatory authority (SSM) is tasked to perform a formal consultation of the nuclear power plants' joint RD&D programme report that is produced and submitted to SSM by SKB. These consultations provide a broad range of concerned parties with information regarding new facilities as well as a possibility to state opinions in the pre-licensing process.

According to the Act (2006:647) and Ordinance (2008:715) on Financial Measures for the Management of Residual Products from Nuclear Activities, the municipalities that might host a spent nuclear fuel or nuclear waste facility, including a disposal facility, are reimbursed for information activities aimed at their citizens. Municipalities have been reimbursed for their information activities since the mid-1990s. Currently the municipalities of Östhammar and Oskarshamn are receiving reimbursement. In 2004 the Parliament approved a new regulation in the Act on Financial Measures, which made it possible also for non-profit non-governmental organisations to apply for financing. These organisations are entitled to financial support from the Nuclear Waste Fund until 12 months after the EIA has been announced by the Environmental Court. Decisions concerning reimbursement to municipalities and non-profit organisations are made by SSM.

Preceding the Government's licensing decision, the host municipality concerned has a right to veto and is to formally declare its support or rejection of the decision.

See also information under section C.7.1 in the report on transparency.

Financing provisions

Article 5.1 (h)

the financing scheme(s) for spent fuel and radioactive waste management in accordance with Article 9.

Basic requirements related to obligations to cover the costs for management and disposal of spent fuel and radioactive waste are found in Section 13 of the Act (1984:3) on Nuclear Activities. It is explicitly stated that anyone who has a license to conduct nuclear activities is bound to be responsible for the cost of the measures referred to in Sections 10-12 of the act, i.e. for (subsequent) management and disposal of spent fuel and nuclear waste.

Detailed provisions are found in the Act (2006:647) and Ordinance (2008:715) on Financial Measures for the Management of Residual Products from Nuclear Activities and the Act (1988:1597) and Ordinance (1988:1598) on Financing of Certain Radioactive Waste etc., which deals with covering of expenses for management of nuclear waste from older experimental activities.

With regard to non-nuclear activities where radioactive material is used for example for medical purposes, industry, agriculture, research and education, any party that has produced radioactive waste is, according to Section 13 of the Radiation Protection Act (1988:220), required to ensure the safe management and disposal of the waste, including securing financial resources.

The Ordinance (2007:193) on Producer Liability for certain radioactive products and radioactive sources with no owner also regulates the management of radioactive waste.

For more information on financial provisions, see also section C.6 on financial resources.

C.2.2. Improvement of the national framework

Article 5.2

Member States shall ensure that the national framework is maintained and improved when appropriate, taking into account operating experience, insights gained from safety analyses for operating nuclear installations, development of technology and results of safety research, when available and relevant.

Before the introduction of new legislation or major amendments of current legislation, a Committee of inquiry is appointed by the Government. The purpose is to investigate the issues in a comprehensive manner. To optimize the process and to ensure that no negative effects of the proposal will arise, the Committee or inquiry is staffed with people with the necessary expertise.

When SSM finds it necessary to introduce new regulations or revise current regulations, the Authority has to follow a specific procedure established in SSM's management system. Before a project is started an analysis report is required which among other things will summarize experiences of the supervisory activities or other background that causes the need for regulations. In addition, before an authority decides on regulations or general advice, the authority - in the extent necessary in each case – must investigate the cost implications and other consequences. Hereby SSM considers all consequences for not only the licensees but also the society in general before deciding upon new or revised regulations.

The improvement of the legislative and regulatory framework can be based on different aspects.

- Firstly, incidents at the facilities significant to safety are reported according to the relevant reporting requirements in SSMFS 2008:1. Hereby SSM is informed not only about the incident itself but also safety significance and circumstances which may have caused the incident. From the reporting, SSM may draw conclusions which are important when evaluating the need for updating of the framework.
- Secondly, from the general supervisory function point of view, the authority may observe tendencies in different safety issues which in the long term can be necessary to meet with new or revised requirements or recommendations. This is a constantly ongoing process at SSM.
- Thirdly, the outcome of the periodic safety reviews can contribute to the knowledge that clarification of current provisions may be necessary. In general, the regulatory reviews of the PSR reports have supported the safety improvement programmes adopted by the licensees.
- Fourthly, international peer reviews give valuable input to improvement of the national framework. The IRRS mission in Sweden in 2012 is a clear example. One of the recommendations regarded SSM's regulations. The report on the IRRS review recommended that SSM review the existing regulatory framework and make it clearer, more consistent and comprehensive. SSM has now begun a major review of its regulations.

SSM's supervisory practices for nuclear installations include compliance inspections with respect to requirements found in regulations, licensing conditions and to some extent in regulatory decisions. The ambition is to systematically supervise the safety situation and monitor developments based on a comprehensive inspection programme. The documented inspection findings provide a basis for SSM's annual integrated evaluation of radiation protection and safety on the part of each nuclear facility. Supervisory strategies are developed so as to facilitate the application of a graded approach in the inspection

programmes. Consideration is also given to recommendations from IRRS review missions as well as recommendations from collaboration as part of e.g. CNRA, WENRA and ENSREG.

C.3. Article 6 – Competent regulatory authority

C.3.1. Establish and maintain a competent regulatory authority

Article 6.1

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

Legal foundations of the regulatory authority

According to the Ordinance (2008:452) with instruction for the Swedish Radiation Safety Authority (SSM), SSM is the central administrative authority for issues of protection of people and the environment from harmful effects of ionizing and non-ionizing radiation, for issues in nuclear safety including security of nuclear technology activities as well as in other activities with radiation, and for issues regarding nuclear non-proliferation. SSM shall actively and preventively work for high levels of nuclear safety and radiation protection in the society.

SSM shall be a driving force for good radiation safety in the society in general and focus on the following:

- Preventing nuclear accidents and ensure safe operation and disposal of nuclear activities,
- Minimize risks and optimize the effects of radiation for medical purposes,
- Minimize the risks of radiation used in the products and services or which arise as a byproduct of the use of products and services;
- Minimize the risks associated with exposure to naturally occurring radiation, and
- Improve radiation safety internationally

See also section C.3.3 of this report on legal powers and associated relevant legislation.

Other authorities with responsibilities concerning nuclear safety

SSM is the main regulatory body regarding nuclear safety and radiation protection. Nevertheless there are other authorities responsible for different aspects of nuclear safety.

The Land and Environmental Courts

The Land and Environmental Courts are responsible for matters in relation to the Environmental Code (1988:808), for example applications for power up-grades. The court examines the application including the content of the environmental impact statement and how it has been developed by the applicant. The court must examine the overall issues such as siting and the planned facility's impact on the environment. However, there is no barrier for the court to also consider matters relating to nuclear safety and radiation protection.

The County Administrative Board

The County Administrative Board has a coordinating role in the environmental impact assessments in the licensing process of a nuclear facility. The three County Administrative Boards where the NPPs are located also have a dedicated role within the emergency preparedness system regarding nuclear accidents.

The Swedish Civil Contingencies Agency (MSB)

The authority was established on January 1, 2009. The task of the MSB is to enhance and support societal capacities for preparedness for and prevention of emergencies and crisis. When one does occur, the MSB support stakeholders involved by taking the right measures to control the situation.

Swedish National Grid (Svenska kraftnät)

The Swedish National Grid (Svenska Kraftnät) is a state-owned public utility. One of its important tasks is to transmit electricity from the major power stations to regional electricity networks, via the national electrical grid. This means that National Grid controls the power supply from the external grid towards the NPPs. The National Grid also has the task as regulatory body for the security regarding the energy supply, in this respect The Swedish National Grid has a status as an authority.

Swedish National Council for Nuclear Waste

The Swedish National Council for Nuclear Waste is an independent scientific advisory body linked to the Ministry of the Environment and Energy. The task of the Council is to carry out studies of issues related to nuclear waste and decommissioning of nuclear facilities, and to advise the Government and other public authorities in these areas.

C.3.2. Functional separation

Article 6.2

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

The Parliament (Riksdag) has the supreme legislative powers. The Government rules the country by enforcing decisions of the Riksdag and by initiating new legislation or amending existing legislation. The Government lays down rules in the form of ordinances. The Parliament and Government have also assigned certain central government authorities with the powers to issue regulations in their respective mandates and areas of operation.

Policy issues regarding nuclear safety and radiation protection are handled by the Minister for Climate and the Environment. Policy issues regarding production, distribution and use of energy are handled by the Minister for Energy. The state's ownership of the nuclear energy company Vattenfall AB is the responsibility of the Ministry of Enterprise and Innovation. The role of central government authorities is to implement political decisions and to ensure compliance with legislation and rules. The Government mainly directs the work of central government authorities by issuing ordinances, particularly in the form of official instructions. Annual appropriation directions serve as a supplement to the

instructions in the form of financial control, also as needed by defining additional assignments and through management by objectives.

The regulatory authority's independence is of fundamental importance in the Swedish constitution. SSM has an independent role and extensive powers to determine how its own tasks are to be performed. The authority is also autonomous in its exercise of public power in relation to individuals and in the context of applying legislation. This effective independence is a crucial component of the Swedish management model, which contributes towards public administration that is efficient, effective and follows the rule of law (the Instrument of Government (1974:152), especially Chapter 12 Sections 1 and 2).

The Director General of SSM is appointed by the Government, is exclusively responsible for the authority's activities. SSM has an advisory council with maximum ten members appointed by the Government. The function of the council is to advise the Director General and to ensure public insight into SSM's operations. Each year, the Authority undergoes an annual audit by the Swedish National Audit Office, an independent control body of the Riksdag.

Also, the provisions in Administrative Procedure Act(1986:223) regarding conflicts of interest are always applicable. The aim is to prevent officials who might have a vested interest in the issues to be decided to take part in the decision-making process. In addition, the Criminal Code provides for punishment of officials who disregard the requirements of their service. This means that anyone who breaches the high standards of impartiality and objectivity that governs the authorities, run the risk of being prosecuted.

C.3.3. Legal powers and financial resources

Article 6.3

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

Legal powers and associated relevant legislation

SSM has a legal mandate which enables the authority to issue legally binding safety and radiation protection regulations for nuclear facilities in its Code of Statutes SSMFS (See for example Sections 8 and 9 in the Ordinance (1988:293) on Radiation Protection and Sections 3 a–3 b in the Ordinance (1984:14) on Nuclear Activities). Beyond this, SSM also has the legal powers to impose licensing conditions if necessary due to safety reasons. SSM also has extensive legal powers to enforce its decisions and is authorized to decide in measures that are needed and issue orders and prohibitions in individual cases in order to enforce the Act (1984:3) on Nuclear Activities, regulations or licensing conditions issued with support of the Act.

The Act (1984:3) on Nuclear Activities

According to Section 4 and 9 of the Act the regulatory authority is authorized to issue regulations concerning safety matters and issues regarding verification, testing and inspection. Section 30 of the Act states that the Government or an authority appointed by the Government is authorized to issue regulations concerning fees for the authority's function according to the Act.

According to Sections 16–18 of the Act (and Section 22 of the Ordinance on Nuclear Activities) the supervision of compliance of the Act and the conditions or regulations issued under the Act are exercised by SSM.

According to Section 22 of the Act, SSM can also decide on fines in cases of non-compliance with licence conditions or regulations.

The Radiation Protection Act (1988:220)

Sections 29–33 of the Act (and Section 15 of the Ordinance (1988:293) on Radiation Protection) regulate the supervision of compliance of the Act and the conditions or regulations issued under the Act that are exercised by SSM.

SSM may issue prohibitions when required considering radiation protection (Section 15 the Radiation Protection Act).

The Environmental Code (1998:808)

According to Chapter 2 Section 1 and 26 in the Environmental Inspection Ordinance (2011:13), SSM is responsible for the supervision according to the Environmental Code in the case of activities that require a license under Environmental Assessment Ordinance (1998:905) and of activities under the Act on Nuclear Activities or activities involving radiation under the Radiation Protection Act. SSM is also responsible for giving regulatory guidance on issues certain issues according to Chapter 3 Section 14 in the Environmental Inspection Ordinance.

This means that SSM is responsible for regulatory supervision according to Chapter 26 of the Code and other areas of the Code that are a part of SSM:s mandate for example general rules of consideration according to Chapter 2, environmental impact assessments according to Chapter 6 and environmentally hazardous activities and health protection according to Chapter 9.

See also section C.1.3 in this report on the SSM:s mandate to use graded approach.

Financial resources

The regulatory activities of SSM are financed over the State budget. The costs are largely recovered from the licensees in the form of fees covering the cost of regulatory activities and related research. The Ordinance (2008:463) on certain fees to the Radiation Safety Authority provides for audit fees, fees for continuous supervision and research fees for various categories of nuclear facilities in order to ensure the authority the necessary financial resources. The fees are distributed to revenue heading and funding made through yearly budget appropriations. The amounts of the fees and the yearly budget appropriations to SSM are decided by the Government.

Other budget appropriation items at the Authority's disposal are directed towards international cooperation with Russia, for nuclear security and radiation protection in Eastern Europe and for management of orphan sources.

SSM also utilizes fee revenues for licensing activities and laboratory services.

Following a decision by the Government, certain regulatory supervision and licensing reviews of the nuclear industry's management and disposal of spent nuclear fuel as well as decommissioning of nuclear power plants and related areas, are financed through contributions from the Nuclear Waste Fund (see the Act (2006:647) on Financial Measures for the Management of Residual Products from Nuclear Activities and Section 34 in the Ordinance (2008:715) on Financial Measures for the Management of Residual Products from Nuclear Activities).

The appropriation item for research may be used for basic and applied research work on developing national competence in the Authority's areas of operation, also for supporting

and developing the Authority's regulatory supervision. Research work is mainly carried out by external experts and researchers engaged by the Authority.

SSM's total budget for its 2014 operations was approximately SEK 506 million, of which SEK 76 million earmarked for research and SEK 71 million sourced from the Nuclear Waste Fund.

Arrangements regarding availability of human resources

As of 1 January 2015, SSM had 321 employees with an average age of 47 years. The staff turnover rate, excluding retirements, was 5%.

SSM works continuously on long-term planning to identify recruitment needs and competence requirements. As a result of the many specialised areas and fields encompassed by the Authority's area of responsibility, SSM's employees have a relatively high level of education compared with many other public authorities. More than 30 per cent of SSM's employees have a university education, many with postgraduate degrees.

The Authority performs systematic professional skills assessments and gap analyses for providing SSM's senior management with input on the competence required by the Authority in both the short and long term. In spring 2012, SSM launched a continuous professional development programme for skilled supervision. The objective is for all employees involved in regulatory supervision to have the same basic skills for performing consistent supervisory work regardless of the area or licensee that is the focus of this supervision.

The purpose of SSM's research is sustaining and developing professional skills of importance for radiation safety work, both in-house on the part of the Authority's employees and on a national level. For these reasons, SSM provides funding not only for basic and applied research, but also for development of methods and processes that lead to improved national competence in the Authority's areas of operation. This also underpins and improves SSM's regulatory supervision.

SSM provides funding for several research projects and research positions at Swedish universities for the purposes of professional development and maintaining expertise and teaching skills. Areas of key importance include reactor physics, severe accidents and non-proliferation. SSM also provides funding for high level research positions in fields such as radiation biology, radioecology and dosimetry. The availability of research funding is also announced in the form of public invitations to apply for funding in the areas of radiation protection and waste management research.

The international nuclear safety cooperation is substantial; SSM is involved in more than 100 international groups related to nuclear safety and radiation protection issues. The cooperation takes place within the frameworks of IAEA, OECD/NEA and EU, but also in connection with the international conventions ratified by Sweden and in non-governmental organizations such as the Western European Nuclear Regulator's Association (WENRA), Heads of European Radiation Control Authorities (HERCA), and the International Nuclear Regulator's Association (INRA). In addition to multilateral collaboration, SSM has bilateral agreements with several countries to exchange information and to cooperate on agreed issues (e.g. nuclear safety, emergency preparedness, occupational exposure, environmental radiological protection and radioactive waste management). Additionally Sweden has special agreements with the Nordic Countries regarding emergency preparedness and information exchange on the technical design of nuclear facilities.

C.4. Article 7 – Licence holders

C.4.1. Prime responsibility for safety

Article 7.1

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

The Act (1984:3) on Nuclear Activities is clear about the prime responsibility for safety:

Nuclear activities shall according to Section 3 of the Act be conducted in a way so that the requirements imposed on safety are met.

According to Section 10 of the Act, the licensee for nuclear activities shall ensure that all measures are taken which are needed for:

- Maintaining safety, taking into account the nature of the activities and conditions under which they are conducted,
- The safe management and disposal of nuclear waste arising in the activities or therein arising nuclear material which is not reused, and
- The safe decommissioning and dismantling of facilities in which no longer nuclear activities are carried out.

Section 10, was amended in 2006 as follows:

The holder of a licence for nuclear activities shall, in connection with near-accidents, threats or other similar circumstance, without delay to the regulatory body report such information which is of consequence for the assessment of safety.

In the pre-work to the Act on Nuclear Activities it is stated that the licensee shall not only take measures to maintain safety but also measures to improve safety where this is justified.

According to Section 14 of the Act, the obligations under Section 10 shall remain until they have been fulfilled, regardless of whether a licence has been revoked or has expired.

An exemption from the obligations imposed under Section 10 may be granted by the Government or the public authority appointed by the Government.

Section 5 of the Act on Nuclear Activities stipulates that nuclear activities can only be conducted in accordance with a licence issued under the Act. A licence is required for construction, possession and operation of a nuclear facility. A licence to operate a facility applies only to the licensee and is not transferable to another person.

Rules on the use of contractors in nuclear operation

All contractors whom the licence holders plan to use in nuclear operations need approval – upon application – by SSM. On 1 July 2006, more strict requirements on the use of contractors for nuclear activities entered into force. According to the new wording of the Act on Nuclear Activities (1984:3), Section 5, at most two contractors are allowed to be involved in a specific task. This means that it is no longer possible to run a system where one general entrepreneur has several sub-contractors. Based on the amendment of the Ordinance (1984:14) on Nuclear Activities, the regulatory authority issued regulations on some specific exemptions from the requirement of approval of contractors. A simplified notification procedure can be used for most types of nuclear activities, provided that the

prescribed management and control measures, as well as satisfying assessment of contractors, has been conducted. Such exemption from approval is only allowed in cases with a single (one) contractor.

The legal and regulatory requirements are currently under review due to the enter into force of EC Directive 2014/87/Euratom.

C.4.2. . Systematic safety assessments

Article 7.2

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

The SSM regulations SSMFS 2008:1 on safety in nuclear facilities specify the responsibility of the licensee through a number of fundamental requirements on safety management, design and construction, safety analysis and review, operations, nuclear materials-/waste management and documentation/archiving. In addition it is clearly pointed out in these regulations (Chapter 2, Section 9, item 8) that safety shall be monitored and followed up by the licensee on a routine basis, deviations identified and corrected so that safety is maintained and further developed according to valid objectives and strategies. Any reasonable measure useful for safety shall be taken as a result of this proactive and continuous safety work and be documented in a safety programme that shall be updated annually (Chapter 2, Section 10).

The SSM regulations spell out three basic control principles, making the roles clear between licensee and regulator:

- Approval by SSM (in specified matters) after primary and independent safety review by the licensee.
- Notification of SSM (in specified matters) after primary and independent safety review by the licensee.
- Self-inspection by the licensees according to their own management systems.

The basic safety documentation (SAR including OLCs, plans for emergency response and physical protection) must be formally approved by SSM. Facility and organizational modifications and changes in the safety documentation are to be notified and SSM can, if needed, impose additional conditions and requirements. All other issues are handled under the licensees' self-inspection. SSM examines how this liability is managed.

Continuous improvement

Safety management

The licensees work continuously with safety improvement. All nuclear licensees have safety programmes in place as required by SSM regulations SSMFS 2008:1. The programmes are part of the management system documentation. They contain priorities and time schedules for technical, organizational and administrative measures to be implemented as a result of safety analyses, audits, safety culture surveys and other evaluations done at the facility.

All licensees are committed to maintaining a strong safety culture in their operations. Management at all levels, including the managing directors, is involved in activities to enhance the safety culture and to stress the responsibility of all personnel to work actively in maintaining and developing the safety culture standard.

International cooperation

The nuclear power plant and fuel cycle facility licensees have traditionally been quite active in international cooperation to enhance nuclear safety by sharing experience, contributing to work with international regulations and guidelines and in participating in safety assessments and peer reviews. This is today primarily accomplished through memberships in WANO, in participating in IAEA and OECD/NEA activities and various task forces representing most of the disciplines in nuclear facilities.

Verification of safety

A number of different verification programmes are used in order to ensure that the physical state and the operation of the nuclear installation continue to be in accordance with its design, safety requirements, and its operational limits and conditions. These programs can be gathered in the groups: surveillance, in-service inspection, preventive maintenance and safety reviews. The following are the most important points.

Surveillance

The operational limits and conditions (OLC) are described in the operational limits and conditions document. The OLC document also clarifies what types and with what frequency functional tests are to be carried out in order to verify that components and systems are ready for operation. These tests are carried out in accordance with documented procedures and all test results are reviewed and documented.

Preventive maintenance

Maintenance is optimised with regard to the relation between corrective and preventive maintenance. The preventive maintenance implemented at the nuclear facilities includes predictive (condition-based), periodic and planned maintenance, and serves the purpose of maintaining equipment within its design and operating conditions and extending its life, thereby eliminating, or at least minimizing, the risk for failures that can limit safe and reliable facility operation. A well-balanced preventive maintenance programme is based on engineering analysis in which safety as well as economic aspects are considered. The programme is well defined and periodically revised as additional operational experience is gained.

Periodic maintenance consists of activities performed on a routine basis, and may include any combination of external/internal inspection, alignment or calibration, overhaul, and component or equipment replacement. Typically, any deficiencies found by predictive or periodic maintenance are addressed by corrective or planned maintenance.

Periodic safety assessments

The licensees of nuclear installations are according to Section 10a of the Act (1984:3) on Nuclear Activities required to carry out a Periodic Safety Review (PSR) at least every 10 years. The review shall verify that the facility complies with the current safety requirements as well as having the prerequisites for safe operation until the next periodic safety review, taking into account advances in science and technology. The analyses, assessments and proposed measures as a result of the review shall be submitted to SSM. The requirement applies to all nuclear facilities but SSM has been authorized to decide on exemptions when the risks associated with the facility are small.

The outcomes of the PSRs are reported to SSM, who performs a comprehensive review and assessment of the report and its references.

C.4.3. Safety demonstration and prevention of accidents

Article 7.3

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

Safety demonstration

According to the Environmental Code (1998:808) and Act (1984:3) on Nuclear Activities a licence is required to construct, possess and operate any nuclear facility. A licence application must demonstrate that the requirements are fulfilled under those acts as well as the Radiation Protection Act (1988:220). It must further be demonstrated that the more detailed requirements in SSM's regulations can be met. The most important regulations in this context are:

- Regulations Concerning Safety in Nuclear Facilities (SSMFS 2008:1)
- Regulations Concerning safety in connection with the disposal of nuclear materials and nuclear waste (SSMFS 2008:21)
- Regulations Concerning the Protection of Human Health and the Environment in Connection with the Final Management of Spent Nuclear Fuel and Nuclear Waste (SSMFS 2008:37)

Key input to the licence application is the EIA and a preliminary safety report.

The procedures for carrying out the EIA, as well as its contents, are specified in the Environmental Code. The EIA must contain the following elements:

- A description of the activity or measure with details of its location, design and scope.
- A description of the measures being planned with a view to avoiding, mitigating or remedying adverse effects.
- The information needed to establish and assess the main impacts on human health, the environment and management of land, water and other resources that the activity or measure is likely to have.
- A description of possible alternative sites and alternative designs, together with a statement of the reasons why a specific alternative was chosen and a description of the consequences if the activity or measure is not implemented.
- A non-technical summary of the information.

Requirements on the content of the safety report are given in the Regulations Concerning Safety in Nuclear Facilities, and include for example:

- A description of how the site and its surroundings, from the standpoint of safety, can affect the facility.
- A description of the design basis, including the requirements that have determined the design and construction of the facility. Descriptions of facilities for the handling of spent fuel or nuclear waste shall contain requirements that are determined by the description of safety in the particular disposal facility after closure.
- A description of measures taken to ensure adequate protection of workers, the public and the environment from radiation, as required by the Radiation Protection Act (1988:220) and regulations promulgated according to that act.

Prevention of accidents and mitigation of consequences

The general safety regulations SSMFS 2008:1 apply to measures required to maintain safety in connection with the construction, possession and operation of nuclear facilities with the aim of, as far as reasonably achievable, taking into account the best available technology, preventing radiological accidents and preventing the unlawful handling of nuclear material and nuclear waste.

According to Chapter 2 Section 1 radiological accidents shall be prevented through a facility-specific and fundamental design which shall incorporate multiple barriers as well as a facility-specific system for defence-in-depth. Defence-in-depth shall be achieved by preventing accidents and mitigate the consequences if an accident does occur.

Chapter 2 Section 3 stipulates that an observed deficiency or if there is reason to suspect that there is a deficiency in a barrier or in the defence-in-depth system, measures shall be taken to the extent and within the time frame necessary depending on the severity of the deficiency. For this purpose, the deficiencies shall be evaluated, classified and investigated without delay.

Chapter 4 Section 1 requires an analysis of a facility's barriers and defence-in-depth system to prevent radiological accidents and mitigate the consequences in the event of an accident.

More specific requirements on design and construction are given in Chapter 3 of SSMFS 2008:1. These can be summarized in the following points.

The design shall

- Be able to withstand component and system failures,
- Be reliable and have operational stability,
- Be able to withstand such events and conditions which can affect the safety function of the barriers or defence-in-depth, as well as
- Make it possible to maintain, inspect and test structures, systems and components and as far as reasonable facilitate a safe future decommissioning.

It is further required that design principles and design solutions shall be tested under realistic conditions, or if this is not possible or reasonable, have undergone the necessary testing or evaluation with regard to safety. Design solutions shall be adapted to the ability of the personnel to manage the facility in a safe manner as well as to manage abnormal events, incidents and accidents. Functionally based safety classification is also required. In the general advice on these legally binding requirements, guidance is given on their interpretation and application.

Prevention of accidents during the operation

According to SSMFS 2008:1 Chapter 5 Section 1, the licensee is obliged to establish procedures which have been drawn up for measures to be taken at a facility during normal operation, abnormal operation and design basis accidents.

It is also necessary for the licensees to establish documented guidelines for measures which may be necessary to implement in order to control and mitigate the consequences of beyond design basis accidents.

The operational limits and conditions for nuclear facilities are included in an operational document named STF (Säkerhetstekniska driftförutsättningar = Technical Specifications). This document is considered one of the cornerstones in the governing and regulation of the operations of nuclear facilities.

Mitigation of consequences of accidents

SSM's regulations SSMFS 2008:1 require the licensee, in the event of emergencies, to take prompt actions in order to:

- Classify the event according to the alarm criteria,
- Alert the facility's emergency preparedness organisation,
- Assess the risk for and size of possible releases and time related aspects,
- Return the facility to a safe and stable state, and
- Inform the responsible authorities.

The actions shall be documented in an emergency preparedness plan which is subject to safety review by the licensee and must be approved by SSM. The plan shall be kept up to date and validated through regular exercises. SSM shall be notified of changes in the plan.

The SSM regulations SSMFS 2008:15 on emergency planning and preparedness at nuclear installations have a radiation protection perspective. They are mainly based on the IAEA Safety Standards GS-R-2: Preparedness and Response for a Nuclear or Radiological Emergency and include requirements on:

- Emergency planning
- Alarm criteria and alarming
- Emergency rooms/premises/facilities
- Assembly places
- Iodine prophylaxis
- Personal protective equipment
- Evacuation plan
- Training and exercises
- Contacts with SSM
- Radiation monitoring
- Emergency ventilation
- Collection of meteorological data.

Depending on the radiological hazard potential, the requirements regarding radiation monitoring, emergency ventilation, and collection of meteorological data differ between the facilities.

C.4.4. Integrated management systems

Article 7.4

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

Regulatory requirements on management systems

The SSM general safety regulations SSMFS 2008:1, Chapter 2, Section 8 require that nuclear activities with regard to design and construction, operation and decommissioning, shall be managed, controlled, assessed and developed through a management system so designed that requirements on safety will be met. The management system, including the necessary routines and procedures, shall be kept up to date and be documented. This view on quality and safety being integrated with other business concerns into a total integrated management system is in line with the IAEA Safety Requirements on Management Systems, GS-R-3.

It is further required in SSMFS 2008:1 that the application of the management system, its efficiency and effectiveness, shall be audited systematically and periodically by a function having an independent position in relation to the activities being audited. An established audit programme shall exist at the facility. In the general advice to the regulations it is made clear that the management system should cover all nuclear activities at the facility. Furthermore, it should be clear from the management system how contractors and vendors are to be audited, and how to keep results from these audits up to date.

The internal audit function should have a sufficiently strong and independent position in the organization and should report to the highest management of the facility. The audits should have continuity and auditors should have good knowledge about activities being audited.

Main features of the management systems implemented by the licensees

The licence holders have integrated management systems where requirements addressed to the operation are provided for in a systematic manner. Safety issues have a special status in the management systems.

The main features of the licence holder's management systems can be summarized in the following areas:

- The structure of the management system
- How requirements regarding radiation safety are converted and met
- Aims and guidelines for radiation safety
- Structure, responsibility and decision-making of the organization
- How organization modifications are handled
- Procedures for competence assurance
- The operative radiation protection work
- Activities and eventual processes identify process owners plus how activities and processes are evaluated and developed
- Interaction with external organizations of importance for radiation safety
- How the requirements on radiation safety are satisfied when tendering products and services
- How guiding documents shall be initiated, reviewed, approved and revised.

Verification of the management system

In a systematic and continuous manner SSM follows-up how the management system is structured and how the licensees work with its suitability as an integrated part of the inspection programme. Important factors are that the management systems are up-dated and how the licensees deal with requirements management.

Furthermore, SSM also carries out random sampling within different areas. The purpose is to review how a specific area, for example system for feedback of experience, is controlled and applied by the management systems.

C.4.5. Licence holders' financial and human resources

Article 7.5

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

According to Section 13 of the Act (1984:3) on Nuclear Activities, a licensee is obliged to have an organisation for the activity with sufficient financial, administrative and human resources to uphold safety and to take protective measures in the event of disruptions in the operations or accidents in the facility.

The legal requirement clarifies the licensee's obligation to have an organization formed and staffed in such a manner that it ensures a safe and reliable operation of all activities related to nuclear safety and meets the need for effective measures in an emergency situation. This applies even to the contractors hired by the licensee.

Great importance is given to the licensee's ability to be responsible for the obligations arising from the nuclear activities. The licensee must demonstrate the financial capacity to meet far reaching obligations in a long term.

In addition to this basic requirement, the Act (2006:647) on Financial Measures for the Management of Residual Products from Nuclear Activities defines the responsibilities pertaining to the management and disposal of spent nuclear fuel and radioactive waste. The Act lays down the principles for the financing of expenses for the future decommissioning and disposal of spent nuclear fuel and nuclear waste for all nuclear licensees. The main objective is to minimize the risk of the state and future generations being forced to bear costs considered to be the liability of licensees for nuclear facilities. Apart from the fees to be paid to the nuclear waste fund, the licensees must also provide guarantees in case a facility is closed prematurely and to cover contingencies. The financing system is described more in detail in section 9 in this report.

C.5. Article 8 – Expertise and skills

Article 8

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

C.5.1. Legal requirements concerning education and training

According to the general regulations SSMFS 2008:1 the licensee has to ensure that the staff has the competence and suitability needed for all tasks of importance for safety and this has to be documented. Long-term planning is required in order to ensure enough staff with sufficient competence and suitability for the safety related tasks are available. A systematic approach should be used for the definition of competence requirements, planning and evaluation of all safety related training. Annual competence assessments shall be performed. These general requirements apply also to the extent applicable on the use of contractors. It is also a requirement that there is a careful balance between the use of in-house personnel and contractors for safety related tasks. The competence necessary for ordering, managing and evaluation of the results of contracted work should always exist within the organization of a nuclear installation.

C.5.2. Education and training of the staff of the licence holders

All licensees are required to have an established process for competence assurance. SSM is the appointed authority to supervise the licensees compliance to the requirements. The process usually consists of the following parts:

- Identification of tasks relevant for safety,
- Identification of existing staff competence
- Identification of relevant and necessary staff competence
- Performing a gap analysis.

In view of the performed gap analysis, the licensees develop relevant educational programmes or training in order to achieve the right skills among the staff, both in short and long term perspective.

All licensees have a systematic approach in place for the training of staff, as required. Training programmes are developed based on task analysis and definitions of required competence. A systematic method is also used to define any re-training that is required.

C.5.3. Education and training on the national level

The academic institutions are a source of specialists to the nuclear sector. The Government is responsible for funding of basic university training. Experimental research within safety and radiation protection is performed at Chalmers University, Royal Institute of Technology, Uppsala University, Stockholm University and Lund University.

SSM is by Government ordinance tasked with contributing to development of national competence within the Authority's areas of operation. The purpose of SSM's research is sustaining and developing professional skills of importance for radiation safety work, both in-house on the part of the Authority's employees and on a national level. For these reasons, SSM provides funding for several research projects and research positions at Swedish universities, not only for basic and applied research, but also for development of methods and processes that lead to improved national competence in the Authority's areas of operation. The availability of research funding is also announced in the form of public invitations to apply for funding in the areas of radiation protection and waste management research. Research in the areas of final disposal of spent nuclear fuel and decommissioning of nuclear facilities is financed through the Nuclear Waste Fund. Funding is for example awarded to research projects on canister corrosion, biosphere processes, bentonite and backfill, geosphere processes, fuel processes and consequence/impact analyses. The purpose of this research is to provide input for ongoing

and future reviews, including impending review elements as part of the step-wise licensing processes that disposal facilities are subject to. The research funding also has the aim of longer term maintenance of know-how, skills and continuity in areas, fields and disciplines relating to final disposal of radioactive waste. Alongside the funding for research projects, the Authority provides funding to researchers at institutions of higher education.

C.5.4. Education and training of the staff of the regulatory authority

A long-term plan on competence needs for SSM was established after the forming of SSM in 2008 and it is continuously up-dated with systematic professional skills assessments and gap analyses to provide SSM's senior management with input on the competence required by the Authority in both the short and long term.

On the basis of individual competence development plans, all employee competence needs are identified on a yearly basis and training is performed to meet both individual and operational needs. An average of 5-6 days per employee are used for training and skills development each year, besides "on the job" training and mentorship assignments. Individual needs of training courses and competence development in general are usually met by training courses on the market.

A basic training programme is given to all new employees in the following areas: authority role, occupational health, safety and SSM's core operations. The aim is to foster a deeper understanding of the Authority's activities and to give new employees an important network. On the part of SSM management, development efforts include leadership programmes and organisational and systems skills.

SSM in spring 2012 launched a comprehensive training programme in skilled supervision. The programme is compulsory for all employees involved in supervisory work. The aim is to ensure the right level of competence for all supervisory personnel and inspection leaders leading to more consistent supervisory inspections, regardless of organisational department performing the supervision or the licence holder being supervised. The programme is since a few years well established and operational. The training courses given covers the internal processes of the management system, the legal framework for regulatory activities, IT and security routines, project management, inspection methodology, nuclear technology, nuclear power plant and systems courses, as well as media training.

As mentioned above, SSM's funding of research contributes to sustaining and developing professional skills of importance also for the Authority's radiation safety work. Other developments to further enhance the Authority's supervisory skills include the development of its management system, including the exchange of experiences with other regulatory authorities on supervisory methodologies for radiation safety.

C.6. Article 9 – Financial resources

Article 9

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

For more information on legal provisions for arrangements for availability of financial resources, see also section C.2.1 on financing provisions.

C.6.1. Nuclear power plants

The financing system was established in 1981 to secure the financing of the nuclear power plant licensees' future costs for the management and disposal of spent nuclear fuel and nuclear waste. The main objective is to minimize the risk of the state and future generations being forced to bear costs considered to be the liability of licensees. If there is insufficient money in the funds to pay for the costs, the nuclear industry will still be liable.

The nuclear power utilities' cost estimates are coordinated by SKB and a detailed report including all cost estimates is submitted to the regulator, SSM, every three years for review. SSM reviews the cost estimates and calculates the fees and guarantees to be set individually for each utility. The reference scenario is based on the reactor owners' current plans for future reactor operation. The fees are calculated on the assumption that each reactor will generate electricity for 40 years, but always with a minimum remaining operating time of six years. Based on SSM's statement, the fees to be paid to the nuclear waste fund and the guarantees are decided on by the Government for a period of three years. The management of this nuclear waste fund is the responsibility of a separate government agency: the Nuclear Waste Fund. The Swedish National Debt Office administrates and manages the guarantees.

Two separate guarantees must be provided by the power plant utilities:

- to cover the shortfall if a reactor is closed before it has reached its 40 years of operating time, and
- to cover costs in connection with unexpected events.

To date, the Nuclear Waste Fund has covered SKB's expenses for the central interim storage facility for spent nuclear fuel (Clab), for the transport system and for the research and development activities, laboratories, siting and feasibility studies included. Future expenses should cover the encapsulation plant for spent fuel, repositories for spent fuel and long-lived low and intermediate level waste, the decommissioning and dismantling of nuclear power plants, the disposal facility for decommissioning waste and the continued research and development work. The waste fund also finances regulatory control and supervision following closure of reactors.

C.6.2. Other nuclear facilities

Licensees other than nuclear power reactor operators must also pay fees to the Nuclear Waste Fund. The cost estimates and the build-up of adequate financial resources are to be based on the expected remaining period of operation. Licensees of nuclear facilities other than nuclear power reactors must also provide a guarantee to cover the discrepancy between funded means and estimated costs.

The nuclear waste fees and guarantees for other nuclear facilities are decided on by the regulatory authority, SSM, for a period of three years.

C.6.3. Legacy waste

There is also a funding mechanism for legacy waste from historic nuclear activities. A special fee is levied on the nuclear power utilities according to the Act (1988:1597) on Financing of Certain Radioactive Waste etc., which deals with covering of expenses for

management of nuclear waste from older experimental activities, the ‘Studsvik Act’. The fee is intended to cover expenses for the decommissioning of the research reactors in Studsvik, the Ågesta reactor and the uranium mine in Ranstad.

The Studsvik Act stipulates a set fee of SEK 0.003 per kWh of produced nuclear electricity (ca EUR 0.3 per MWh). The Act is in effect until 2017, when the fund should be complete. SSM reviews the fee on a yearly basis and can propose changes in legislation to the Government if needed.

In addition, there is a state financing scheme for the clean-up of orphan sources and other legacy waste that is administered by SSM through the Swedish Environmental Protection Agency's appropriation “1.4 Remediation and restoration of contaminated areas”.

C.6.4. Radioactive waste from non-nuclear activities

With regard to non-nuclear activities where radioactive material is used for example for medical purposes, industry, agriculture, research and education, any party that has produced radioactive waste is, according to Section 13 of The Radiation Protection Act (1988:220), required to ensure the safe management and disposal of the waste, including securing financial resources.

C.7. Article 10 – Transparency

C.7.1. Openness and public information

Article 10.1

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

Legal requirements for making information available to the public

The right of public access to official records is inscribed in the Swedish constitution. All official documents are public unless a decision is made to classify them according to the Public Access to Information and Secrecy Act (SFS 2009:400). The reasons for confidentiality could be national security, international relations, commercial relations, or the individual right to privacy. To see a public document there is no need to justify or to reveal identity to have access to such document.

If an authority has rejected a request to obtain a document, the applicant is generally entitled to appeal against the decision. Appeals are made to the administrative court of appeal.

SSM's missions and tasks are defined in the Ordinance (2008:452) with instructions for the Swedish Radiation Safety Authority. According to Section 7 SSM is responsible to contribute toward public insight into all activities performed by the authority. The aim is to promote health and prevent ill-health, prevent acute radiation injuries and reduce the

risk of delayed injuries due to radiation, and to provide advice and information about radiation, its properties and areas of application and about radiation protection.

Public insight and the tasks of local safety boards are regulated by the Act (1984:3) on Nuclear Activities and by Ordinance (2007:1054) on Instructions for the Local Safety Boards of Nuclear Facilities. A party that holds a licence to operate a nuclear power or research reactor, or a facility for the production, management, processing, storage or disposal of nuclear material or nuclear waste, is under an obligation to provide the local safety board with the insight necessary for it to be able to inform the public on the safety and radiation protection work at the facility.

The regulatory authority's communications strategy

SSM uses its website (www.ssm.se) as a source of information about relevant current events and official decisions, and as a means of communicating to the general public as well as to occupational users whose work involves radiation. SSM gives advice and recommendations and provides information in the event of a nuclear energy accident or other incident involving radiation via the Authority's website and through social media.

The Swedish right of public access to official records not only gives the public and mass media the right to gain insight into SSM's organisation and its work, but also the right to access the Authority's official documents, provided they are not subject to secrecy. SSM's online register (e-registry), which contains details about the Authority's registered items of business, is available to the general public from the website. All reports issued by SSM may be ordered. Some are downloadable from the SSM website. An emergency website linked to SSM's public website can be activated during an event or accident with a radiation hazard.

See also section C.2.1 in this report on provisions for public information and participation.

C.7.2. Public participation

Article 10.2

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

The legal framework for the licensing of nuclear activities gives provisions also for transparency, openness and public participation. There are several procedures that serve the purpose to involve the public in the siting of new spent nuclear fuel and nuclear waste facilities.

As mentioned in section C.2.1 of this report, an EIA (Environmental Impact Assessment) must be performed for any new nuclear facility or any nuclear facility applying for a new license. The legislation emphasizes the role of the public and other stakeholders in the EIA. The EIA must for instance contain a plan for the formal process on consultation with stakeholders. The developer must initiate early consultations with those parties that might be affected by a new facility. Parties that must be consulted include:

- municipalities that may host the facility,
- regulatory authorities, primarily SSM and County Administrative Boards,
- national environmental organisations,
- local interest groups, and
- affected individuals, e.g. land owners or those living close to a proposed location.

The County Administration Boards have an important function besides participating in the consultations. They are requested to assist the developer in identifying stakeholders and to facilitate consultations and an exchange of information.

Furthermore, the regulatory authority (SSM) is tasked to perform a formal consultation of the nuclear power plants' joint RD&D programme that is produced and submitted to SSM by SKB. These consultations provide a broad range of concerned parties with information regarding new facilities as well as a possibility to state opinions in the pre-licensing process.

According to the Act (2006:647) and Ordinance (2008:715) on Financial Measures for the Management of Residual Products from Nuclear Activities, the municipalities that might host a spent nuclear fuel or nuclear waste facility, including a disposal facility, are reimbursed for information activities aimed at their citizens. Currently, the municipalities of Östhammar and Oskarshamn are receiving reimbursement. Since 2004 it is also possible for non-profit, non-governmental organisations to apply for financial support from the Nuclear Waste Fund in the siting and licensing process for a spent nuclear fuel repository. This is applicable until 12 months after the EIA has been announced by the Land and Environmental Court. Decisions concerning reimbursement to municipalities and non-profit organisations are made by SSM.

Preceding a Government's licensing decision on an encapsulation plant and a spent nuclear fuel repository, the host municipality concerned has a right to veto and must formally declare its support or rejection of the decision. In practice, the formal consultations, the financial support to host municipalities and certain environmental organisations, and the municipal right to veto have so far been very beneficial to the overall quality and public acceptance of the licensing process for a spent fuel repository. SKB's strategy to involve the local communities on a voluntary basis in the siting process for a spent fuel repository has been another important factor.

Also the Aarhus Convention establishes a number of rights of the public (individuals and their associations) with regard to the environment. The Parties to the Convention are required to make the necessary provisions so that public authorities (at national, regional or local level) will contribute to these rights to become effective.

C.8. Article 11 – National programme

C.8.1. Implementation of the national programme

Article 11.1

Each Member State shall ensure the implementation of its national programme for the management of spent fuel and radioactive waste ('national programme'), covering all types of spent fuel and radioactive waste under its jurisdiction and all stages of spent fuel and radioactive waste management from generation to disposal.

SSM is by the Ordinance (2008:452) with instructions for the Swedish Radiation Safety Authority responsible for maintaining an up-to-date National plan for the management of spent fuel and radioactive waste. This plan must contain the information necessary under Article 12 of Council Directive 2011/70/Euratom.

The first National plan [11], published in 2015, is a comprehensive account of national policies, the legal and organisational framework and strategies governing the management

of spent fuel and radioactive waste. A presentation is also made covering quantities of spent nuclear fuel and radioactive waste as well as estimates of future quantities.

The National plan, as well as a translation of the National plan, [12] with its main references, covering all the items provided for in Article 12, has been notified to the Commission as Sweden's national programme on implementing national policies for the responsible and safe management of spent fuel and radioactive waste, as required by Articles 13.1 and 15.4, respectively.

Recent development as regards management and disposal of spent fuel and radioactive waste are presented in section B Summary. As for the date for submission of this report no significant changes in the program for management and disposal of spent fuel and radioactive waste was identified.

C.8.2. Review and update of the national programme

Article 11.2

Each Member State shall regularly review and update its national programme, taking into account technical and scientific progress as appropriate as well as recommendations, lessons learned and good practices from peer reviews.

Section 12 of the Ordinance (2008:452) with instructions for the Swedish Radiation Safety Authority requires SSM to ensure that there is a current national plan that includes the information that is necessary under Article 12 of Directive 2011/70/Euratom.

The main references to the National plan comprise the following latest reports of the system of environmental objectives, the programme for research, development and demonstration and the financing system.

- *In-depth evaluation of the environmental objectives 2012. Steps along the way, Swedish Environmental Protection Agency, Report 6500, 2012*
- *RD&D Programme 2013. Programme for research, development and demonstration of methods for the management and disposal of nuclear waste, SKB TR-13-18, SKB, 2013,*
- *Plan 2013. Costs from and including 2015 for the radioactive residual products from nuclear power. Basis for fees and guarantees for the period 2015-2017, SKB TR-14-16, 2013.*

The in-depth evaluation of the environmental objectives is performed every four years. The RD&D programme and Plan cost estimate reports are up-dated and reviewed every three years. The National plan [11, 12] contains an in-depth description of the processes in place for review and update of the main reference documents to the National plan. In the National plan it is also described how the results of the authority's review of safety analysis reports, international peer reviews and international cooperation activities are used as means to further follow-up the technical and scientific progress of the national programme.



C.9. Article 12 – National programme

C.9.1. Spent fuel and radioactive waste inventory and future estimates

Article 12.1

The national programmes shall set out how the Member States intend to implement their national policies referred to in Article 4 for the responsible and safe management of spent fuel and radioactive waste to secure the aims of this Directive, and shall include all of the following:

...

(c) an inventory of all spent fuel and radioactive waste and estimates for future quantities, including those from decommissioning, clearly indicating the location and amount of the radioactive waste and spent fuel in accordance with appropriate classification of the radioactive waste.

An overview of current and estimated future volumes of radioactive waste and spent fuel arising is presented in table C.1.



Table C.1: Current/estimated volumes of waste and spent fuel arising (31 December 2013)

Type	Current Amount	Estimated disposal amount ^{*)}	Current Disposal Capacity	Total forecast at 2030	Disposal Capacity at 2030	Total forecast at 2050	Disposal Capacity at 2050
Spent Fuel Storage	6296			9500		4000	
Wet storage (AR)	556						
Wet storage (AFR)	5740						
Dry storage (AR)	0						
Dry storage (AFR)	0						
Total amount Spent Fuel sent to Reprocessing and Recycling	145			0		0	
Total amount Spent fuel disposed	0		0	0	0	8000	12600
Waste in storage:							
VLLW-SL	2058	2058		2000		2000	
LLW-SL	2745	2745		3000		3000	
ILW-SL	4213	4213		4000		4000	
LILW-LL	4000	8000		12000		10000	
Waste disposal:							
VLLW-SL	19659		38540				
LLW-SL	15007		22000	50000	108400	100000	108400
ILW-SL	19946		38500	40000	59400	50000	59400
LILW-LL	0		0	0	0	5000	16000

AR = "at reactor site"

AFR = "away from reactor site"

^{*)} calculated equivalent amount when waste has been conditioned and packaged for disposal as per table of conversion factors given.

References

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2. ENSREG Final Guidelines for Member States Reports to the Waste Directive <http://www.ensreg.eu>
3. In-depth evaluation of the environmental objectives 2012. Steps along the way, Swedish Environmental Protection Agency, Report 6500, 2012,
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5. Review and evaluation of the Swedish Nuclear Fuel and Waste Management Company's RD&D Programme 2013, Statement to the Government and summary of the review report, SSM report 2014:12 (in Swedish)
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8. SSM statement regarding nuclear waste fees and financing and supplementary amounts for 2015-2017 under the Act (2006: 647) on Financing of of Management of Residual Products from Nuclear Activities, SSM2013-6255
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10. Ds 2014:32 Sweden's fifth national report under the Joint Convention on the safety of spent fuel management and the safety of radioactive waste management
<http://www.stralsakerhetsmyndigheten.se/Ds2014-32>
11. Ansvarsfull och säker hantering av använt kärnbränsle och radioaktivt avfall I Sverige, Nationell plan SSM report 2015:31, 2015.
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