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KVU – Handling of Norwegian Spent Fuel and other Radioactive Waste

Operation of the intermediate storage facility, Task 6

Bengt Hallberg
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Studsvik Report

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2014-10-01
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Abstract

This report give the results of technical Task 6 of the KVU (Concept selection study) for a possible solutions for handling the situation with spent nuclear fuel and radioactive waste are identified and analyzed.

The main objective for this report is to establish what requirements exist regarding organization for operation of the intermediate storage, and to describe alternatives regarding such organisations and present costs for each option.

New organizational structure is proposed which would give an precondition for effective, skilled and long-term safe operation of all facilities with a focus on the intermediate storage and repository.

Reviewed by		Approved by	
2015-01-20		2015-01-20	
Sture Nordlinder	Date	Lars Johansson	Date

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1 Introduction and method

This report was issued within the project KVU – Handling of Norwegian Spent Fuel and other Radioactive Waste ("Konseptvalgsutredning," KVU). Responsible for the report is Task 6 – Operation of the Intermediate Storage Facility.

Appedix A lists the contributors to the project. A glossary is found as Appendix B.

1.1 Purpose

This task report (Task 6) is part of a KVU (Concept selection study) where possible solutions for handling the situation with spent fuel and other radioactive waste are identified and analysed. Also, the scope for the KVU was expanded to include short-lived radioactive waste (waste that is deposited at Himdalen today) as the capacity of the Himdalen repository for this type of waste is reached in 2030, − i.e within the time period that the KVU shall cover.

The purpose of Task 6 is to:

- Identify specific requirements affecting the operation of facilities for storing radioactive waste. This sub-task covers a detailed assessment of the specific operational requirements.
- Identify all possible solutions for of organization and management of storage for radioactive waste. The work will be based on the experience of the Consortium and on international recommendations and guidelines.
- Identify the most relevant options for configuration and organization the management of the waste management organization.
- Assess the selected options of organization for the intermediate storage. In addition, it should be described the impact of the basic principles of the technical operation conditions. It will have a direct impact on size diagram and skill/expertise requested for the new organization.
- Summarize recommendations for optimal structure of Norwegian waste disposal structure and organization and recommended optimal structures and organization.

The main objective for this report is to establish what requirements exist regarding organisation for operation of the intermediate storage.

Another purpose is to describe the reference alternative as regards organisation. This alternative means that no new intermediate storage will be built before decommissioning of reactors and other nuclear facilities belonging to Institutt for Energiteknikk (IFE), and hence spent fuel and long-lived radioactive waste have to be kept at IFE site(s).

1.2 Method

Information was mainly gathered from Norwegian Law and Norwegian authority regulations. International guides and requirements were also consulted. Those parts concerned with organisational issues were selected and documented in this task report.

Investigation and information on today's existing facilities in terms of cost and staffing have IFE contact submitted to the project investigators. Information is then evaluated and questioned in many cases. The interface in today's organization is a bit difficult to interpret in all sections to fit into the reported tables. The author has, however, so far as possible, transferred these to the current report's summary

1.3 Basis for the analysis

This section describes the basis for the analysis.

Short-lived radioactive waste is kept at KLDRA in Himdalen. The repository has capacity to operate to the year 2030, accepting waste from operation and decommissioning /D118/. The facility is operated by IFE.

IFE has in Kjeller:

- a reactor (JEEP II),
- a treatment and storage facility for radioactive waste, and,
- a storage space for spent nuclear fuel.

At Halden, there is:

- a reactor (HBWR), and,
- a storage for spent nuclear fuel.

According to the tendering documentation from the Ministry of Trade, Industry and Fishery, IFE’s storage space will last until about the year 2025 for HBWR fuel, and about the year 2032 for JEEP II fuel.

Difference between an oraganisation for operation of a facility for storage of waste vs. repository is discussed. (This can be seen by the requirements of Chapter 4 and the organization proposed in Chapter 5).

The study shall also take into account the extended task to also include short-lived waste. (This does not affect the organizational structure of any large scale, however some additional resources may be needed).

2 Background

The nuclear activities at IFE has generated about 17 tonnes of spent reactor fuel, currently stored at seven storages at IFE's plants in Halden and at Kjeller.

In principle the reactors can be closed whenever the Norwegian Radiation Protection Authority (NRPA) should find that continued operation is not acceptable, or if IFE does not find it profitable to continue operating. Stored fuel and radioactive waste, in addition to the waste generated from decommissioning, must then be treated. At present, it is most likely not possible to store all fuel and waste in existing stores, in case of a decommissioning. It is, according to the tender documentation, capacity at their store until 2025 (Halden) and 2032 (Kjeller) with the current operation.

There is a need for a safe, prudent and cost-effective intermediate storage solution for existing and future spent nuclear fuel and other long-lived radioactive waste, where the environment, health and safety are maintained in accordance with national law and relevant international recommendations.

The need for safe interim storage of radioactive waste and spent nuclear fuel has been subject to several committees appointed by the Norwegian government looking into possible solutions. The studies carried out all conclude that there is a need for a new intermediate storage solution in Norway.

3 Conclusions and recommendations

The staffing, competence and costs have been evaluated for the reference alternative and selected alternatives. In Chapter 5 presents the reference alternative in most parts similar of today's organization at IFE. In the same chapter presents also proposed options for intermediate storage and disposal of all radioactive waste in Norway.

Special arrangements for the management of radioactive waste are necessary because of the radiological hazards associated with it. A clear strategy and good practice are necessary for the transfer of waste from one operator to another one. Since waste may be stored for extended periods of time prior to its disposal, the regulatory body should confirm that the operator is providing the necessary human, technical and financial resources for the lifetime of the storage facility, to the extent that such confirmation is within its statutory obligations.

The legal framework should include provisions to ensure a clear allocation of responsibility for safety throughout the entire process of predisposal management, in particular with respect to storage, and including any transfer between operators. A review of the legal framework has been performed and no serious flaws has been identified.

The continuity of responsibility for safety should be ensured by means of authorization by the regulatory body. The regulatory and operational responsibilities for radioactive waste management should be clearly specified and functionally separated. A single organization should not be given both operational and regulatory responsibility for waste management. In Chapter 5, presents a proposed a shared organization might look like. The organizational structure is similar to of how SKB AB in Sweden has organized the company to handle all radioactive waste for the country.

Systems for financing radioactive waste management and disposal of the radioactive waste has to be established, this has not been an issue for this task, but is essential for safe management of long-lived radioactive waste. The financing system must provide sufficient funding for future activities at the time required. This main challenge arises out of uncertainties about future technological, economic and social developments. There is a time lap of several decades between the time of waste generation, waste storage and the time when the last step, final disposal, is carried out. It follows that there are also large gaps in time between receipt of the revenue out of which waste management costs will need to be covered and the actual incurring of those costs. Obviously, technological development continues during this time, and the institutional framework tends to adapt to the improving technology.

The structure and configuration of an organizations that would be suitable manage a storage facility for radioactive waste including staffing and competence both at operation and maintenance are suggested for the options considered. The organization should be set up to be able to take over waste from al present operation as well as future generation of radioactive waste.

It is very important that when the new organization and the facilities are planned and implemented, they must meet all requirements as reported in Chapter 4 Requirements.

Conclusion and recommendation are following:

Organization
New organizational structure is proposed as shown in Figure 4 below. It gives a precondition for effective, skilled and long-term safe operation of all facilities with a focus on the intermediate storage and repository.

Alternative
Combined alternative, build a combined storage facility in the mountains with an intermediate storage for spent fuel (BB/brukt brensle) in casks and repository for other radioactive waste (ARA/annat radiactivt avfall). It provides the ability to send the fuel for reprocessing after a decision at a later stage. Himdalen fills up completed and phase out the storage on both Halden and Kjeller

Organizations Cost
The cost of a joint organization for all types of waste will be most effective alternatives. Otherwise increased costs must expect in connection with commissioning and education of staff at newly built facilities.

It should be also take into account retaining the experience and skills of existing staff as far as possible in the new organization. Location should be considered from a human perspective.

The cost does not differ between the alternatives as much extent that this determines the choice of storage options.

It should be clearly commented that overhead costs (e.g. financial management, communication, certain development costs, Security Audit, quality assurance, etc.) are not included in the accounts in any alternatives below.

4 Requirements

4.1 Requirement types

Requirements from authorities on organisation may be divided into two types:

- direct requirements, e.g. on certain persons with special competence, and,
- indirect requirements, e.g. on certain documentation.

The latter type of requirements is indirect in the sense that they influence how a licensee will set up an organisation, e.g. as regards staff size and staff competence, both of which will vary during the facility's life cycle. Most requirements are indirect.

Requirements are put by the authorities on a licensee through acts of law, regulations, licences and/or other means.

4.2 National applicable acts and regulations

This section lists applicable acts according to Norwegian law and regulations /D118/:

Norwegian Law	Regulations
Act on Nuclear Energy Activities (ANEA) (in Norwegian: Lov om atomenergivirksomhet, LOV-1972-05-12-28)	• Regulations of 2 November 1984 on the Physical Protection of Nuclear Material • Regulations of 15 November 1985 on Exemption from the Act on Atomic Energy Activity for Small Amounts of Nuclear Material • Regulations of 12 May 2000 on Possession, Transfer and Transportation of Nuclear Material and Dual-use Equipment • Regulations of 14 December 2001 on Financial Compensation after Nuclear Accidents

Act on Radiation Protection and Use of Radiation (RPA) (in Norwegian: Lov om strålevern og bruk av stråling [strålevernloven], LOV-2000-05-12-36)	• Regulation on Radiation Protection and Use of Radiation of 29 October 2010 • Regulation on the Applicability of the Act on Radiation Protection and Use of Radiation on Svalbard and Jan Mayen of 9 May 2003 • Regulation relating to Systematic Health, Environmental and Safety Activities in Enterprises of 6 December 1996 (based on several acts, RPA incl.)
Act Concerning Protection against Pollution and Concerning Waste	• Regulation on the application of the Pollution Control Act on Radioactive Pollution and Radioactive Waste of 1 November 2010 • Regulation on the Recycling of Waste of 1 June 2004 • Regulation on Pollution control of 1 June 2004
Royal Decree of 17 February 2006 (emergency preparedness)	
Act of 10 August 2012 No. 61 on Planning and Building Activities	• Regulations concerning impact assessments of 26 June 2009 No. 855

4.2.1 Requirements in laws and regulations

This section presents a summary of parts of regulatory documents that give requirements on organisation. A comprehensive list is given as Appendix C. It should be noted that laws and requirements in Norwegian are those that have legal status, but not the translations to English given here.

4.2.1.1 Direct requirements

Requirements were categorised for the purpose of clarity. The following direct requirements are made:

General:

- The management and personnel shall have proper qualification and clear areas of responsibility.

Physical protection, on-site:

- The licensee shall organise a *Security Unit*, with *guards*.
- Entrance to a controlled area shall be through a *reception* or *central guard service*, which shall always be manned.
- No one shall be alone in a vital area, unless special surveillance is employed.

Physical protection, transports:

- For each transport, an *On-site Transport Coordinator* shall be appointed.
- For Class II or Class III material, an *Off-site Transport Coordinator* shall be selected.
- Personnel involved in transport of material shall be authorised1.

Radiation Protection:

- A *Radiation Protection Manager* shall be appointed.
- Concerned personnel shall have competence in radiation protection and the safe use of radiation.
- Personnel who need special consideration, e.g. due to pregnancy, shall be given tasks with low radiation impact.

Nuclear materials and equipment:

- A *Safeguards Manager (*literally translated: *Manager of Nuclear Materials and Equipment)* shall be appointed, who will act as liaison with the NRPA.

Protection against pollution and on waste:

- Personnel involved in practices that may cause pollution shall have special competence.
- The NRPA may instigate establishment of a sewage plant, and prescibe competence of its staff.

1 No reference to whom shall give authorisation was found.

4.2.1.2 Indirect requirements

Indirect requirements are given in this section, divided into categories for clarity.

Documentation:

- *Safety Analysis Report* (*SAR*).
- *Environmental Impact Assessment*.
- *Emergency Preparedness Plan*.
- *Declarations of Radioactive Waste*.
- *Design Base Threat Analysis*.
- *SAR for Physical Protection*.
- *Preparedness Plan for Physical Protection*.

Management system:

- The management system shall be designed to document knowledge and experience.
- Applicable laws and regulations health, environment and safety shall be made available for employees.
- A programme for internal control of health, environment and safety shall be implemented and carried out in cooperation with the employees. The programme shall include assessement of risks and contingency plans, objectives, systematic control procedures, and education.
- Special instructions for Security Personnel shall be made.

Design and operation:

- The facility shall be kept in proper working condition.
- Changes in construction, operation or management must be approved by the NRPA.

Radiation protection:

- Competence as regards record-keeping for internal checks and authority inspection shall be employed.
- The facility shall be designed to be a radiation safe workplace, incl. work procedures, shielding and personal protective equipment (PPE).
- Radiation sources shall be labelled, radiological zoning shall be applied, and proper education shall be given to those who will enter those zones.

- Radiation and doses shall be measured.
- Releases to the environment shall be monitored.

Safeguards:

- An inventory list of nuclear materials shall be kept. Treatment data and material balance shall be sent to NRPA on request
- The facility shall be accessible for safeguard inspection.
- Each transport package shall be given a seal.

Radioactive waste:

- Radioactive waste shall be declared as to: origin, content and physical/chemical state.
- Packages shall be clearly labeled according to a scheme that is approved by the NRPA, and accompanied by a waste declaration.

Emergency preparedness:

- Information pertaining to accidents shall be given to Rescue Services and the NRPA.
- Measures shall be planned together with local authorities.

Decommissioning:

- When decommissioning the facility, the licensee shall provide long-term protection of the environment from pollution.

4.3 International requirements and guidelines concerning organisation

A list of international requirements and guidelines on management of spent fuel and radioactive waste is given in this section. They represent a selection of the many available documents.

Document	Comment
IAEA (2012a). Storage of Spent Nuclear Fuel. Specific Safety Guide SSG-15	
IAEA (2006). The management system for facilities and activities. Safety Requirements GS-R-3	Reference 5 of IAEA/2012a/
IAEA (2011a). Radiation protection and safety of radiation sources: international basic safety standards: general safety requirements Part 3. – Interim edition. General Safety Requirements GSR Part 3	Reference 9 of IAEA/2012a/
IAEA (2009). Predisposal management of radioactive waste. General Safety Requirements GSR Part 5	Reference 30 of IAEA/2012a/
IAEA (2011b). Disposal of radioactive waste. Specific Safety Requirements SSR-5	
IAEA (2008). The management system for the disposal of radioactive waste: safety guide. GS-G-3.4	Reference 14 of IAEA/2011b/
IAEA (2012b). Regulations for the safe transport of radioactive material: specific safety requirements – 2012 edition. SSR-6	
ICRP (2007). The 2007 recommendations of the ICRP. ICRP 103, vol. 37, 2-4	

A summary of requirements is given in this section. A comprehensive list is given in Appendix C.

4.3.1 Direct requirements

Requirements were categorised for the purpose of clarity. The following direct requirements are made:

General:

- The operating organization should ensure that all concerned staff members understand the nature of the spent fuel, its potential hazards and the relevant operating and safety procedures pertaining to it.

Management system:

- Information relevant to safety, health, environmental, security, quality and economic goals shall be communicated to individuals in the organization and, where necessary, to other interested parties
- All individuals involved in preparing, revising, reviewing or approving documents shall be specifically assigned this work, shall be competent to carry it out and shall be given access to appropriate information on which to base their input or decisions on.
- An organizational unit shall be established with the responsibility for conducting independent safety and security.

Radiation Protection:

- *Qualified experts* shall be identified and consulted as deemed necessary.

Protection against pollution and on waste:

- Information relevant to safety, health, environmental, security, quality and economic goals shall be communicated to individuals in the organization and, where necessary, to other interested parties.
- Expertise to manage difficulties that may arise from the effects of storage beyond the original design lifetime is essential.

4.3.2 Indirect requirements

Indirect requirements are given in this section, divided into categories for clarity.

Financing:

- The operating organization is required to put in place appropriate mechanisms for ensuring that sufficient financial resources are available to undertake all necessary tasks throughout the lifetime of the facility, including its decommissioning.

Documentation:

- A *Commissioning Report* should be prepared.
- *Operational Limits and Conditions* should be developed.
- *Emergency Preparedness Plan*.
- *Waste Acceptance Criteria*.
- *Safety Case (issues may be adressed in a SAR).*
- *Radiation Protection Programme for Transports.*

Management system:

- A management system shall be established, implemented, assessed and continually improved.
- Minimum staffing levels that need to be available to operate the spent fuel storage facility safely shall be established.
- For each process, a designated individual shall be given the authority and responsibility for actions (see Appendix C).
- The management systems established to provide assurance of quality in design features and operational features have to be addressed in the safety case.
- The management system for a disposal facility has to provide for the preparation and retention of documentary evidence to illustrate that the necessary quality of data has been achieved; that components have been supplied and used in accordance with the relevant specifications; that the waste packages and unpackaged waste comply with established requirements and criteria; and that they have been properly emplaced in the disposal facility.

Design and operation:

- The organization shall confirm that products meet the specified requirements and shall ensure that products perform satisfactorily in service.
- To the maximum extent practicable, cooling systems for dry spent fuel storage should be passive and should require minimal maintenance.
- An understanding of the features of a disposal facility and how it will perform over time is necessary.
- For geological disposal and for the disposal of intermediate level radioactive waste, the passive safety features (barriers) have to be sufficiently robust so as not to require repair or upgrading.
- For near surface disposal facilities, including those for radioactive waste from the mining and processing of minerals, measures for surveillance and control of the disposal facility might be instituted.
- Reviews of the policies for waste disposal facilities and activities should take into account changes in legislation, international developments, technological advances, lessons learned (incl. from other waste disposal operations.), results of domestic and international assessments.

Radiation protection:

- Protective actions or remedial actions shall be justified.
- Protection and safety shall be optimized.
- Dose limits shall not be exceeded.
- Decisions with regard to measures for protection and safety shall be recorded.
- Suitable and adequate facilities, equipment and services for protection and safety shall be provided.
- Necessary health surveillance and health services for workers shall be provided.
- Appropriate monitoring equipment and personal protective equipment are provided and arrangements are made for its proper use, calibration, testing and maintenance.
- Suitable and adequate human resources and appropriate training in protection and safety shall be provided, as well as periodic retraining as required to ensure the necessary level of competence.

- All personnel shall be provided with adequate information on health risks due to their occupational exposure in normal operation, anticipated operational occurrences and accident conditions, adequate instruction and training and periodic retraining in protection and safety, and adequate information on the significance of their actions for protection and safety.
- A radiation protection programme shall be established for the transport of radioactive material.

Criticality:

- Fissile material has to be managed and has to be emplaced in the disposal facility in a configuration that will remain subcritical.

Radioactive waste:

- Interdependencies shall be considered in all steps of radioactive waste management.
- Radioactive waste shall be characterized in terms of its physical, mechanical, chemical, radiological and biological properties.
- Waste acceptance criteria shall be established.

Emergency preparedness:

- Emergency response drills, exercises and planned reviews of the adequacy of measures for emergency preparedness and response should be continued during any extended pre-closure period after operations have ceased.

Protection against pollution and on waste:

- Provision for suitable and adequate resources (including facilities, equipment and services) for the protection and safety of members of the public, shall be made.
- Provision for appropriate monitoring equipment, surveillance programmes and methods for assessing public exposure shall be made.
- Adequate records of surveillance and monitoring shall be kept.

4.4 Requirement competence on waste managment organisation

During the analysis of the national and international requirement on organisation for radioactive waste treatment no major lack in the Norwegian legislation has been identified. The following competences must be included in a waste management organization:

- Management and personnel have proper documented qualification for the
- Radiation protection, a qualified expert
- Criticality
- Safeguard
- Physical protection
- Radioactive waste management
- Transport of radioactive material
- Documentation system
- Emergency preparedness
- Decommissioning

5 Alternative studies organisation and cost

5.1 Alternative

The following three alternatives have been studied, Reference scenario, Release of capacity in present storage and a new storage. There is only reference alternatives which is described in detail below. Description of the different buildings and storages shown by Task 3 [SEW 14-066] in parallel study into this project.

5.2 Reference alternative

The reference alternative means that no new intermediate repository will be built before decommissioning of IFE's reactors and other facilities. This means that spent fuel and long-lived radioactive waste have to be kept with IFE until decommissioning, i.e. to the beginning of the 2030's. An increase of IFE storage capacity must then be undertaken, because the storage capacity at Halden will be reached about year 2025. At Kjeller, there is capacity to store fuel until 2032. If the current commissioning of the two reactors are extended, additional storage capacity will be necessary and this alternative includes expansion. However, such expansion do not have any major impact on the organization, the structure of the organisation can remain, maybe some minor increase of the staff.

In the reference alternative operation of KLDRA in Himdalen will continue to be carried out by personnel from IFE as today and with the radwaste facility still located at Kjeller. The capacity of KLDRA Himdalen will be reached around 2030. Extended capacity for short-lived radioactive waste is therefore needed, which is included in the reference alternative.

5.2.1 Licensing procedure

IFE already has a license according to ANEA to operate reactors, store spent fuel, and treat and store radioactive waste etc. The procedure for authority approval of increased storage space on one or both IFE sites will therefore be performed according to §12 ANEA as change(s) in the facility(ies), accompanied by updating of safety documentation such as SARs etc. An application to the NRPA will be made, and before the alterations are put into operation. NRPA must grant permission.

5.2.2 Organisational aspects

Staffing and competence needed to operate spent fuel storages, as well as the treatment and storage facility for radioactive waste, will be the same as today's situation.

Building additional storage space in Halden is here assumed to be undertaken by a contractor, but IFE personnel is required for support to the management of the project with nuclear and radiological competence.

An organisational chart of IFE is given in Figure 1 /D069/.

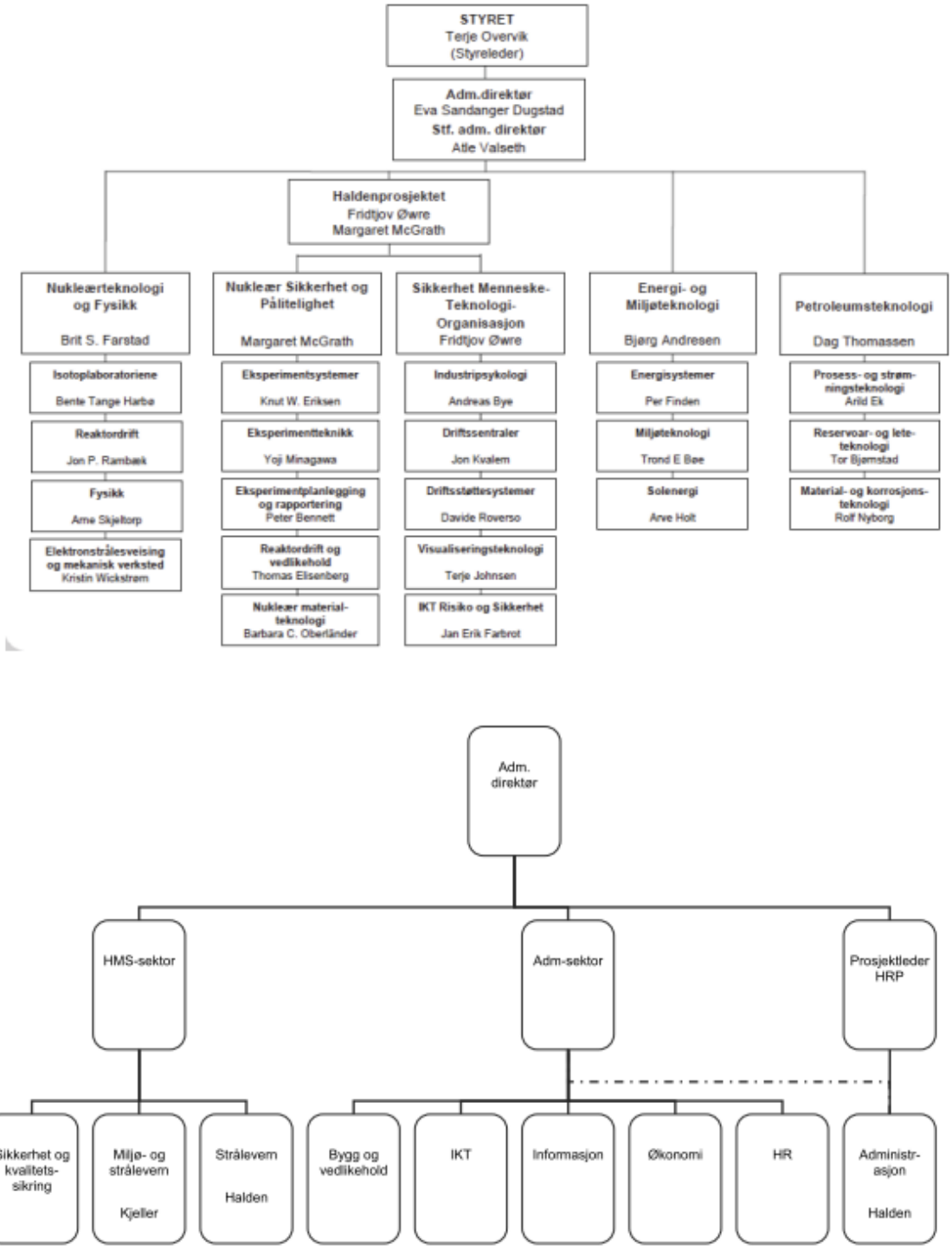

Figure 1
IFE – present organisational structure /D069/.

At IFE, there are separate organisations for the sites that concerned with spent fuel and radioactive waste. Figure 2 summarises the functional entities and the number of personnel involved.

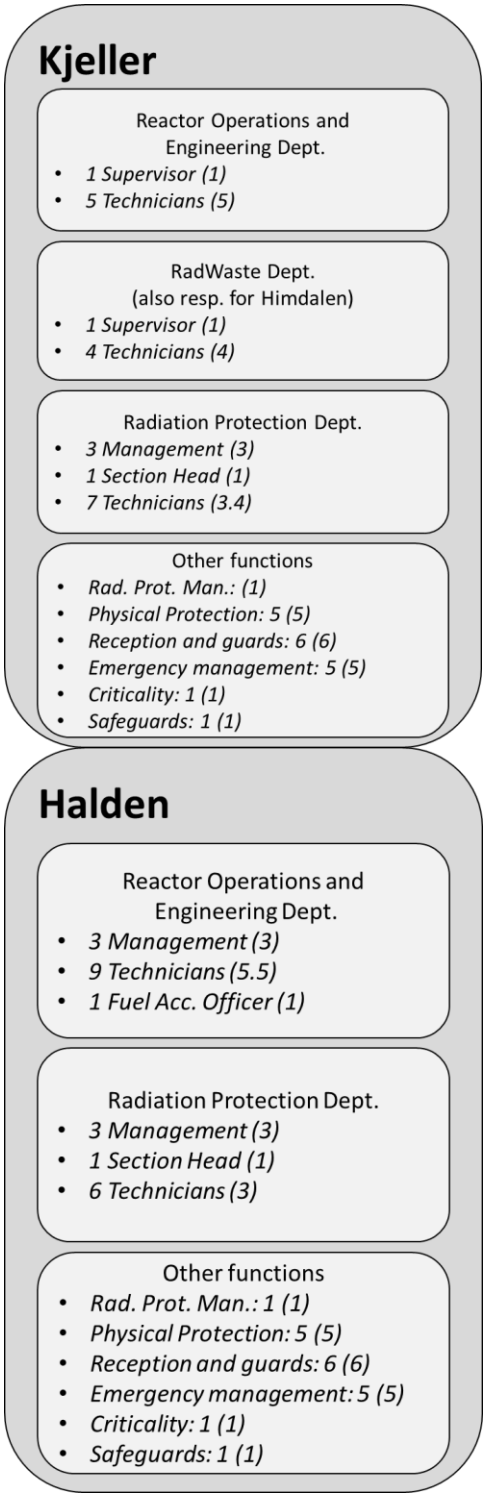

Figure 2
Summary of IFE personnel concerned with handling of spent fuel and radioactive waste. Figures within parentheses give the corresponding number of full-time employees.

5.2.3 Costs

Summary of IFEs cost for the operation of the Halden and Kjeller with turned off reactor and operation of Himdalen are briefly shown in Figure 3.

It should be clearly commented that some overhead costs (eg, financial management, communication, certain development costs, Security Audit, etc.) are not included in the report below. It is mainly focused on the operation of the facilities.

	Reference Alternative The current solution, additional capacity obtained by expanding the current store at Kjeller and Halden		Costs MNOK
Spent Fuel, BRUKT BRENSEL BB	Post	Yearly working	Estimated
	Management / Administration	2	2
	Physical security	6	5
	Radiation and environmental protection	2	2
	Operating costs	2	2
	Maintenance	1	1
	Strålvern Control Authority		1
	Totalt Kjeller		13
	Management / Administration	2	2
	Physical security	6	5
	Radiation and environmental protection	2	2
	Operating costs	3	3
	Maintenance	1	1
	Strålvern Control Authority		1
	Totalt Halden		14
ARA	Reference Alternative The current solution, additional capacity obtained by expanding the current store in Himdalen		
	Management / Administration		1,5
	Physical security		0,5
	Radiation and environmental protection		1,5
	Operating costs		2
	Maintenance		0,5
	Strålvern Control Authority		1
	Totalt Himdalen		7

Figure 3
Summary of IFE Operating Costs concerned with handling of spent fuel and radioactive waste.

The responsibilities and duties of the various areas are:

Management/Administration
The department is mainly responsible for:

- Training
- Quality Assurance
- Safety Documentation
- Licensing

Physical security
The department is mainly responsible for:

- Securing the area (guard and physical barriers)
- Reception / guards
- Security Management
- Maintenance / upgrading of systems including service agreements

Radiation and environmental protection
The department is mainly responsible for:

- Dose Monitoring and protection
- Environmental protection
- Reporting to authorities
- Operation, maintenance of laboratory
- Calibrations
- Instruments / monitoring systems

Operating costs
The department is mainly responsible for:

- Operation of the plant
- Documentation and maintenance of plants knowledge
- Maintenance of ventilation and drainage in the plant
- Electricity
- Water / wastewater
- Cleaning, Housekeeping
- Laboratory services (chemical and radiation)

Maintenance
The department is mainly responsible for:

- Overall Maintenance
- Disposal (filter, ion waste, other waste)
- Transfer of waste to Himdalen
- Warehousing and purchasing of components (pumps, valves, etc.)

Strålvern Control Authority (Supervisory and control activities of the authority)

- Regulator fees to the radiation protection authority)

5.3 Alternatives

Two main alternatives are considered in addition to the reference alternative:

- Storing capacity at Kjeller and Halden are made available by removing present fuel by reprocessing or export.
- New repository for spent fuel, or a combined storage for spent fuel and other waste.

5.3.1 Release capacities in present repositories

This implies that the spent fuel in the present storage at Kjeller and in Halden are taken out from the intermediate storage. There are some possible option for this, see also Section 5.4:

- "Export" of the spent fuel
- Send the spent fuel reprocessing

By exporting or reprocessing the spent fuel which today is stored at Halden and/or Kjeller, capacity will be released and new spent fuel and other waste can be stored in present facilities. The capacity that will be released depends on the amount of spent fuel and other waste which will be removed. For the spent fuel there is two options, one to send for export or reprocessing all present spent fuel or the second option to send the unstable spent fuel. The latter is the metallic uranium fuel and/or aluminium clad fuel.

According to the Joint convention on the safety of spent fuel management and on the safety of radioactive waste management /D153/ the waste generated in the country should be disposed of in the state where it was generated. However, the convention also state that during certain circumstance, especially waste generated from joint projects, could be stored or deposited in another state than generated. Such handling needs agreement between all involved parties and should be beneficial to all. The convention also state that any state has the right to ban import of foreign spent fuel or radioactive waste into the country. Export of spent fuel from research reactors is made within the two programs by USA and Russia. US department of Energy conduct the retrieval program for Global Threat Reduction Program (GTRP).

Export of spent fuel could be a possible solution within GTRP, however, according to the contacts already performed the spent fuel in Norway do not fulfil the criteria to be included in the program /D049/. Presently there is now partner for export of spent fuel.

Reprocessing is performed routinely in Europe, Russia and Japan. Reprocessing is a proven technology for dealing with standard types of fuel as well as for metallic fuels. In reprocessing plants fissile materials and fission products are separated. The reprocessed fissile material, uranium and plutonium can be used for fabrication of new fuel elements or sold for other peaceful uses all in accordance with the safeguard agreement controlled by IAEA. The waste from the reprocessing can be returned to the owner of the fuel or in some cases it can be taken care of in the country performing the reprocessing. The amount of waste which will come back as vitrified waste is in the order of 50 kg.

5.3.1.1 Licensing procedure

The implementation of those option requires significant political efforts to resolve the complex agreements. Reprocessing is a methods which are in use and international experience can be used. The same is valid for export within GTRP. Both these option will require comprehensive and accurate safety assessments and documentation before licence to implement the action can be achieved.

For the present facilities operation of those will continue and IFE already has a license according to ANEA to operate reactors, store spent fuel, and treat and store radioactive waste etc.

5.3.1.2 Organisational aspects

Staffing and competence to operate spent fuel storages as well as the treatment and storage facility for radioactive waste will be the same as present. But for the licensing procedure additional personnel will be necessary.

5.3.2 New storage

There are several concepts for new storage. The advantages and dis-advantages is discussed in the Task 3 report of this KVU. The influence of the cost or staffing for operation for different concepts will not be any major issue. The storage alternative discussed are waste placed in vaults or casks and the storage is an underground facility or industrial building.

5.3.2.1 Licensing procedure

An application to the NRPA has to be made, and before the alterations are put into operation, the NRPA must grant permission. A new safety case has to be performed with safety documentation and SAR's etc.

Also consider the requirements presented in Chapter 4 above and Appendix C below. These shall be presented in detail in connection with the licensing of a new plant, and the following summary are:

"Requirements from authorities on organisation may be divided into two types:

- Direct requirements, e.g. on certain persons with special competence.
- Indirect requirements, e.g. on certain documentation.

The latter type of requirements is indirect in the sense that they influence how a licensee will set up an organisation, e.g. as regards staff size and staff competence, both of which will vary during the facility's life cycle. Most requirements are indirect.

Requirements are put by the authorities on a licensee through acts of law, regulations, licences and/or other means."

IFE already has a license according to ANEA to operate reactors, store spent fuel, and to treat and store radioactive waste etc.

5.3.2.2 Organisational aspects

Organization of new plants, or combinations of plants shown in Figure 4.

The organizational structure covering all plant that may be present in Norway. The idea is to collect expertise/ skills and staffing in a central organization to most cost effectively utilize resources and staffing.

Presented organization chart figure can be applied to all possible alternatives and is the most effective way to take care of Norway's nuclear spent fuel, waste and other radioactive waste.

This means that parts of the current IFE organization can be included in the new organization, with new main owner.

The alternatives or facilities that will not be built by decision may simply be removed from the organization chart.

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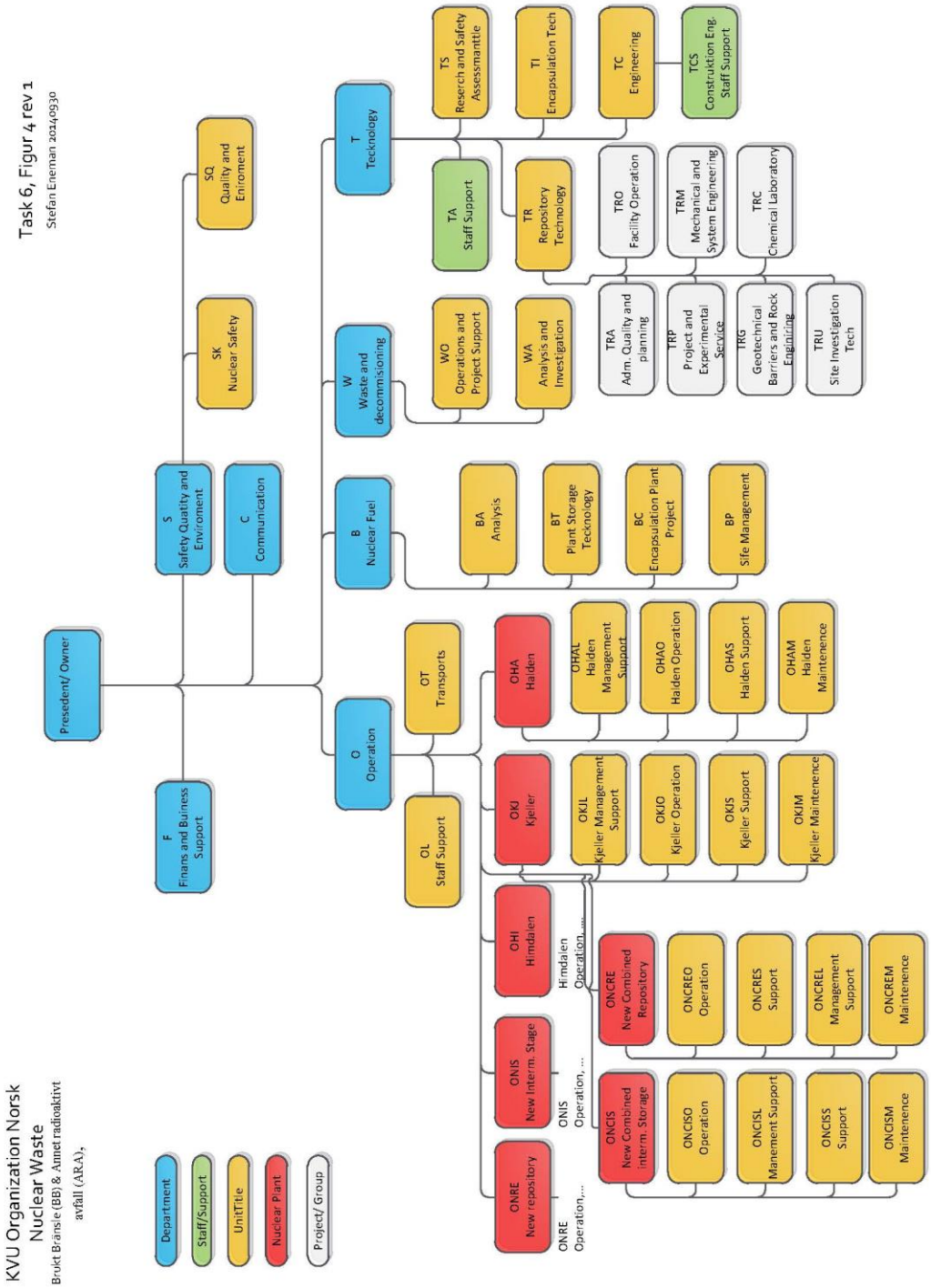

Figure 4
Organization of new plants and combination of plants.

5.4 Organisational cost for alterantives

It should be clearly commented that some overhead costs (eg, financial management, comminication, certain development costs, Security Audit, etc.) are not included in the costs presented below. It is mainly focused on the operation of the facilities.

It is three different main alternative considered

- Reprocessing or export of spent nuclear fuel.
- New repository for spent fuel.
- Combined storage for spent fuel and storage and other radiacitve waste.

In Table 1 the operational cost are shown for the waste storage if the spent fuel are sent for reprocessing or export.

Table 1
Operatioal costs for waste storage if spent fuel is reprocessed or exported, and Himdalen is filled up, and additional waste are then assumed to be exported abroad.

	Alternative 1 Export of spent fuel		Costs MNOK
BRUKT BRENSEL (BB)	Post	Yearly working	Estimated
	Management / Administration		0
	Physical security		0
	Radiation and environmental protection		0
	Operating costs		0
	Maintenance		0
	Strålvern Control Authority		0
	Totalt Kjeller		
	Ledelse/Adminsitrasjon		0
	Physical security		0
	Radiation and environmental protection		0
	Operating costs		0
	Maintenance		0
	Strålvern Control Authority		0
	Totalt Halden		
ARA	Alternative 1 Himdalen fills up, then exported abroad ARA		
	Management / Administration		1,5
	Physical security		0,5
	Radiation and environmental protection		1,5
	Operating costs		1
	Maintenance		0,5
	Strålvern Control Authority		1
	Totalt Himdalen		6

In Table 2 the cost for operations of a new intermediate storage for spent fuel are shown. The storage at Kjeller and Halden will be emptied. The present repository for other radioactive waste at Himdalen will be filled and a new facility at another location will be established.

Table 2
Operational costs for a new intermediate storage for spent fuel in the mountains and a new disposal site for other radioactive waste as Himdalen will be filled up.

	Alternative 2: A new intermediate storage in Norway		Costs MNOK
	Post	Yearly working	Estimated
BRUKT BRENSEL (BB)	Management / Administration		0
	Physical security		0
	Radiation and environmental protection		0
	Operating costs		0
	Maintenance		0
	Strålvern Control Authority		0
	Totalt Kjeller		
	Management / Administration		0
	Physical security		0
	Radiation and environmental protection		0
	Operating costs		0
	Maintenance		0
	Strålvern Control Authority		0
	Totalt Halden		
	Management / Administration	2	3
	Physical security	6	5
	Radiation and environmental protection	2	3
	Operating costs	2	2
	Maintenance	1	1
	Strålvern Control Authority		1
	Totalt Nytt Mellomlager		15
ARA	Alternative 2: Himdalen + New Disposal for ARA		
	Management / Administration		1
	Physical security		0,5
	Radiation and environmental protection		1
	Operating costs		1
	Maintenance		1
	Strålvern Control Authority		0,5
	Totalt Himdalen		5
	Management / Administration		1
	Physical security		0,5
	Radiation and environmental protection		1
	Operating costs		2
	Maintenance		1
	Strålvern Control Authority		0,5
	Totalt Nytt Deponi		6

In Table 3 the operational costs for a combined storage for spent fuel and other radiactive waste are shown. The location together will reduce some investment costs and, in particular, operating costs.

Table 3
Operational costs for a new combined intermediate storage in the mountains for spent fuel and a repository for other radioactive waste.

	Combined Alternative 1: Intermediate storage and repository BB (+ new repository ARA)		Costs MNOK
	Post	Yearly working /	Estimated)
BRUKT BRENSEL (BB)+B169:H199	Management / Administration		0
	Physical security		0
	Radiation and environmental protection		0
	Operating costs		0
	Maintenance		0
	Strålvern Control Authority		0
	Totalt Kjeller		
	Management / Administration		0
	Physical security		0
	Radiation and environmental protection		0
	Operating costs		0
	Maintenance		0
	Strålvern Control Authority		0
	Totalt Halden		
	Management / Administration	2	3
	Physical security	6	5
	Radiation and environmental protection	2	3
	Operating costs	3	3
	Maintenance	1	1
	Strålvern Control Authority		2
	Totalt Nytt Mellomlager BB og Deponi ARA		17
ARA	Combined Alternative 2: Himdalen and New reposity for ARA (intermediate storage and repository BB)		
	Management / Administration		1
	Physical security		0,5
	Radiation and environmental protection		1
	Operating costs		1
	Maintenance		1
	Strålvern Control Authority		0,5
			5

6 References

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7 Revision record

Rev. no.	Reviewed by	Approved by	Report date
0	Sture Nordlinder	Lars Johansson	2014-10-01
1	Sture Nordlinder	Lars Johansson	2015-01-13

Rev. no	Section	Description of revisions
1		New title of report and minor editorial corrections.

Appendix A

Table of contributors.

Name	Role (task responsible/contributor)	Company
	An independent foundation with more than 10 000 employees in over 100 countries	Det Norske Veritas - DNV
	An engagement funded research institution associated with NHH	SNF
	A consultancy company with 1 100 employees and 60 years' experience of nuclear technology and radiological services	Studsvik
	A consultancy company that provides scientific & mathematical consultancy, contract research and software to address energy and environmental challenges	Quintessa
	A nuclear power consultancy with a long-standing commitment to excellence in commercial nuclear reactor technology	Westinghouse

Appendix B

Glossary.

Concept	Explanation
ANEA	Act on Nuclear Energy Activities (“Lov om atomenergivirksomhet”)
HBWR	IFE’s research reactor at Halden
IAEA	International Atomic Energy Agency
IFE	Institutt for Energiteknikk
JEEP II	IFE’s research reactor at Kjeller
KLDRA	Storage facility at Himdalen, operated by IFE
KVU	“Konseptvalgsutredning”, concept study
NRPA	Norwegian Radiation Protection Authority, “Statens strålevern”
RPA	Act on Radiation Protection and Use of Radiation (“Lov om strålevern og bruk av stråling [strålevernloven]”)
SAR	Safety Analysis Report

Appendix C

Requirements on organisation.

Act on Nuclear Energy Activities (ANEA) of 12 May 1972				**LOV-1972-05-12-28 (LOV-2010-12-10-76)**
	§	**Req. type (Direct/Indirect)**	**Text**	**Comment**
	4	Ind.	”Overføring av atomanlegg eller dets drift til ny eier eller innehaver trenger særskilt konsesjon”	New owner req. new concession
	11	Dir.	2b. ”anleggets ledelse og personell har de nødvendige kvalifikasjoner og klare ansvarsområder”	The management and personnel shall have proper qualification and clear areas of responsibility
	11	Ind.	3 and 4	Reqs that a SAR be made
	12	Ind.	”Dersom en innehaver akter å gjennomføre en endring i anleggets konstruksjon, drift eller ledelse som avviker fra det som lå til grunn for godkjenning etter § 11 punkt 2 og som kan ha betydning for sikkerheten, plikter han før endringen settes i verk å legge saken frem for Statens strålevern til godkjenning”	Changes in construction, operation or management must be approved by NRPA
	15	Ind.	1. ”Innehaveren av et atomanlegg plikter å holde anlegg og utstyr i forskriftsmessig og forsvarlig stand”	Proper maintenance must be performed
	25 (new number acc. 15 June 2007)	Ind.		Responsibility for an accident may be put on transporter
	49	Ind.		Emergency preparedness measures in cooperation with local authorities
	51	Ind.		Safeguard reqs.
	Regulations of 2 November 1984 on the Physical Protection of Nuclear Material			**FOR-1984-11-02-1809 (FOR-2007-06-29-902)**
	§	**Req. type (Direct/Indirect)**	**Text**	**Comment**
	1	Ind.	”Nukleært materiale og nukleære anlegg som faller inn under denne forskrift, er å anse som skjermingsobjekter. Lov 20. mars 1998 nr. 10 om forebyggende sikkerhetstjeneste”	Nuclear materials and nuclear facilities are object of special protection and need a security unit (see LOV-1998-03-20-010)

	12	Ind.	”Anleggsinnehaveren skal, på grunnlag av en trusselvurdering utarbeidet av Politiets sikkerhetstjeneste, utarbeide en designbasistrussel. Denne skal godkjennes av Statens strålevern. Designbasistrusselen skal holdes oppdatert basert på endringer i politiets trusselvurderinger og det generelle trusselbildet”	The Licensee shall make a design base threat analysis report, which shall be kept up-to-date
	12	Ind.	”Anleggsinnehaveren skal utarbeide en sikkerhetsrapport vedrørende den fysiske beskyttelse”	The Licensee shall make a SAR for physical protection
	13	Ind.	”En beredskapsplan skal utarbeides i samråd med politiet og den skal være i samsvar med de reelle myndighetsforhold mellom de involverte instanser. Nødvendig verne-/ måleutstyr som anleggsinnehaveren kan stille til politiets disposisjon, skal tas med i planen, og den skal også omfatte nødvendige øvelsesaktiviteter. Beredskapsplanen for fysisk beskyttelse skal også inkludere transport av nukleært materiale. ”	A preparedness plan for physical protection (incl. exercises) shall be prepared in cooperation with proper authorities
	15	Dir./Ind.	Anleggsinnehaveren skal utarbeide vaktinstruks hvor vaktens plikter med hensyn til områdesikring, områdepatruljering, adgangskontroll og inspeksjon av kjøretøyer, herunder varetransporter m.v. er spesifisert. Vaktinstruksen skal graderes etter sitt innhold, men minimum begrenset i henhold til lov 20. mars 1998 nr. 10 om forebyggende sikkerhetstjeneste § 11.	The licensee shall provide an instruction for security service personnel (guards needed)
	15	Dir.	Kontrollert område. Adgang skal skje gjennom en resepsjon/vaktsentral som skal være bemannet dag og natt	Entrance to controlled area shall be through a central guard service which shall be manned day and night
	15	Ind.	Beskyttet område. Kjøretøy og alt som bringes inn i området, skal kontrolleres for å sikre at det ikke bringes inn ønskede personer eller utstyr som kan representere fare for anlegget.	Any vehicle entering the protected area shall be searched (competence for personnel required)
	15	Ind.	Vitalt område:Ved inn- og utpassering skal personer og pakker kontrolleres med spesielle detektorer supplert med manuell kontroll	When entering or leaving a vital area, search of people and parcels shall be performed (competence for personnel required)
	15	Dir.	Vitalt område: Adgang forutsetter at det alltid er to eller flere personer tilstede i området, eller at det er etablert særlig overvåking	Vital area: there shall always be a minimum of two persons present, or special surveillance shall be employed

	17	Dir.	Fysisk beskyttelse under transport. a. Generelle tiltak - at personer som er direkte involvert i gjennomføringen av transporten er autoriserte	Physical protection during transport: persons that are directly concerned shall be authorised
	17	Dir.	b Ansvar. Anleggsinnehaveren skal for hver enkel transport oppnevne en transportkoordinator som er ansvarlig for forberedelse av transporten til den ytre transportledelse (se § 17 e) overtar ansvaret	Licensee shall for each transport appoint a transport coordinator who is responsible until the off-site transport coordinator assumes responsibility (se §17e)
	17	Ind.	c. Forhåndsgodkjennelse av den fysiske beskyttelse ved transporter. Den fysiske beskyttelse av alle transporter som kommer inn under disse forskrifter, skal godkjennes av Statens strålevern. En forhåndsgodkjennelse vil inneholde de betingelser og krav som skal gjelde for transporten. For transport av materiale i klasse II og III kan Statens strålevern gi en generell tillatelse som ikke medfører ytterligere meldeplikt med hensyn til den enkelte transport. For transport av materiale i klasse I skal Statens strålevern gi tillatelse i hvert enkelt tilfelle	Licensee may have a general permit from NRPA to transport Class II and III material. Class I material needs a permit for each transport (competence)
	17	Dir.	e. Ytre transportledelse. Anleggsinnehaveren skal opprette en ytre transportledelse i forbindelse med gjennomføringen av transporter, og informere alle parter som deltar i transporten hvem dette er. Den ytre transportledelse skal holde telefon- eller radiokontakt med transportkjøretøy og/eller eskorte, og mottaker, og skal på bakgrunn av mottatte rapporter gi instruksjoner til transportpersonale, politi eller veimyndigheter vedrørende uregelmessigheter under transporten. For materiale i klasse II og III kan autoriserte personer hos anleggs-innehaveren fungere som ytre transportledelse. For materialer i klasse I skal anleggsinnehaveren samarbeide med politiet om den ytre transportledelse. Nærmere detaljer skal fremgå av beredskapsplanen	Licensee shall appoint an off-site transport coordinator for each transport. For Class II and II material, this may be an authorised employee. For Class I material, the Licensee shall cooperate with the police regarding off-site transport coordinator
	17	Ind.	g. Plombering. Anleggsinnehaveren er ansvarlig for at alle kolli som transporteres plomberes med segl	Licensee is responsible for providing each package with a seal (competence)
	18	Dir.	Særlige bestemmelser i forbindelse med transport av nukleært materiale i klasse	Road vehicles shall have at least two persons present

	Regulations of 15 November 1985 on Exemption from the Act on Atomic Energy Activity for Small Amounts of Nuclear Material			
	not applicable			
	Regulations of 12 May 2000 on Possession, Transfer and Transportation of Nuclear Material and Dual-use Equipment			
	not applicable for facilities with licence according to ANEA			
	Regulations of 14 December 2001 on Financial Compensation after Nuclear Accidents			
	not applicable			
Act on Radiation Protection and Use of Radiation (RPA) of 12 May 2000				**LOV-2000-05-12-36**
(many requirements are the same as for ANEA)				
	§	**Req. type (Direct/Indirect)**	**Text**	**Comment**
	8	Dir.	Virksomhet som omfattes av loven, skal treffe nødvendige tiltak for å verne de ansatte, andre tilknyttede personer, og miljøet mot stråling. Personer som pga. lav alder, graviditet eller av andre årsaker er særlig følsomme for stråling, skal enten gis arbeidsoppgaver som ikke medfører eksponering for stråling, eller vernes gjennom andre egnede beskyttelsestiltak	Personnel sensitive to radiation e.g. due to pregnancy shall be given tasks of low radiation impact
	9	Ind.	Når apparater eller utstyr som kan avgi stråling, kasseres eller settes endelig ut av drift, skal eieren eller den ansvarlige hindre senere skadelig bruk ved å sørge for at apparater eller utstyr ikke lenger kan avgi stråling	Discarded radiation sources shall be treated to not emit radiation (competence)
	12	Dir.	a) organisering av strålevernet, herunder utpeking av strålevernsansvarlig, samt krav til registrering av nødvendige opplysninger for internkontroll eller tilsynsformål	Licensee shall appoint a Radiation Protection Manager and keep records as regards radiation protection
	12	Ind.	b) skjermingstiltak i form av konstruksjon og innretning av lokaler og arbeidsplass, arbeidsprosedyrer og bruk av persontilpasset verneutstyr.	Design of facility/equipment (incl. PPE) and procedures as regards radiation protection

	12	Ind.	c) merking av strålekilder og opplysning om anvendelse, håndtering og lagring av strålekilder. Det kan videre stilles krav om advarselsskilting i lokaler eller områder der det befinner seg strålekilder eller radioaktivt avfall som kan medføre en risiko for helsen. Likeledes kan det stilles krav til å opplyse berørte personer og allmennheten om strålebruk og strålevern. d) måling av strålenivåer, herunder persondosimetri. e) dosegrenser for relevante typer stråling. f) transport av strålekilder, herunder radioaktivt avfall og utstyr inneholdende slike kilder. g) oppfølging av vernetiltak i forbindelse med gjennomføring av reparasjon, vedlikehold eller endring av strålekilde eller anlegg	Reqs on labeling of radiation sources, dosimetry, dose limits, transport
	Regulation on Radiation Protection and Use of Radiation of 29 October 2010			**FOR-2010-10-29-1380**
	§	**Req. type (Direct/Indirect)**	**Text**	**Comment**
	7	Dir.	I virksomhet som omfattes av loven, skal de ansatte og andre tilknyttede personer i nødvendig utstrekning ha utdanning eller opplæring, som sikrer at de har tilstrekkelige kvalifikasjoner eller kunnskap innen strålevern og sikker bruk av stråling	Reqs on competence in radiation protection and safety
	8	Ind.	Virksomhet som omfattes av loven, skal treffe nødvendige tiltak for å verne de ansatte, andre tilknyttede personer, og miljøet mot stråling. Personer som pga. lav alder, graviditet eller av andre årsaker er særlig følsomme for stråling, skal enten gis arbeidsoppgaver som ikke medfører eksponering for stråling, eller vernes gjennom andre egnede beskyttelsestiltak	Replacement e.g. due to pregnancy
	9	Ind.	I forskriftene kan det fastsettes plikt for leverandører av radioaktive stoffer til å etablere returordninger for radioaktivt avfall, og likeledes plikt for virksomheter til å etablere og benytte slike returordninger. Bestemmelsene i dette ledd gjelder også avfall, utstyr eller emballasje som inneholder eller er forurenset av radioaktive stoffer	Competence and org. for return of radioactive substances or contaminated equipment

	12	Dir.	a) organisering av strålevernet, herunder utpeking av strålevernsansvarlig, samt krav til registrering av nødvendige opplysninger for internkontroll eller tilsynsformål	Reqs on radiation protection organisation and that a Radiation Protection Manager be appointed
	12	Ind.	b) skjermingstiltak i form av konstruksjon og innretning av lokaler og arbeidsplass, arbeidsprosedyrer og bruk av persontilpasset verneutstyr. Det kan også stilles krav til stråleavgivende utstyrs utforming og funksjon.	Comp. of radiation shielding, PPE and work procedures
	12	Ind.	c) merking av strålekilder og opplysning om anvendelse, håndtering og lagring av strålekilder. Det kan videre stilles krav om advarselsskilting i lokaler eller områder der det befinner seg strålekilder eller radioaktivt avfall som kan medføre en risiko for helsen. Likeledes kan det stilles krav til å opplyse berørte personer og allmennheten om strålebruk og strålevern	Comp. of labeling radiation sources, handling and storage, zoning. Education and information on radiation protection for personnel and the public
	12	Ind.	d) måling av strålenivåer, herunder persondosimetrie) dosegrenser for relevante typer stråling. f) transport av strålekilder, herunder radioaktivt avfall og utstyr inneholdende slike kilder. g) oppfølging av vernetiltak i forbindelse med gjennomføring av reparasjon, vedlikehold eller endring av strålekilde eller anlegg	Comp. for measurement of radiation, dose limits, transports of radioactive substances, follow-up on changes in shielding and protective measures
	15	Ind.	Vedtak kan omfatte plikt til å gi melding til etater i redningstjenesten og tilsynsmyndigheten om særskilte risiki som redningstjenesten og tilsyns-myndigheten bør være kjent med, for å håndtere uhell eller ulykker	Comp. in emergency planning
	15	Ind.	Virksomhetene kan pålegges å gi melding til fysiske og juridiske personer i virksomhetens nære omgivelser om særskilte risiki som kan oppstå. Fysiske og juridiske personer som ikke selv utøver en virksomhet som omfattes av denne loven, men som kan bli rammet av inntrådte uhell eller ulykker, kan pålegges en selvstendig plikt til å planlegge hvordan mulige skade-virkninger kan begrenses	Comp. regarding information on risks to Rescue Services and NRPA

	15	Ind.	Ved ulykke eller hendelse ved atomanlegg eller under transport av atomsubstans som medfører nær forestående trussel mot folkehelsen eller miljøet, skal det organ som har ansvar for atomberedskapen eller Statens strålevern sikre at befolkningen straks gis informasjon som gjør det mulig å treffe tiltak for å forebygge eller redusere skade	Comp. regarding information to the public regarding countermeasures in accident situations
	16	Ind.		
	Regulation on possession, transfer and transport of nuclear materials and equipment			**FOR-2000-05-12-433**
	6	Ind.	Innehaveren skal føre regnskap med beholdningen av nukleært materiale. Vedkommende skal hvert år ved en gitt dato foreta en opptelling av beholdningen. For hver type materiale skal det for hvert oppbevarings- og brukssted angis elementvekter i gram. For uran-233, uran-235 og plutonium skal vektene oppgis i tidels gram. Etter opptelling skal beholdningsoppgave samt materialbalanse omgående sendes kontrollorganet. Regnskapene skal oppbevares etter regnskapslovens bestemmelser for alminnelige regnskaper	An inventory of nuclear materials shall be kept. Treatment data and material balance shall be sent to NRPA on request
	10	Dir.	Innehaveren skal utpeke en ansvars-havende person for nukleært materiale og flerbruksvarer. Denne skal være kontrollorganets kontaktperson hos innehaveren	There shall be a manager of nuclear materials and equipment, who shall be contact person for the NRPA
	Regulation on systematic work programmes for health, environment and safety (Regulation on Internal Control)			**FOR-1996-12-06-1127**
	§	**Req. type (Direct/Indirect)**	**Text**	**Comment**
	4	Ind.	Den som er ansvarlig for virksomheten skal sørge for at det innføres og utøves internkontroll i virksomheten og at dette gjøres i samarbeid med arbeidstakerne og deres representanter Arbeidstakerne skal medvirke ved innføring og utøvelse av internkontroll	Programme for internal control shall be implemented and performed in cooperation with the employees
	5	Ind.	1. sørge for at de lover og forskrifter i helse-, miljø- og sikkerhetslovgivningen som gjelder for virksomheten er tilgjengelig, og ha oversikt over de krav som er av særlig viktighet for virksomheten	Applicable laws and regulations shall be made available

	5	Ind.	2. sørge for at arbeidstakerne har tilstrekkelig kunnskaper og ferdigheter i det systematiske helse-, miljø- og sikkerhetsarbeidet, herunder informasjon om endringer	Educate personnel
	5	Ind.	3. sørge for at arbeidstakerne medvirker slik at samlet kunnskap og erfaring utnyttes	Have a system that allows personnel to participate so that knowledge and experience is documented
	5	Ind.	4. fastsette mål for helse, miljø og sikkerhet	Establish goals as regards health, environment and safety
	5	Ind.	5. ha oversikt over virksomhetens organisasjon, herunder hvordan ansvar, oppgaver og myndighet for arbeidet med helse, miljø og sikkerhet er fordelt	Manage organisation for issues of health, environment and safety
	5	Ind.	6. kartlegge farer og problemer og på denne bakgrunn vurdere risiko, samt utarbeide tilhørende planer og tiltak for å redusere risikoforholdene	Assess risks and make contingency plans
	5	Ind.	7. iverksette rutiner for å avdekke, rette opp og forebygge overtredelser av krav fastsatt i eller i medhold av helse-, miljø- og sikkerhets- lovgivningen	Establish routines to avoid, correct and prevent deviations from reqs in the fields of health, environment and safety
	5	Ind.	8. foreta systematisk overvåkning og gjennomgang av internkontrollen for å sikre at den fungerer som forutsatt	Establish systematic control procedures to assure compliance with the internal control programme
	5	Ind.	Internkontrollen skal dokumenteres i den form og det omfang som er nødvendig på bakgrunn av virksom-hetens art, aktiviteter, risikoforhold og størrelse. Dokumentasjon som følger av krav i eller i medhold av helse-, miljø- og sikkerhetslovgivningen, for eksempel instrukser, tillatelser, kompetansebevis, sertifikater o.l. skal inngå. Skriftlig dokumentasjon etter denne forskrift skal minst omfatte annet ledd nr. 4) til og med nr. 8) i denne paragraf.	Documentation shall be kept with applicable form and content. Written doc. shall be kept for point 4 through 8 in this par.
Act on protection against pollution and on waste				**LOV-1981-03-13-6**
	§	**Req. type (Direct/Indirect)**	**Text**	**Comment**
	9	Dir.	5. at driftspersonell i virksomhet som kan medføre forurensning skal ha bestemte kvalifikasjoner	Competence for personnel who operates the facility

	13	Ind.	Den som planlegger virksomhet som kan medføre store forurensninger på et nytt sted, eller en vesentlig utbygging av ny karakter på sted for eksisterende virksomhet, skal på et tidlig trinn under planleggingen gi melding til forurensningsmyndigheten	Plans for establishment of a facility on a new site, or extension of a new kind in an existing facility, shall notify NRPA in and early phase
	13	Ind.	Forurensningsmyndigheten kan fastsette at den som planlegger meldepliktig virksomhet skal foreta en konsekvensanalyse for å klarlegge virkningene forurensningen vil få. Konsekvensanalysen skal vanligvis inneholde en utredning om: 1. hvilke forurensninger virksomheten vil medføre ved vanlig drift og ved praktisk tenkelige former for uhell, samt sannsynligheten for slike uhell, 2. hvilke virkninger forurensningen kan få på kort og lang sikt. Om nødvendig skal det foretas undersøkelser av naturforholdene der forurensningen vil gjøre seg gjeldende. Det skal særskilt klarlegges hvordan forurensningen vil påvirke menneskenes bruk av miljøet og hvem som særlig får ulemper av forurensningen, 3. alternative lokaliseringer, produksjonsprosesser, rensetiltak og måter for å gjenvinne avfall på som har vært vurdert og nærmere begrunnelse for de løsninger søkeren har valgt, 4. hvordan virksomheten blir innpasset i oversiktsplan og reguleringsplan for området, eventuelt hvordan den vil binde fremtidig planlegging	NRPA may request an impact assessment containing: 1. Expected releases during normal operation and accidents 2. Assessment of short-term and long-term consequences of releases 3. Alternatives with motivation as regards localization, production processes, protective and mitigating measures, and recycling of waste 4. How the matter-at-hand fits with society planning in the area
	15	Ind.	Når det foreligger konsekvensanalyse etter § 13 skal forurensnings-myndigheten i samarbeid med søkeren holde offentlig møte for drøfting av de forurensningsmessige følger virksomheten kan få. Møtet skal holdes i god tid før søknaden blir avgjort og skal kunngjøres på stedet. På møtet skal søkeren og forurensningsmyndigheten redegjøre for tiltaket og de forurensningsmessige følger det kan få.	A public hearing shall be organized in cooperation with the NRPA

	19	Ind.	Den som har tillatelse etter § 11 og som skal foreta en vesentlig utskiftning av utstyr som gjør det teknisk mulig å motvirke forurensninger på en vesentlig bedre måte enn da tillatelsen ble gitt, skal på forhånd gi melding til forurensningsmyndigheten.	Notification to the NRPA regarding exchange of equipment in order to decrease releases
	20	Ind.	Hvis et anlegg blir nedlagt eller en virksomhet stanser, skal eieren eller brukeren gjøre det som til enhver tid er nødvendig for å motvirke forurensninger. Hvis anlegget eller virksomheten kan medføre forurensninger etter nedleggelsen eller driftsstansen, skal det i rimelig tid på forhånd gis melding til forurensnings-myndigheten. Forurensningsmyndigheten kan fastsette nærmere hvilke tiltak som er nødvendig for å motvirke forurensning. Den kan pålegge eieren eller brukeren å stille garanti for dekning av fremtidige utgifter og mulig erstatningsansvar	When decommissioning the facility, the licensee shall provide long-term protection of the environment from pollution. Notification to the NRPA shall be made, if cease of operations may give rise to pollution. The NRPA may establish which measures to be made in order to prevent pollution. The NRPA may request financial guarantees from the licensee for possible future costs and liabilities
	24	Dir.	Forurensningsmyndigheten kan gi nærmere forskrifter om bygging, drift og vedlikehold av avløpsanlegg, herunder fastsette krav til personell	The NRPA may instigate establishment of a sewage plant, and prescribe competence of its staff
	39	Ind.	Ved akutt forurensning eller fare for akutt forurensning, skal nærmeste politimyndighet straks varsles	The local police authority shall be notified during a pollution event, or when there is danger of a pollution event
	40	Ind.	Den som driver virksomhet som kan medføre akutt forurensning skal sørge for en nødvendig beredskap for å hindre, oppdage, stanse, fjerne og begrense virkningen av forurensningen. Bered-skapen skal stå i et rimelig forhold til sannsynligheten for akutt forurensning og omfanget av skadene og ulempene som kan inntreffe. Forurensningsmyndigheten kan i forskrift eller enkeltvedtak fastsette nærmere krav til beredskapen etter første ledd. Beredskapen skal etter forurensningsmyndighetens nærmere bestemmelse tilpasses den kommunale og den statlige beredskapen mot akutt forurensning	Licensee shall establish emergency preparedness procedures for hindering, detecting, stopping, removing, and limiting consequences of, a release. They shall be adapted to municipality and governmental emergency preparedness

	41	Ind.	Forurensningsmyndigheten kan i forskrift eller enkeltvedtak fastsette at det for virksomhet som kan medføre akutt forurensning, skal legges fram en beredskapsplan til godkjennelse. Planen skal gi retningslinjer for hva som skal gjøres ved akutt forurensning og den skal fornyes etter behov	An emergency preparedness plan shall be developed and approved. The plan shall provide guidance on actions in an acute pollution event. The plan shall be kept up-to-date
	42	Ind.	Forurensningsmyndigheten kan pålegge de som driver virksomhet som kan medføre akutt forurensning å samarbeide om beredskapen. Slike pålegg kan omfatte plikt til å utarbeide felles beredskapsplan etter § 41 og å holde beredskapsutstyr i fellesskap. Forurensningsmyndigheten kan kreve at avtaler om etablering av særskilt beredskapsorganisasjon og andre avtaler om beredskapssamarbeid blir lagt fram til godkjennelse. Når det ikke foreligger slik avtale, kan forurensnings-myndigheten treffe vedtak om organisering og utgiftsfordeling i forbindelse med beredskapssamarbeidet	NRPA may order licensee to cooperate on em. prep. NRPA may request that contracts on em. prep. with a third party be presented for approval. NRPA may make decisions regarding organisation and cost distribution
	46	Ind.	Oppstår det akutt forurensning eller fare for akutt forurensning, skal den ansvarlige i samsvar med § 7 iverksette tiltak for å avverge eller begrense skader og ulemper	Licensee shall employ measures to avoid a pollution event, and perform mitigative actions in case of an acute release
	50	Ind.	Forurensningsmyndigheten kan kreve å få lagt fram og få granske dokumenter og annet materiale som kan ha betydning for dens gjøremål etter loven. Ved inspeksjon av virksomhet skal forurensningsmyndigheten først ta kontakt med representanter for virksomhetens ledelse.	NRPA may request relevant documentation. Initial contact will be taken with the management in the case of inspection of the facility
	52b	Ind.	Forurensningsmyndigheten kan gi forskrifter om internkontroll og internkontrollsystemer for å sikre at krav fastsatt i eller i medhold av denne lov overholdes	NRPA may issue regulations regarding internal control

	Regulation on the application the Act on Protection against Pollution and on Waste to release of radioactive substances and radioactive waste			**FOR-2010-11-01-1394**
	§	**Req. type (Direct/Indirect)**	**Text**	**Comment**
	4	Ind.	Statens strålevern kan gi tillatelse etter forurensningsloven § 11 til virksomhet som medfører eller kan medføre radioaktiv forurensning, og fastsette nærmere vilkår etter forurensningsloven § 16 for å motvirke at radioaktiv forurensning fører til skader eller ulemper. Virksomhet som medfører eller kan medføre tilførsel av radioaktive stoffer med total aktivitet eller spesifikk aktivitet som er større eller lik verdiene angitt i vedlegg II, skal i relasjon til forurensningsloven § 8 siste ledd alltid anses å medføre nevneverdige skader eller ulemper og kan ikke finne sted uten tillatelse etter forurensningsloven § 11	NRPA may issue licenses according to §11, with possible requirements acc. to §16. Activities that manage or may manage radioactive substances with a total activity or a specific activity greater than or equal to values in Appendix II shall be presumed always to give rise to significant damage or inconvenience, and thus require a license acc. to §11
	App. II	Ind.		List of exemption levels (competence needed)
	Regulation on recycling and treatment of waste			**FOR-2004-06-01-930**
	§	**Req. type (Direct/Indirect)**	**Text**	**Comment**
	16-5	Ind.	Radioaktivt avfall skal ikke blandes sammen med annet avfall og ulike typer radioaktivt avfall skal ikke sammenblandes dersom dette kan medføre fare for forurensning eller skape problemer for den videre håndteringen av avfallet. Det ikke er tillatt å fortynne radioaktivt avfall med den hensikt å komme under grensene for radioaktivt avfall i vedlegg I til forskrift 1. november 2010 nr. 1394 om forurensningslovens anvendelse på radioaktiv forurensning og radioaktivt avfall	Radioactive waste shall not be mixed with other types of waste, and different types of radioactive waste shall not be mixed. It is not allowed to dilute radioactive waste for the purpose of achieving exemption levels

	16-9	Ind.	Virksomhet som leverer radioaktivt avfall skal gi tilstrekkelige opplysninger om avfallets opprinnelse, innhold og egenskaper, slik at den videre håndteringen av avfallet kan skje på en forsvarlig måte. Når avfallet leveres, skal virksomheten fylle ut et deklarasjonsskjema som er godkjent av Statens strålevern. Emballasjen skal merkes tydelig med deklarasjonsskjemaets løpenummer. Merkingen må tåle fysiske og klimatiske påvirkninger	Radioactive waste shall be declared as to: origin, content and physical/chemical state. Packages shall be clearly labeled according to a scheme that is approved by the NRPA, and each have a unique id. Labels shall withstand physical and climatological conditions
	16-10	Ind.	Den som håndterer radioaktivt avfall, er ansvarlig for å påse at avfallet som mottas fra virksomheter, er deklarert og skal sørge for at deklarasjonsskjema følger alle leveranser ved videreleveringe	Those who handle radioactive waste shall see to that the waste declaration accompanies the waste at delivery
Act on planning and building				**LOV-2008-06-27-71**
	§	**Req. type (Direct/Indirect)**	**Text**	**Comment**
	12-1	Ind.	For gjennomføring av større bygge- og anleggstiltak og andre tiltak som kan få vesentlige virkninger for miljø og samfunn, kreves det reguleringsplan. Tillatelse etter § 20-1, jf. § 21-4 for slike tiltak, kan ikke gis før det foreligger reguleringsplan.	An area overview map of land use must exist for an area in which larger building processes shall be undertaken
	14-2	Ind.	For tiltak og planer som omfattes av bestemmelsene, skal det tidligst mulig under forberedelsen av tiltaket eller planen utarbeides melding med forslag til program for utredningsarbeidet. Forslaget skal gjøre rede for tiltaket, behovet for utredninger og opplegg for medvirkning. Melding med forslag til program skal sendes på høring og legges ut til offentlig ettersyn før programmet fastsettes. Søknad eller planforslag med konsekvensutredning skal utarbeides på grunnlag av fastsatt utredningsprogram og sendes på høring og legges ut til offentlig ettersyn	For projects, a first investigation programme shall be presented. The programme shall include a description of the project, need for consequence assessments and planned societal participation. The programme shall be sent for review and be publicly displayed before it may be finalized. The application for the project shall be developed based on the investigation programme, and be sent for review and publicly displayed

	21-1	Ind.	For nærmere avklaring av rammer og innhold i tiltaket kan det holdes forhåndskonferanse mellom tiltakshaver, kommunen og andre berørte fagmyndigheter. Andre berørte kan også innkalles. Forhåndskonferanse kan kreves av tiltakshaver eller plan- og bygningsmyndighetene	A conference between the applicant, the municipality and expert authorities may be instigated by the applicant or authorities concerned with planning and building. Other concerned parties may be asked to participate
	21-10	Ind.	Søknadspliktige tiltak skal avsluttes med ferdigattest, som utstedes av kommunen når det foreligger nødvendig sluttdokumentasjon og erklæring om ferdigstillelse fra tiltakshaver eller ansvarlig søker. For tiltak som krever uavhengig kontroll skal det foreligge dokumentasjon for utført sluttkontroll	The building phase shall be considered ended when the municipality issues a declaration to that extent, based on final documentation (including results from independent review, when applicable), and a declaration from the applicant that the building works are finalized
	24-1	Ind.	Ansvarlig prosjekterende og ansvarlig utførende skal ha system for å sikre og dokumentere at plan- og bygningslovgivningens krav er oppfylt. I tillegg skal det gjennomføres uavhengig kontroll av ansvarlige kontrollforetak når: a) det foreligger viktige og kritiske områder og oppgaver b) kommunen krever det etter en konkret vurdering	The applicants shall have a system to assure that requirements of the plan and building law are met. This includes independent review when: a. sensitive areas are involved. b. the municipality demands it, after scrutiny
	Regulation on consequence assessment			**FOR-2009-06-26-855**
	§	**Req. type (Direct/Indirect)**	**Text**	**Comment**
	9	Ind.	Konsekvensutredningen av arealdelen skal beskrive virkninger for miljø og samfunn av nye områder for utbygging eller vesentlig endret arealbruk i eksisterende byggeområder. Omfang og nivå på utredning av enkeltområder må tilpasses områdets størrelse, utbyggingens omfang og antatte konfliktgrad. Det skal også gis en vurdering av virkningene av de samlede arealbruksendringene for miljø og samfunn	The consequence assessment shall describe influence on the environment and the society due to significantly altered land use. Assessment depth and area of consideration shall be based on area size, size for the proposed facility and assumed influence

	9	Ind.	Det skal redegjøres for hva som kan gjøres for å tilpasse tiltaket til omgivelsene og for å avbøte skader eller ulemper, samt hvilke undersøkelser og tiltak som kan gjøres for å overvåke og klargjøre faktiske virkninger av planen eller tiltaket	The consequence assessment shall describe all measures taken to adopt the proposed facility to the surroundings, and which monitoring that will take place to assess actual consequences
	12	Ind.	Plan- eller tillatelsesmyndigheten kan bestemme at det skal utarbeides et miljøoppfølgingsprogram med sikte på undersøkelser og tiltak, jf. tredje og fjerde ledd. Miljøoppfølgingsprogrammet skal sikre at forslagsstiller, i samarbeid med plan- eller tillatelsesmyndigheten og berørte tilsynsmyndigheter, overvåker virkninger av planen eller tiltaket. Dette innebærer også å ta stilling til eventuelle uforutsette virkninger og treffe egnede utbedringstiltak	The Planning Authority or the license-granting authority may decide that an environment monitoring program be launched
	17	Ind.	Ved omgjøring eller fornyet behandling av konsesjon skal det, dersom tiltaket har nye vesentlige virkninger, gjennomføres en offentlig høring. Ved høringen skal det gis en redegjørelse for tiltaket og tiltakets virkninger for miljø og samfunn	When changes are made that have significant impact, a public hearing shall take place
	Appendix III	Ind.	…	Diverse requirements on consequence assessments

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