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Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

National Report of the Kingdom of Norway to the Eighth Review Meeting

17–28 March 2025

DSA

Norwegian Radiation and Nuclear Safety Authority

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Resymé

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Abstract

National Report of the Kingdom of Norway to the eighth Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, prepared in accordance with Guidelines regarding the form and structure of National Reports

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A. Introduction

This is the Norwegian report to the eighth Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) to be held at IAEA in Vienna, 17–28 March 2025. The Kingdom of Norway signed the Joint Convention on 29 September 1997, the day it was opened for signature. The Joint Convention was ratified, and Norway's instrument of ratification was deposited on 12 January 1998. Since Norway was among the first 25 States to ratify, the Joint Convention entered into force for Norway when it entered into force generally, on 18 June 2001.

This report is prepared by the Norwegian Radiation and Nuclear Safety Authority (Direktoratet for strålevern og atomsikkerhet (DSA))[1]. DSA is an independent regulatory body under the administrative authority of the Ministry of Health and Care Services. DSA is also a directorate under the Ministry of Climate and Environment in relation to radioactive pollution[2] and radioactive waste management and under the Ministry of Foreign Affairs, with respect to the State System for Accountancy and Control (SSAC) for safeguards, implementing safety measures in Ukraine and Other Countries in Eurasia. DSA also has areas of responsibility for the Ministry of Defence concerning the regulation of nuclear-powered military vessels entering Norwegian waters and ports. DSA also provides assistance and advice to other ministries on matters related to radiation protection, radioactive waste management, and nuclear safety, security and safeguards.

The report has been written in accordance with the Guidelines regarding the Form and Structure of National Reports, established by the Contracting Parties under Article 29 of the Convention at the Preparatory Meeting held from 10–12 December 2001, and amended by the seventh Review Meeting held from 27 June–8 July 2022[3]:

- Section B describes national policies and practices related to spent fuel management and radioactive waste management;
- Section C summarizes the position of Norway as regards the matters of scope referred to in Article 3;
- Section D summarizes the inventories of spent fuel and radioactive waste and describes the facilities for spent fuel management and radioactive waste management in Norway;
- Section E provides an overview of Norway's legislative and regulatory system related to spent fuel management and radioactive waste management;
- Section F describes the general safety provisions covered in Articles 21–26 of the Convention;
- Sections G and H describe the more specific safety provisions related to spent fuel management and radioactive waste management, respectively;

[1] DSA was known as the Norwegian Radiation Protection Authority (NRPA) before 1 January 2019. For simplicity in this report, actions of NRPA before 1 January 2019 are attributed to DSA.

[2] The Pollution Control Act defines "pollution" as: (1) the introduction of solids, liquids or gases to air, water or ground; (2) noise and vibrations; (3) light and other radiation to the extent decided by the pollution control authority; and (4) effects on temperature; which causes or may cause damage or nuisance to the environment. The term pollution also means anything that may aggravate the damage or nuisance caused by earlier pollution, or that together with environmental impacts such as are mentioned in items 1 to 4 causes or may causes damage or nuisance to the environment. The Regulation on the application of the Act for radioactive waste imply more specific quantitative definitions for radioactive pollution.

[3] Draft INFCIRC/604/Rev.5' Guidelines regarding the Form and Structure of National Reports' was subsequently discussed and agreed at the Fifth Extraordinary Meeting, 25 – 26 March 2024. The report is also consistent with the revised draft guidance. [4] IFE is an independent research foundation. Activities include those related to nuclear technology, petroleum technology and R&D in alternative energy. Some of the funding for general research and radioactive waste handling come from various ministries. The HBWR was part of the OECD Halden Reactor Project, which was a co-sponsored research programme involving 19 countries, with the OECD Nuclear Energy Agency as the umbrella organization.

- Section I reports on Norwegian experience in relation to transboundary movements of spent fuel and radioactive waste;
- Section J describes the legislative and regulatory system, and practice, relating to disused sealed radioactive sources;
- Section K provides a summary of general efforts to improve safety, including safety issues of concern and planned future actions to address those issues, and of international peer review services hosted by Norway;
- Section L contains Annexes providing a list of relevant documentation, an overview matrix summarizing Norway's policy and practice in relation to spent fuel management and radioactive waste management, a copy of the General Licence Conditions being introduced for nuclear facilities, and a list of abbreviations used in this report.

This eighth report takes account of the comments, questions and remarks addressed to Norway's national reports submitted for, and presentations given during, the previous Review Meetings, as appropriate.

Norway's research reactors are permanently shut down, and preparations are continuing for decommissioning of the reactors and associated facilities, and for the management of the radioactive waste (including spent nuclear fuel) from Norway's nuclear activities. A white paper on the policy and strategy for safe decommissioning and management of waste from the Norwegian research reactors was presented by the Government to the Parliament in November 2021. There have been a number of significant relevant developments since the seventh Review Meeting, which are reported under the relevant headings in this report, notably:

- A National Strategy for Safe, Secure and Environmentally Sound Management of Radioactive Waste was published by the Ministry of Climate and the Environment on the 3 July 2024.
- DSA published a guidance document on how to plan for the decommissioning, clean-up and waste handling of the Norwegian research reactors in 2023.
- Norwegian Nuclear Decommissioning (NND) submitted applications to the Ministry of Health and Care Services for licences to own and operate the three nuclear facilities at Halden, Kjeller and Himdalen in December 2022. These facilities are currently operated by the Institute for Energy Technology (IFE).
- In 2023, NND was requested by the Ministry of Trade, Industry and Fisheries to assess a step-wise transfer of the licences, recommending that the licence for Halden was given priority and to be transferred first, followed by the licence for Himdalen. NND is accordingly planning for operation of the facility in Halden in 2025.
- DSA is currently assessing the applications by NND in respect of Halden and Himdalen and will forward its recommendation through the Ministry of Health and Care Services. A decision on the application from the Government is expected for the facilities at Halden and Himdalen by the end of 2024 with effect from the start of 2025, at the earliest.
- The disposal of low and intermediate level radioactive waste at KLDRA Himdalen is currently suspended and IFE has been requested to perform a periodic safety review of the repository and its functions. This work will be continued by NND when they become a licensee.
- The Norwegian Parliament (Stortinget) adopted White Paper no 8 (2020-2021) in March 2021 as the decommissioning strategy for the Norwegian nuclear facilities and decided that the State will take the full responsibility for the decommissioning, including the financial costs.
- In 2023, the Ministry of Health and Care services performed an assessment of all their agencies and authorities with a view to strengthen the efficiency of the whole sector. In this review it was decided to maintain DSA as an independent regulatory body.

- DSA is currently seeking clarification on the extent of its legal mandate as the highest specialist agency according to the Nuclear Energy Act as far as questions of safety and security are concerned.
- An IAEA integrated Regulatory Review Service (IRRS) follow up mission is planned for November 2025.

In this context, the main current safety issues include:

- Ensuring that all spent fuel is in a stable and passively safe condition, including safely removing the remaining fuel from the Halden research reactor, and providing for its safe, secure and environmentally sound long-term storage until a disposal solution is available, including upgrading the safety of and safety assessment for existing stores and establishing additional storage where necessary.
- Updating regulations and guides, focusing on decommissioning and on the management of spent fuel and radioactive waste.
- Improving the inventory of spent fuel and radioactive waste and the characterization of facilities to be decommissioned to provide a more accurate basis for planning decommissioning and the management of spent fuel and radioactive waste.
- The disposal of low and intermediate level radioactive waste at KLDRA Himdalen is currently suspended and waste intended for disposal is therefore currently stored at the Radioactive Waste Facility at Kjeller, where the capacity is limited. There is a pressing need for more storage capacity for all radioactive waste, from both a short- and long-term perspective, and DSA has requested IFE to plan and apply for interim storage solutions at the Kjeller site.
- NND is mandated to and is currently planning for new long-term storage and disposal facilities for all radioactive waste, with the exception of NORM wastes which are not part of NNDs responsibilities.

This report concludes that Norway meets the obligations of the Joint Convention. Furthermore, it demonstrates that the relevant Norwegian authorities have established a new national policy and strategy for the management of spent nuclear fuel and radioactive waste. Norway is committed to facilitating its implementation during nuclear decommissioning and to further enhance safety, in line with the aims of the Joint Convention.

B. Policies and Practices

Article 32(1). Reporting

B.1 Historical Background

Norway has no nuclear power programme but has had four research reactors at Kjeller and Halden, all of which are now permanently shut down. Nuclear activities in Norway started in 1948 with the establishment of the Institute for Atomic Energy, now the Institute for Energy Technology (IFE) [4].

- The first research reactor at Kjeller, JEEP I (Joint Establishment Experimental Pile), reached criticality in June 1951. It was permanently shut down in 1967 and partially dismantled.
- Halden boiling water reactor (HBWR), a 25 MW boiling heavy water reactor which was part of the OECD Halden Project, started operation in 1959. Among other things, it was used for material science research and investigations of high burn-up fuel performance. It was permanently shut down in 2018.
- The N0RA (Norwegian zero power Reactor Assembly) reactor at Kjeller was started in 1961 as a joint Norwegian–IAEA project. It was permanently shut down in 1968 and partially dismantled.
- JEEP II, a 2 MW heavy water pool reactor, reached criticality in December 1966. Its applications included production of isotopes, neutron transmutation doping of silicon and neutron physics research. It was permanently shut down in 2019.

Several operational facilities are associated with the research reactors, mostly at Kjeller, including storage facilities for spent fuel and a radioactive waste treatment facility. In addition, some facilities used in past activities, including a pilot reprocessing plant at Kjeller, were not fully decommissioned after operation.

The Combined Storage and Disposal Facility for Low and Intermediate Level Radioactive Waste (KLDRA), a cavern-type facility for the disposal and storage of short lived low and intermediate level radioactive waste, also operated by IFE at Himdalen, was opened in 1999. Some waste previously disposed of at the Kjeller site was retrieved and transferred to the KLDRA Himdalen facility.

Major resources of oil and gas were discovered in Norwegian waters in the North Sea between 1969 and 1979. Production in the main fields peaked in the 1990s and 2000s, but Norway is still the thirteenth largest producer of oil and the seventh largest producer of natural gas in the world. The oil and gas industry generates significant amounts of NORM waste. The waste is deposited at the Wergeland-Halsvik repository in Gulen. The repository has a permit under the Pollution Control Act, to deposit NORM waste from the oil and gas industry, and from other Norwegian industries that generate NORM waste.

Norway also has substantial deposits of alum shale and other rocks containing naturally occurring radionuclides and with the potential to produce acidic chemical conditions in groundwater. Norway currently has three repositories for alum shale and other NORM wastes.

[4] IFE is an independent research foundation. Activities include those related to nuclear technology, petroleum technology and R&D in alternative energy. Some of the funding for general research and radioactive waste handling come from various ministries. The HBWR was part of the OECD Halden Reactor Project, which was a co-sponsored research programme involving 19 countries, with the OECD Nuclear Energy Agency as the umbrella organization.

B.2 National Policies and Strategies for the Management of Spent Fuel and Radioactive Waste[5]

In 2018 and 2019, IFE decided to permanently shut down its two remaining operational research reactors, HBWR at Halden and JEEP II at Kjeller. Current policies and strategies are focused on decommissioning existing nuclear facilities and managing the spent fuel and radioactive waste from these facilities. Some non-nuclear activities will continue to produce radioactive waste, but, with the exception of NORM wastes, the amounts will be much smaller than those from nuclear decommissioning.

In 2018, the Government decided to establish the Norwegian Nuclear Decommissioning (NND) as a state agency under the Ministry of Trade, Industry and Fisheries, to take over responsibility for decommissioning the research reactors and other nuclear infrastructure and for management, storage and disposal of radioactive waste containing artificial radionuclides. In the future, NND will therefore be responsible for:

- Operating KLDRA Himdalen, the Radioactive Waste Facility at Kjeller, the spent fuel stores at Kjeller and Halden, and any other facilities needed for decommissioning;
- Decommissioning the research reactors and other nuclear facilities currently operated by IFE at Kjeller and Halden;
- Managing the former Søve mine in Telemark and other sites contaminated with radioactive material as a result of past activities; and
- Developing additional storage and disposal facilities needed for spent fuel and other radioactive waste, including waste from non-nuclear waste producers.

The Norwegian Parliament (Stortinget) adopted White Paper no 8 (2020-2021) in March 2021 as the decommissioning strategy for the Norwegian nuclear facilities, and decided that the State will take the full responsibility for the decommissioning, including the financial costs. The White Paper states the principles for safe management of spent fuel and management of radioactive waste, economic aspects and the process for decision-making for funding. This includes the principle that the current generation must initiate the long-term management without causing undue burdens on future generations. It also states that Norway will take full responsibility to manage its radioactive waste, without excluding international cooperation and that Norway will not accept nuclear waste from other countries for storage or disposal. Applying internationally recognized best available technology and methodology is also recognized as a key principle, and that this work should be characterized by openness, transparency and stakeholder involvement.

NND is currently working with the Government and IFE to obtain a full understanding of the facilities and associated responsibilities and to develop the resources and competence to take them over. In December 2022, NND submitted applications to the Ministry of Health and Care Services for licences to own and operate the three nuclear facilities at Halden, Kjeller and Himdalen. and Kjeller. In 2023, NND was, however, requested by the Ministry of Trade, Industry and Fisheries to assess a step-wise transfer of the licences, recommending that the licence for Halden was given priority and to be transferred first, followed by the licence for Himdalen.

DSA is therefore currently assessing the applications by NND in respect of Halden and Himdalen and will forward its recommendation and conclusions for decision through the Ministry of Health and Care

[5] Reprocessing of Norwegian spent nuclear fuel outside Norway is considered as a possible management option, but only as a possible treatment option to facilitate disposal. Spent fuel is therefore effectively considered as waste, and policies and strategies for the management of spent fuel and radioactive waste are therefore reported together.

Services. A decision on the application from the Government is expected for the facilities at Halden and Himdalen, with effect from the start of 2025 at the earliest.

Following an instruction from DSA, a risk and vulnerability study (ROS analyse) was developed by IFE to identify risks associated with the transition from operation to decommissioning of the nuclear facilities and the transfer of responsibilities from IFE to NND and means to mitigate such risks. DSA developed an independent analysis from a regulatory perspective and provided it to the relevant ministries. The analysis is providing input to the safe management of the sites and planning for the transition to decommissioning and transfer to NND.

In 2019, the Ministry of Climate and Environment requested DSA to develop supporting documents for a strategy for the management of radioactive waste, to take account of commitments under the Joint Convention and priority issues related to future waste streams, notably from nuclear decommissioning, and to follow up a previous investigation of the need for radioactive waste management capacity up to the year 2035.

Since the last National Report, a National Strategy for Safe, Secure and Environmentally Sound Management of Radioactive Waste has been published. The strategy contains a compilation of existing relevant information, management practices, laws, regulations and policies related to the management of all radioactive waste in Norway. The strategy also identifies responsible entities and priorities for Norway, and the main challenges and possible solutions.

The following challenges are identified in the Strategy:

- Insufficient storage and disposal capacity for radioactive waste. The wastes specifically mentioned are: spent nuclear fuel, waste from decommissioning of the Norwegian nuclear facilities, increasing wastes from the medical sector, disused radioactive sources that cannot be returned and organic radioactive waste

- Establishing, maintaining, and further developing relevant competence for handling radioactive waste.

- The need to enhance the responsibility of the producer of waste.

The strategy applies to all types of radioactive waste, including NORM waste and spent nuclear fuel. It is intended to provide relevant information for those who generate, keep, transport or manage radioactive waste. It is also aimed at relevant decision makers both in the private and public sector.

The purpose of the strategy is to highlight what is needed to ensure safe, secure and environmentally sound management of radioactive waste in Norway, and to describe overall principles, laws and regulations and challenges and possible solutions for managing such types of waste. The overall principles are based on the Joint Convention, and IAEA safety standards for the protection of human health and the environment from the consequences of exposure to radiation.

In addition to discussing classification of waste, waste types, amounts and prognosis for radioactive waste in Norway, the strategy contains possible measures for managing radioactive waste, including disposal solutions. It also addresses decommissioning of Norwegian nuclear facilities and managing the Norwegian spent reactor fuel.

In 2024, DSA requested external support for developing a new investigation into volumes and capacity needs for radioactive waste until 2100. Although the prognoses have a high uncertainty, the report shows that there is an urgent need for more storage- and disposal capacity both in the near and the long term.

The report also identifies the need for enhanced competence and capacity in the waste management sector in Norway, and stresses that new generation of radioactive waste only should be permitted if waste solutions have been identified.

The report contains the following:

- An assessment of current waste streams and forecast of volumes until 2100. This includes assessing which new types of waste have emerged since the previous study conducted in 2016, before the reactors were shut down.
- An evaluation of whether the forecasts for 2035, made in 2016, are still considered to be accurate, taking account of the various types of waste included in the 2016 study.
- An assessment of the necessary capacity for waste management until 2100, for all types of waste and based on the foundation in the report from 2016 and new types of waste identified in the study.
- A summary of challenges in the management of radioactive waste now and until 2100.

The report concluded the following:

- There are vulnerabilities and capacity challenges in most steps of radioactive waste management in Norway. For example, in many of the steps there is only one operator currently available to manage the waste and, in other cases, the geographical distribution of operators is limited. In addition, the current capacity for storage and disposal will be exceeded in most sectors that were investigated in the report. New storage solutions for waste containing anthropogenic waste from nuclear activities and other uses of radioactive material are needed immediately, especially since KLDRA Himdalen is not currently accepting radioactive waste for disposal;
- Extending permits for storing short-lived waste until its activity is under the limiting values for radioactive waste can reduce the need for storage and disposal;
- Sorting waste and new treatment methods can alleviate the pressure on storage and disposal capacity;
- There must be realistic plans for managing new types of radioactive waste before they are generated;
- Communication between the authorities, waste producers, and waste management operators should be improved to secure good solutions.
- Knowledge about classification of radioactive waste is increasing but should be further improved to ensure identification of all radioactive waste.

DSA has developed a Knowledge Management Strategy for the period 2024-2028. The main focus of the strategy is to ensure adequate competence and knowledge, which is especially important entering the phase of nuclear decommissioning. The strategy encompasses DSA's role as instigator for knowledge, education and training, making data available, dissemination of knowledge and application of existing knowledge. As part of the strategy, a model has been established for Norwegian technical support functions. These functions will consist of a coordinated network of internal functions within DSA as well as external functions. DSA will be further developing and implementing this network over the next several years.

DSA has also developed a guidance document on how to plan for the decommissioning, clean-up and handling of waste from the Norwegian nuclear programme[6]. The guidance is based on Norwegian regulations and international obligations, standards, and principles. The aim is to ensure that decommissioning is conducted in line with international best practices for nuclear safety, security, non-proliferation, and environmental protection. The guide discusses the operation of the nuclear facilities

[6] https://dsa.no/publikasjoner/_/attachment/inline/53ca0b90-b637-40c3-abb6-87752955cc1c:bae00c7f13c326f0a4b6f1366cba9f51cf7938ba/Veileder%2015%20Veileder%20for%20planlegging%20av%20opprydning%20etter%20de%20norske%20atomanleggene.pdf (In Norwegian)

during the planning phase of the decommissioning, the establishment of new nuclear facilities, including waste facilities, and the decommissioning of nuclear facilities and associated facilities. The guide also describes interdependencies and strategic decision points that must be considered in a holistic lifecycle plan for the safe, secure, and environmentally sound decommissioning and management of radioactive waste from the Norwegian nuclear facilities.

NND will be responsible for radioactive waste management (other than for NORM waste). NND issued a draft waste strategy for operational aspects of dealing with waste from the nuclear sector in 2019[7]. The intention is for the draft strategy to be updated to take account of the National radioactive waste management strategy, which was published on 3 July 2024.

Options for the management and disposal of spent nuclear fuel have been under consideration since the first official reports, issued in December 2001 (NOU 2001:3 and the later NOU 2011:2). Subsequent concept evaluation studies (KVU) and corresponding quality assurance reports (KS1)[8] have provided a basis for proposed strategies with respect to spent nuclear fuel which are under consideration. NND is continuing to perform KVU studies as a basis for developing its strategies and plans for the future management of spent fuel, decommissioning and management of radioactive waste.

In 2017, the Ministry for Trade, Industry and Fisheries gave the Directorate for Public Construction and Property (Statsbygg) an assignment to begin conceptual design, siting analysis and cost estimates for a new central storage facility for spent fuel, co-located with a new repository for low and intermediate waste. This assignment was later halted after the establishment of NND and pending further development of the national strategy for radioactive waste.

In 2022, NND carried out an assessment of a possible new storage facility for radioactive waste, and DSA provided extensive guidance to this proposal. This assessment was for a new facility to be created for all types of radioactive waste for which NND is responsible, except spent fuel.

In 2023, NND started a project on Storage for Radioactive Waste. The project aims to ensure the availability of storage and treatment capacity for radioactive waste that will be generated from the decommissioning of the nuclear facilities in Norway. NND has also started to assess possible geological areas that might be suitable for storage and disposal of waste, based on a voluntary approach from local communities

Technical assessments commissioned by DSA in 2018[9] indicated that it is likely that packaging and other disposal system features could be designed, and a disposal site found in Norway, suitable to allow safe direct disposal for the relatively small amounts of spent nuclear fuel concerned. Some previous evaluations had indicated or assumed that some of the spent fuel in Norway has characteristics that would make it unsuitable for direct disposal and therefore would require chemical treatment to facilitate disposal.

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[7] https://www.norskdekommisjonering.no/wp-content/uploads/2019/12/Avfallsstrategi.pdf (in Norwegian).

[8] Major infrastructure projects in Norway require a concept evaluation study (KVU), produced by the developer, describing and justifying the proposed project, and an independent quality assurance review of the concept evaluation (KS1). For simplicity, this report refers explicitly primarily to the concept evaluations, and such references may be assumed to include the quality review of the evaluation.

[9] Walke R et al, Disposability Assessment for Norwegian Research Reactor Fuel: Post-ciosure Safety Assessment Report, Quintessa Ltd report QRS- 1924A for DSA (2018); and Avila R et al, Generic Post-Closure Safety Assessment of Alternative Disposal Concepts for the Spent Nuclear Fuel from Research Reactors in Norway, ÅF Industry AN and Intera report PCSA-NSF for DSA (2019).

A further concept evaluation report was issued in 2020[10], as a part of NND's project Handling of Norwegian spent reactor fuel, which includes proposals for shorter-term management of spent nuclear fuel and possible options for treatment. This report, and the independent quality assurance review, have been the subject of detailed review by DSA. In June 2022, the Ministry for Trade, Industry and Fisheries commissioned NND to carry out a clarification phase for the project. The clarification phase is currently in progress and aims to clarify whether and possibly what kind of treatment is necessary for the spent fuel, and to reduce uncertainty regarding treatment alternatives, or combinations of alternatives, and the steps in handling the fuel.

Concept evaluation studies of this type (KVU) and the associated quality assurance reports are made publicly available, and the public and relevant stakeholders are invited to provide comments, questions and concerns, which are put on the record. Formal processes for public involvement in decision making relating to specific proposed projects are described in section G.

B.3 National Practices for the Management of Spent Fuel and Radioactive Waste

Four research reactors (listed in B1) generated spent fuel during operation, as well as some irradiated research and experimental fuel.

Both N0RA and JEEP I research reactors were defueled after final shutdown and fuel was removed from reactor buildings. Most of the N0RA reactor fuel was returned to the USA, the country of origin. Some of the JEEP I reactor spent fuel underwent reprocessing at the pilot plant at Kjeller and some was reprocessed (and the products and waste retained) in Belgium. The remaining spent fuel is stored in spent fuel storage facilities on the Kjeller site.

From the most recent operation of research reactors (JEEP II at Kjeller and BHWR at Halden), fuel withdrawn from reactor core was placed in cooling pools or wells in the reactor buildings for cooling. After the necessary cooling period, spent fuel was transferred to wet or dry stores on the reactor sites. At present, the last fuel core load at JEEPII research reactor remains in cooling wells in reactor building. Reactor HBWR was partially defuelled after final shutdown, but part of the fuel still remains in the reactor core. The fuel in temporary locations (cooling wells and the HBWR reactor) will be moved to spent fuel storage facilities when shortcomings in safety assessment of those facilities will be resolved.

No decision on the processing or final disposal of the spent fuel has yet been taken. The inventory of the spent fuel can be found in section D.2.

Spent fuel and long-lived radioactive waste unsuitable for disposal at KLDRA Himdalen will be stored until final disposal (or treatment prior to disposal) is possible.

The Radioactive Waste Facility at Kjeller started operation in 1959 and continues to be used for handling, treatment, conditioning, and storage of radioactive waste. Radioactive waste suitable for disposal at KLDRA Himdalen is conditioned in the facility at Kjeller and transported in conditioned form to KLDRA for disposal. Low and intermediate level waste from the HBWR is routinely transported to the facility at Kjeller for conditioning for disposal at KLDRA Himdalen. Currently, the disposal of radioactive waste at KLDRA Himdalen is suspended (see below). As a result, waste is not currently being transported to KLDRA

[10] https://www.norskdekommisjonering.no/wp-content/uploads/2020/06/Begrenset-konseptvalgutredning-om-behandling-av-norsk-brukt-reaktorbrensel.pdf (in Norwegian).

Himdalen but is stored at Kjeller until either it can be disposed of at KLDRA Himdalen or new disposal solutions are established.

One incineration plant, Senja Avfall IKS in Troms County in northern Norway, currently has a permit to receive small amounts of combustible radioactive waste (e.g. from medical facilities) for incineration.

KLDRA Himdalen, about 25 km south-east of the Kjeller site, has been in operation since 1999. It consists of four rock caverns with two concrete sarcophaguses in each cavern. At present, one cavern is used for storage and three caverns for disposal. Low and intermediate level waste (LILW), except NORM waste, high activity disused sealed sources and long-lived intermediate level waste, are disposed at KLDRA Himdalen. Earlier estimates indicated that this facility had sufficient capacity to accommodate disposal needs until 2030. However, the shutdown and planned decommissioning of the research reactors earlier than originally anticipated have implications for the continued capacity of this facility.

IFE decided, in March 2020, to suspend the disposal of radioactive waste in KLDRA Himdalen. The background for the decision was uncertainty related to whether the functional requirements for the facility were met. The decision to suspend the disposal of radioactive waste in KLDRA Himdalen was upheld in April 2021 after further investigation. In December 2023, DSA gave an instruction to IFE to suspend disposal of radioactive waste in KLDRA Himdalen until a full safety report for the facility, showing that it is safe to resume disposal of radioactive waste at the facility, had been approved by DSA. This instruction is being addressed in parallel with the separate instruction to IFE to conduct a PSR (see section H.2), and NND's application for a licence to operate KLDRA Himdalen. Final decisions about the future use of KLDRA Himdalen (including the possibility of extending the facility) and/or development of replacement disposal capacity are unlikely to be taken until these processes have reached a conclusion and a fully updated SAR has been approved. NND is currently evaluating alternative strategies. The storage cavern at KLDRA Himdalen contains, among other things, 166 drums containing small amounts of plutonium contaminated waste. The final decision on the disposal of these drums is dependent on further assessment.

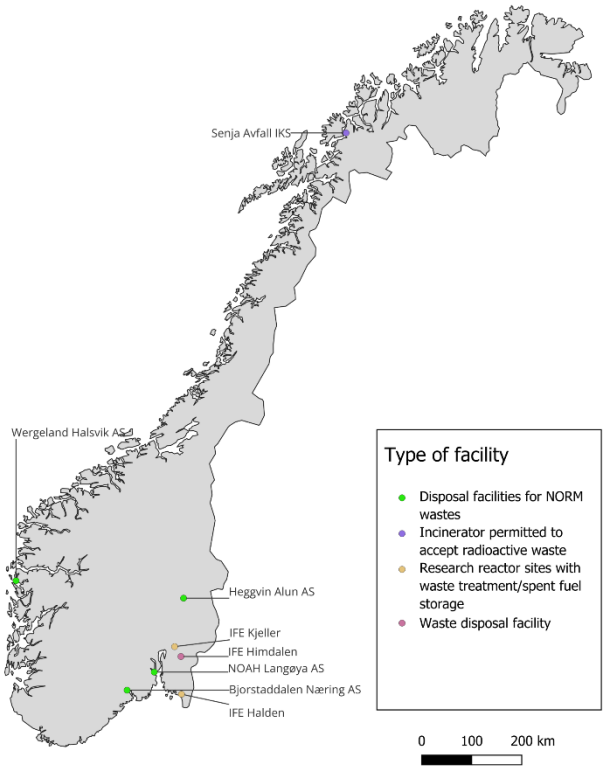

Figure 1: The national facilities in Norway

Waste with naturally occurring radioactive materials (NORM) above exemption levels is regulated as radioactive waste in Norway. There are four repositories in Norway for radioactive waste containing NORM:

- A cavern-type repository for disposal of NORM from the petroleum industry, Wergeland-Halsvik, repository, at Gulen on the West coast of Norway, has been in operation since 2008;
- Heggvin Alun, a landfill type repository, has permits to receive and dispose of wastes containing acid forming rocks with NORM (alum shale), NORM from mining and sludge containing NORM;
- The main repository in Norway for hazardous waste, NOAH Langøya, also has a licence to receive and dispose of NORM waste, and mainly receives acid forming rocks;

- Bjorstaddalen Næring, a landfill type repository, received a permit from DSA in 2020 to receive dispose of phosphate sand containing NORM.

B.4 Categorization of Radioactive Waste in Norway

The categorization of radioactive waste is based on definitions in the Regulation on application of the Pollution Control Act to radioactive pollution and radioactive waste. Annexes I a and I b of this Regulation provide radionuclide-specific limiting values defining, respectively, 'radioactive waste' and 'radioactive waste subject to a disposal requirement' (i.e. for which disposal in a radioactive waste repository is required). The limiting values for radioactive waste are specified as specific activity (Bq/g) and for radioactive waste subject to a disposal requirement as specific activity (Bq/g) and total activity (Bq) for each radionuclide. A 'sum of fractions' formula is specified for waste containing combinations of radionuclides. These levels are generally in line with the criteria in the International Basic Safety Standards for, respectively, clearance of bulk amounts of material or waste and exemption of moderate amounts.

According to the Regulation on the Recycling and Management of Waste (Waste Regulation) § 16-4, radioactive waste must be handled, and disposed of, in an environmentally sound way. In order to facilitate appropriate disposal solutions for radioactive waste in Norway, the following classification is used in the National Waste Strategy:

Non-radioactive waste: waste under the exemption values for radioactive waste given in Annex 1 a in the Regulation on application of the Pollution Control Act to radioactive pollution and radioactive waste.

Waste containing nuclear substances, defined in the Nuclear Energy Act, but below the limits in the Regulation on application of the Pollution Control Act to radioactive pollution and radioactive waste, will still be subject to a licence under the Nuclear Energy Act. However, the Nuclear Energy Act § 2 allows the Ministry of Health and Care Services to decide that nuclear substances below the limits in the Regulation on application of the Pollution Control Act radioactive pollution and waste are exempt from licensing requirements.

Very short-lived radioactive waste: waste containing radioactive substances with a half-life of up to 100 days. This waste can be stored locally until the radioactive substances have decayed so that the waste is no longer defined as radioactive waste and can be handled as ordinary waste. This requires the waste be exempted from the yearly delivery obligation in § 16-7 of the Waste Regulations if necessary.

Very low-level waste: waste that is suitable for disposal in a landfill with a permit for hazardous waste or a permit from DSA. This applies to radioactive waste that is not subject to a disposal requirement, i.e. radioactive waste with radioactivity levels below the limiting values given in the Regulation on application of the Pollution Control Act to radioactive pollution and radioactive waste, Annex I letter b.

Low-level waste and short-lived intermediate-level waste: waste above the exemption value in the Regulation on application of the Pollution Control Act to radioactive pollution and radioactive waste, Annex I b. This waste can be deposited in a near-surface disposal facility that will ensure the containment of radioactive waste for several hundred years until the radioactivity has largely decayed. This includes large parts of the radioactive waste containing anthropogenic radionuclides in Norway.

High-active waste and intermediate waste with a long half-life: waste that requires disposal in a deep geological repository. This includes, among other things, spent nuclear fuel and/or products from the treatment of spent nuclear fuel. The disposal solution must ensure adequate containment of the waste for a very long time.

The waste acceptance requirements for KLDRA Himdalen prohibit the disposal of radioactive waste with concentrations of long-lived alpha emitting radionuclides exceeding 400 Bq/g on average or 4000 Bq/g in any individual package, and therefore effectively limit disposal at KLDRA Himdalen to low level waste and short-lived intermediate level waste.

NORM waste is radioactive waste if it exceeds the exemption value in the Regulation on application of the Pollution Control Act to radioactive pollution and radioactive waste, Annex I a. Such waste has been reported earlier by Norway under the Joint Convention and is included again in this report. There are four repositories for NORM waste in Norway. Further details are given in section D.3.2.

C. Scope of Application

Article 3. Scope of application

As a Contracting Party to the Joint Convention, Norway has:

a) No reprocessing activity, and no spent fuel held at a reprocessing facility abroad, therefore reprocessing is not declared to be part of spent fuel management.

b) Declared waste that contains only naturally occurring radioactive materials as waste for the purpose of this Convention.

c) Not declared spent fuel or radioactive waste generated within military or defence programmes as spent fuel or radioactive waste for the purpose of this Convention.

D. Inventories and Lists

Article 32(2) Reporting

D.1 Spent Fuel Management Facilities

There are two sites with spent fuel management facilities in Norway, as seen in the map in Figure 1 above; at Kjeller, about 20 km East of Oslo, and at Halden, about 100 km South of Oslo, near the Swedish border. Both sites are currently operated by IFE.

A list of the spent fuel management facilities in Norway is provided in table D.1 below.

Table D1. Spent fuel management facilities

Location	Facility		Essential features	Main purpose
Kjeller	MetLab II	Pit storage	Dry storage for spent fuel. Concrete foundation. Vertical wells constructed in the concrete block. Fuel assemblies placed in steel canisters, closed by lid. Canisters stored in wells. Air cooling, natural circulation.	Storage for several different types of fuel, e.g. operational fuel from JEEP II and HBWR, experimental fuel and materials.
		Hot cells	Concrete and lead shielded hot cells	Irradiated experimental fuel and materials for PIE. After irradiation in HBWR, experimental fuel and materials are examined (post irradiation examination (PIE)) and tested in Metlab II hot cells.
		Fuel wells	Dry storage. Vertical wells in concrete block. Basically, the same construction as in the Pit storage. Air cooling, natural circulation.	Storage for several different types of fuel, e.g. operational fuel from JEEP II and HBWR, experimental fuel and materials.
Kjeller	JEEP I Stavbrønn		Dry storage. Building with below ground fuel storage construction. Fuel assemblies placed in steel canister, closed by lid. Canisters stored in vertical wells. Air cooling, natural circulation	Spent fuel storage of aluminium-clad metallic fuel.
Kjeller	JEEP II reactor hall	JEEP II reactor cooling wells	Wet storage. Wells, constructed in reactor concrete block. Water cooling, artificial circulation	Cooling for JEEP II reactor operational spent fuel, unloaded from reactor.
Halden	HBWR reactor hall	HBWR fuel pits 1-3	Wet storage. Pool type, constructed in concrete block. Water cooling, artificial circulation.	Cooling of spent fuel unloaded from HBWR.
		HBWR compart-ments	Lead shielded compartments for fuel handling	Handling all types of fuel, including operational fuel, booster fuel, experimental fuel and irradiated materials.
Halden	Bunker building	Fuel storage pond (FSP)	Wet storage, pool type. Building with below ground level storage construction (ponds). Water cooling, artificial circulation.	Spent fuel storage for all types of fuel including standard fuel, booster fuel, experimental fuel and materials and more from HBWR.
		Fuel handling pond (FHP)	Wet storage, pool type. The same building description as FSP. Water cooling, artificial circulation.	Spent fuel handling and inspection of fuel pins.
		Dry storage (bunker)	Dry storage. The same building description as FSP. Horizontal wells in concrete block, constructed above	Spent fuel storage. The storage contains all types of fuel from HBWR, including

Location	Facility		Essential features	Main purpose
			ground level. Air cooling, natural circulation	aluminium-clad metallic fuel from HBWR 1st charge.
Halden	MetLab compartments		Lead shielded compartments for fuel handling.	Handling all types of fuel, including operational fuel, booster fuel, experimental fuel and irradiated materials.

D.2 Inventory of Spent Fuel

Information on the inventory of spent fuel in Norway can be found in table D2 below.

The total inventory of spent fuel in Norway is almost 16.4 tonnes. The total amount of spent fuel will be increased by a very small amount, when the remaining fuel is withdrawn from HBWR. No further increase in the spent fuel inventory is expected in the future, since all of the research reactors in Norway are permanently shut down: some of the spent fuel from JEEP I is stored in JEEP I Stavbrønn and the pit storage at Kjeller, and some was reprocessed in the 1960s; Most of the N0RA fuel, which was similar to that used in JEEP I, was returned to the country of origin, i.e. USA; JEEP II is defuelled and the last charge of reactor fuel is stored in the JEEP II reactor cooling wells. The inventory of spent fuel is provided in Table D2.

Table D2: Inventory of spent fuel in Norway as of July 2024.

Site/Location	Kjeller			Halden	
Fuel from reactor	JEEPII, HBWR, JEEPI	JEEPI, HBWR	JEEPII	HBWR	HBWR
Fuel type (s)	UO_2, HBWR experimental	Uranium Metal	UO_2	UO_2 experimental	Uranium Metal, UO_2, experimental
Fuel cladding (s)	Aluminium, Zircaloy	Aluminium	Aluminium	Zircaloy experimental	Aluminium, Zircaloy, stainless steel
Total mass, kg	2 120	3 125	246	399	10 491

D.3 Radioactive Waste Management Facilities

D.3.1. Radioactive waste management facilities for radioactive waste originating from industry, nuclear facilities, research, medicine, disused sealed sources etc.

At the IFE Kjeller site the following facilities are in operation:

- The Radioactive Waste Facility (built 1959) is a facility for receiving, sorting, handling, treatment and conditioning of radioactive waste before storage or disposal. It is currently the only facility of this type in Norway. It receives all LILW (except NORM waste) generated by Norwegian industry, hospitals, universities, research and defence organizations.
- Storage Building 1 (built 1965–66) is part of the Radioactive Waste Facility and is a single-storey building with an area of 434 m^2. It is used for storage of unconditioned waste awaiting treatment and conditioned waste awaiting transfer to storage building 2.
- Storage Building 2 (built 1977–78) is a single-storey building with an area of 430 m^2 and is used partly for storage of conditioned waste ready for transport to the KLDRA Himdalen facility, and partly for

storage of waste containing liquids from radiopharmaceutical production, which is awaiting solidification to facilitate disposal. There is currently no solidification facility in Norway.

The KLDRA facility comprises a set of four rock caverns, connected by an access tunnel, built into a hillside at Himdalen in Aurskog–Høland municipality, about 25 km from Kjeller. It has been in operation since March 1999, and is licensed for the disposal of short lived LILW and the storage of some specific wastes. The builder and owner of the facility is the Directorate for Public Construction and Property, Statsbygg, and the current operator is IFE. NND has applied for a licence for ownership and operation of KLDRA Himdalen with a target date for the transfer from IFE from 1. January 2025. The application is currently under review and assessment by DSA. KLDRA Himdalen has a designed disposal capacity of 2000 m^3 of conditioned waste, if all four caverns are used for disposal.

Table D3. Radioactive waste management facilities.

Facility	Location	Main purpose and essential features
The Radioactive Waste Facility	Kjeller	Receiving, sorting, handling, treatment and conditioning of radioactive waste before storage or disposal. It receives all LILW generated by Norwegian industry, hospitals, universities, defence and research organizations, incl. operational waste from nuclear facilities. Storage of solidified uranium (yellow cake) until a suitable disposal facility is available.
Storage Building 1 (in Radioactive Waste Facility)	Kjeller	Storage of conditioned and unconditioned waste packages.
Storage Building 2	Kjeller	Storage of conditioned waste ready for transport to KLDRA Himdalen and un-irradiated material.
Combined Disposal and Storage Facility (KLDRA)	Himdalen	National facility for disposal, and currently also storage, of LILW. Rock cavern type facility, with caverns close to ground level and with minimum of 50 m of rock cover.

D.3.2. Management facilities for radioactive waste containing only naturally occurring radioactive material.

Norway regulates waste containing naturally occurring radioactive material (NORM waste) as radioactive waste, but NORM wastes are managed and disposed of separately from radioactive waste from nuclear facilities, research, medicine, disused sealed sources, etc. Management and disposal facilities for NORM waste are operated by private companies. Management of NORM wastes is generally regulated by the Norwegian Environment Agency, with DSA regulating in respect of their radioactive properties.

Four disposal facilities for such waste are in operation: one for NORM waste from the oil and gas industry and land-based NORM industries; and three for alum shale and other similar acid forming rocks.

In 2008, the repository for radioactive waste from the oil and gas industry and land- based NORM industries started operation at Gulen, on the West coast of Norway. The repository is operated by Wergeland-Halsvik AS and is situated in an underground rock formation. It consists of an entry tunnel, a tunnel for NORM waste treatment as well as two tunnels for waste disposal, with a total capacity for disposal of 7000 tonnes of NORM waste. Treatment at the facility consists of dewatering waste, filling void space in the barrels with sand or oil absorbent material and sealing between the barrels with a cement matrix. The intention is that the repository tunnels will be filled with waste drums, cemented in concrete mould castings. Wergeland Halsvik who run the Gulen facility has applied for an expansion of the facility. The application is currently being processed by DSA and the Norwegian Environment Agency.

In addition to the Gulen facility, there are currently three repositories that have a permit to accept NORM waste in Norway, see table D4.

The activity concentration of natural uranium in the acid forming rocks are usually similar to the exemption levels for radioactive waste in Norwegian legislation, but they have a high potential for radioactive pollution if not handled correctly.

Table D4. NORM waste management facilities

Facility	Location	Main purpose and essential features
Wergeland Halsvik AS	Gulen	Repository for disposal of NORM waste from oil and gas and land-based industries. Underground rock caverns.
NOAH	Langøya	Former quarry mostly used for hazardous (non-radioactive) waste. Permitted for disposal of alum shale and other similar acid forming rocks.
Heggvin alun	Heggvin	Landfill-type repository for alum shale and other similar acid forming rocks
Bjorstaddalen Næring	Skien	Landfill-type repository for phosphate sand.

D.4 Inventory of Radioactive Waste

The inventory of radioactive waste disposed of and in storage at KLDRA Himdalen is shown in Table D5. Approximately 160–170 drum equivalents of waste were generated each year[11], about half of which was typically from the activities at IFE's sites. The total amount of waste has fallen to less than 120 drums per year since the research reactors have shut down and may be expected to be more variable when decommissioning starts. As described in section B.3, disposal of radioactive waste was suspended by IFE in March 2020, but during 2022 some containers were nevertheless placed in the facility: these were not covered with concrete, and therefore are not considered disposed of. No other radioactive waste has been placed in the facility since 2020.

In addition, 21 drums (1210 kg uranium) of yellow cake from the pilot reprocessing plant and 8 drums (41 GBq) containing radium needles previously used in hospitals are stored at the Kjeller site.

Table D5 Inventory of Norwegian radioactive waste at KLDRA Himdalen as of December 31st 2023

Radionuclide	Disposed waste (Bq)	Stored waste (Bq)
H-3	6,91E+13	
C-14	4,25E+11	
Cl-36	4,63E+07	
K-40	1,89E+09	
Co-60	5,49E+12	1,78E+08
Ni-63	1,62E+13	
Kr-85	1,79E+11	
Sr-90	1,86E+12	1,16E+11
Tc-99	1,01E+09	
I-129	3,91E+07	
Ba-133	3,81E+10	
Cs-137	4,36E+13	1,22E+11
Eu-152	1,42E+09	

[11] Volumes of radioactive waste managed at KLDRA Himdalen are typically expressed in terms of the number of standard 210 litre 'drums' or their equivalent. This does not necessarily mean that all waste is in such drums.

Radionuclide	Disposed waste (Bq)	Stored waste (Bq)
Eu-154	2,67E+09	
Hg-203	1,48E+07	
Pb-210	2,23E+07	
Ra-226	6,78E+09	
Ra-228	1,05E+08	
Ac-227	3,52E+09	
Th-228	4,99E+07	
Th-230	2,30E+06	
Th-232	9,78E+08	
Pu-238	5,80E+11	4,78E+11
Pu-239	2,51E+10	3,12E+10
Pu-240	8,82E+10	1,20E+11
Pu-241	6,133E+12	1,22E+13
Pu-242	2,44E+08	3,32E+08
Am-241	6,30E+12	
Cm-244	3,12E+09	
U-233	1,27E+02	
U-234	2,31E+07	
U-235	4,79E+06	
U-236	3,90E+06	
U-238	1,50E+09	1,66E+08
Total no. of 210-litre drums	6597	166

No facilities are currently being decommissioned (see Section D5) but decommissioning of all of the nuclear facilities at Halden and Kjeller is being planned. Several estimates of the future inventory of radioactive waste for disposal, largely from decommissioning of the nuclear facilities, have been made but are preliminary. In addition to IFE's ongoing work to characterize the nuclear facilities, to support estimation of the inventory of radioactive waste from dismantling and demolition, DSA has instructed IFE to map the radioactive contamination of soil that might originate from IFE activities. The instruction was given to gain knowledge about the amount of contaminated soil needing management during and after decommissioning.

The inventory of LILW (by volume) from decommissioning to be managed is estimated to be several times the capacity remaining in the existing KLDRA Himdalen, but this will depend on the extent to which exempt waste (below the activity criteria defining radioactive waste) and very low level waste (below the activity criteria defining radioactive waste subject to a disposal requirement) is segregated and diverted away from KLDRA Himdalen or a replacement. DSA is developing guidance on the process and regulatory expectations for the clearance of materials.

The total inventory of the repositories for NORM waste in Norway, as of January 2024, is 1 653 684 tonnes of waste, of which 6103 is waste from the petroleum industry. The remaining inventory comprises other NORM wastes, i.e. alum shale and other types of acid forming rocks and phosphate sand, typically generated from various infrastructure projects or industrial processes.

D.5 Nuclear facilities in the process of decommissioning

No facilities are currently being decommissioned but decommissioning of all of the nuclear facilities at Halden and Kjeller is being planned.

The following facilities are partially dismantled and awaiting full decommissioning in the future, together with other nuclear facilities at the Kjeller site.

The uranium purification plant (Uranrenseanlegget) at Kjeller was an experimental plant for the treatment (reprocessing) of reactor fuel, which was in operation from 1961 to 1969. The purpose of the plant was to separate uranium and plutonium from the spent fuel, for further use. Part of the spent fuel from the JEEP-I reactor was reprocessed in this facility. Dismantling the technical parts of the facility has been carried out gradually from 1989 until 2022, when IFE reported that the facility was partly decommissioned, and that further decommissioning had to be done along with the whole Kjeller facility. Parts of the building are partially rehabilitated and used for different purposes, but there remain rooms that contain technical installations that have not begun to be dismantled (e.g., pump room and dissolution cell), and which are assumed to be significantly contaminated.

The N0RA reactor was in operation from 1961 to 1968. The reactor was defuelled after permanent shutdown and spent fuel was returned to the USA, the country of origin. Coolant was drained from the reactor tank. Most of the reactor block, i.e., a cylindrical tank, graphite reflector and biological shield (concrete), was left untouched after the permanent shutdown. Reactor parts outside the reactor block, e.g., cooling system, were dismantled.

The JEEP I reactor was in operation from 1951 to 1967. The reactor was defuelled after permanent shutdown. Some of the spent fuel was reprocessed in Uranrenseanlegget and the rest is stored in JEEP I Stavbrønn. Coolant was drained from the reactor tank after permanent shutdown. Most of the reactor block, i.e., a cylindrical tank, graphite reflector and biological shield (concrete) was left untouched after the permanent shutdown. Reactor parts outside the reactor block, e.g., cooling system, were dismantled.

E. Legislative and Regulatory Systems

Article 18. Implementing measures

Article 19. Legislative and regulatory framework

Norway is a constitutional monarchy formally headed by the King as head of State and the Prime Minister as appointed head of Government. The Prime Minister is supported by a council (cabinet), appointed by him/her with the approval of the Storting (the Norwegian Parliament). Laws are passed by the Storting and sanctioned by the King in Council. Regulations, directives, orders and certain licences are adopted by the King in Council or the Ministries upon the advice of Ministries and specialised agencies and authorities, such as DSA.

Spent fuel management and radioactive waste management, including transboundary movements, are mainly regulated by three legal instruments and their corresponding regulations:

- Act Concerning Nuclear Energy Activities (The Nuclear Energy Act)
- Act Concerning Protection Against Pollution and Concerning Waste (The Pollution Control Act)
- Act Concerning Radiation Protection and Use of Radiation (The Radiation Protection Act)

General Licence Conditions (GLCs) were introduced in IFE's operating licence for the Kjeller site from 1 January 2019 and for the Halden site from 1 January 2021. The intention is also to apply the relevant GLCs for the KLDRA Himdalen site in the future. In 2022, DSA published Guidance on the general licence conditions. The guidance elaborates on the conditions and specifies the significance of IAEA safety standards. It clarifies DSA's view of how the licence conditions are to be understood and is intended to be used as a working reference for licensees, and guidance for those applying for a licence under the Nuclear Energy Act.

In addition, DSA has developed and strengthened procedures relating to core regulatory functions, such as authorization and review and assessment. Currently a proposal to give DSA authority to issue penalty fines, according to the Nuclear Energy Act and the Radiation Protection Act, is out on public hearing. The acts already allow DSA to issue enforcement fines that are administrative *measures*, the penalty fines are, however, administrative *sanctions*.

In December 2023, DSA published a guidance document explaining the requirements for import and export of radioactive waste in the Regulation on the Recycling and Management of Waste.

Since the last National Report, DSA has enhanced its inspection programme, for example by including measures to follow international recommendations and best practice more closely, strengthened competence and capacity of DSA staff, enhanced the quality of regulatory functions and improved mechanisms to promote the operators' understanding of the regulatory requirements.

The IAEA undertook an IRRS Mission to Norway in June 2019, and the recommendations and suggestions from the IRRS team are being addressed by the relevant authorities. Some of these recommendations and suggestions, provided an important input to plans for the further development of the policies and strategies and the regulatory framework in the next few years, notably to address the situation in Norway changing from operation to decommissioning. An IRRS follow up mission is planned for November 2025.

E.1. The Nuclear Energy Act

The Act of 12 May 1972 No. 28 Concerning Nuclear Energy Activities (Nuclear Energy Act) regulates the licensing regime for nuclear facilities, general requirements for licences, inspection regime and the legal basis for the regulatory body. Chapter III of the Act establishes the liability regime according to the Paris Convention of 29 July 1960 with later amendments, and related international legal instruments. The final part of the Act regulates confidentiality and penalties in case of non-compliance. The Act does not explicitly address specific stages in the lifetime of a facility, e.g. decommissioning, but the general responsibilities apply for the whole lifetime of a facility. This was noted in the 2019 IRRS review, and possible means of addressing different lifetime stages more explicitly in regulations, licence conditions and/or guidance are being considered.

Pursuant to the Act, the following four regulations have been issued:

- Regulation of 2 November 1984 No. 1809 on the Physical Protection of Nuclear Material. This establishes requirements for the physical protection of nuclear material and nuclear facilities. The Regulation implements the obligations of the Convention of the Physical Protection of Nuclear Material. The last revision, taking account of the Amendment to the Convention (which entered into force in May 2016), entered into force on 1 January 2019.
- Regulation of 15 November 1985 No. 1912 on Exemption from the Act on Nuclear Energy Activity for Small Amounts of Nuclear Material. This exempts small amounts of nuclear material from Chapter III of the Act and thus from the liability regime.
- Regulation of 12 May 2000 No. 433 on Possession, Transfer and Transportation of Nuclear Material and Dual-use Equipment. This deals with the control of nuclear material to make sure it is not used for undeclared activities. The Regulation implements the Additional Protocol to the Safeguards Agreement between Norway and the IAEA in the Norwegian legal framework.
- Regulation of 14 December 2001 No. 1809 on Financial Compensation after Nuclear Accidents. This stipulates how Contracting Parties to the Vienna Convention of 21 May 1963, Contracting Parties to the Joint Protocol of 21 September 1988 and Hong Kong shall be considered in connection to Norwegian legislation on nuclear liability. It also regulates how nuclear accidents in a non-party state shall be considered in connection with the Norwegian legislation.

Additionally, there are three Royal Decrees granting licences to IFE for its operations:

- 7 December 2020 on “Renewed Licence to Institute for Energy Technology (IFE) for Operation of Nuclear Installations in Halden pursuant to the Act on Nuclear Energy Activities”. The licence expires on 31 December 2030.
- 20 December 2018 on “Renewed Licence to Institute for Energy Technology (IFE) for Operation of Nuclear Installations in Kjeller and for the Fuel Instrumentation Workshop in Halden pursuant to the Act on Nuclear Energy Activities”. The licence expires on 31 December 2028.
- 27 April 2012 on “Renewed Licence to Institute for Energy Technology (IFE) for Operation of the Combined Storage and Repository for low and intermediate level radioactive waste (KLDRA)”. The licence expires on 30 April 2028.

The main basis for the licences are the safety analysis reports (SARs) submitted by IFE for the two reactors and the associated spent fuel management and radioactive waste management facilities at Halden and Kjeller, and KLDRA at Himdalen.

E.2. The Pollution Control Act

The Act of 13 March 1981 No. 6 Concerning Protection Against Pollution and Concerning Waste (Pollution Control Act) was established for the purpose of preventing and reducing harm and nuisance from pollution. This is reflected in the main rule of the act, which says that pollution is forbidden, unless it is specifically licenced by law, regulations or individual licences. The act shall secure a satisfactory environmental quality based on a balance of interests, which includes costs associated with any measures and other economic considerations. Pursuant to the Act, three regulations concerning radioactive pollution and radioactive waste have been issued:

- Regulation on the Application of the Pollution Control Act to Radioactive Pollution and Radioactive Waste of 1 November 2010, which defines radioactive pollution and radioactive waste.
- Regulation on the Recycling and Management of Waste of 1 June 2004 (Waste Regulation), which establishes requirements for waste in general. Section 16 regulates specifically management of radioactive waste.
- Regulation on Pollution Control of 1 June 2004, which defines procedures for applications for licences and establishes administrative provision for radioactive pollution and waste.

E.3. The Radiation Protection Act

The Act of 12 May 2000 No. 36 Concerning Radiation Protection and Use of Radiation (Radiation Protection Act) constitutes the legal basis for regulating the use of ionizing and non-ionizing radiation, radiation protection requirements, medical use of radiation and contingency planning. The Act itself establishes the framework, which is described in further detail by the regulations. Pursuant to the Act, one Regulation has been adopted:

- Regulation on Radiation Protection and Use of Radiation of 16 December 2016 No. 1659. This defines radioactive material that is exempted from the Act, and specifies more detailed requirements, including specific requirements for different types of use of radiation.

E.4. Other Acts, Regulations, and Decrees

The Royal Decree of 23 August 2013 establishes the organization of the emergency preparedness system in Norway.

The Nuclear Energy Act covers transport of nuclear material and the Radiation Protection Act is applicable to the transport of radioactive material, but transport of spent fuel and radioactive waste is also subject to:

- Regulation on Transportation of Dangerous Goods by Land, of 1 April 2009 No. 384;
- Regulation on Dangerous Goods on Norwegian Ships, of 1 July 2014 No. 944; and
- Regulation on the Transport of Goods in Aircraft of 11 January 2003 No. 41.

These regulations generally follow the IAEA Transport Regulations (SSR-6) and the modal regulations and codes of relevant UN organizations.

The Regulation relating to Systematic Health, Environmental and Safety Activities in Enterprises of 6 December 1996 No. 1127 (the Internal Control Regulation) applies generally to Acts concerning health and safety issues, including the Radiation Protection Act and the Pollution Control Act. A public hearing on

applying the Regulation to the Nuclear Energy Act (together with another change in the regulation) took place in 2020: the changes have so far not come into force but are expected to do so soon.

According to the Act of 27 June 2008 No. 71 on Planning and Building Activities and the Regulation on Impact Assessments of 21 June 2017 No. 854, nuclear power plants and other nuclear reactors, plants for the handling of irradiated nuclear fuel, plants for production or enrichment of nuclear fuel, and installations for disposal of radioactive waste and storage facilities, where radioactive waste is stored for a period of more than 10 years, shall always be subjected to an impact assessment. Closure or dismantling of such facilities is also subject to such an assessment. When planning an installation for handling/processing and storing of radioactive waste for a period of less than 10 years, the decision on whether an impact assessment should be carried out is to be taken by the competent authority, in this case DSA.

E.5. Regulatory Body

Article 20. Regulatory body

As defined in the Nuclear Energy Act and Radiation Protection Act, the regulatory body is DSA. DSA is also the regulatory body for the Pollution Control Act in matters concerning radioactive pollution and radioactive waste as delegated by the Ministry of the Environment on 30 December 2010. DSA regulates matters concerning nuclear safety, security, safeguards, nuclear emergency preparedness and radiation protection including radioactive waste and spent fuel management.

DSA is a regulatory body reporting to the Ministry of Health and Care Services. DSA is also a pollution control authority under the Ministry of Climate and Environment, with respect to radioactive releases to the environment and radioactive waste from nuclear and non-nuclear industries. Furthermore, DSA reports to the Ministry of Foreign Affairs, with respect to non-proliferation, including the State System for Accountancy and Control (SSAC) for safeguards, and on the government support to implement safety measures in Ukraine and Other Countries in Eurasia. DSA also has areas of responsibility for the Ministry of Defence concerning the regulation of nuclear-powered military vessels entering Norwegian waters and ports. DSA also provides support and advice to other ministries on matters related to radiation protection, radioactive waste management and decommissioning, and nuclear safety, security and safeguards.

DSA receives funding from all four ministries that assign it tasks through the National budget and through fees from licensees. For budgetary purposes, DSA maintains staff and resources dedicated to work for each of the ministries. The Ministry of Health and Care Services coordinates the yearly letter of assignment to DSA from the different ministries, outlining specific tasks for the year, supplementing the ongoing tasks. DSA reports to the relevant ministries on the different tasks carried out on an annual basis.

Human and financial resources of DSA are not explicitly covered by legislation. However, the Norwegian regulatory body was established in 1993, and precedent serves as the basis for its annual budget.

DSA:

- Is the highest autonomous decision-making authority responsible for the area of nuclear safety, security and safeguards following the Nuclear Energy Act, for which it is reporting to the Ministry of Health and Care Services;
- Is the competent decision-making authority for the Act and Regulation on Radiation Protection and use of Radiation, for which it is responsible to the Ministry of Health and Care Services;

- Is the competent pollution control authority following the Pollution Control Act, for which it responsible to the Ministry of Climate and Environment regarding radioactive waste, radioactive releases, discharges, and remediation of contaminated areas.
- Is the competent agency for regulation according to Planning and Building Act regarding impacts assessments of nuclear facilities and installations for management of radioactive waste. Both development of new facilities and decommissioning of such facilities require an impact assessment.

DSA has a total staff of about 150 persons. DSA is currently organized in five departments, which are further divided into specialized sections:

- Radiation Safety and Security Department
- Radiation and Environment Department
- Nuclear Preparedness Department
- International Nuclear Safety and Security, and Research and Development Department
- Administration and Digitalisation Department

DSA deals with the safety, security and safeguards of Norway's nuclear facilities, licensing of radioactive waste management and discharges. It also handles licensing of shipments of nuclear material and waste. DSA issues, with other competent authorities, the approval certificates for transport of packages in line with modal transport regulations.

Applications for licences and renewals of licences for the operation of nuclear facilities are submitted to the Ministry of Health and Care Services. On behalf of the ministry, DSA assesses the applications. The assessment report with recommendations is then sent to the ministry for further preparation and decision by the government. Licences under the Nuclear Energy Act are finally granted by the King in Council. DSA carries out regular inspections and audits to ensure that the requirements of a licence are fulfilled.

DSA is also responsible for issuing licences for radioactive waste management and releases of radioactive substances under the Pollution Control Act, and approval regarding radiation sources under the Radiation Protection Act.

DSA is responsible for the State System of Accountancy and Control under the Safeguards Agreement between Norway and the IAEA.

DSA is also the competent body with responsibilities for authorization and inspection of transport of nuclear material according to the Nuclear Energy Act, and for transport of radioactive material regulated under the regulations on transport of hazardous material on land. Given the locations of the Halden, Kjeller and Himdalen sites, transport of spent fuel and radioactive waste between the sites is primarily by land. The responsibility for the transport of spent nuclear fuel and radioactive waste at sea and by air is shared with other authorities. The Norwegian Maritime Authority is the competent authority for sea transport.

DSA has developed a quality assurance system with written procedures for licensing and inspection activities. A full integrated management system for DSA is under ongoing development.

DSA is fully authorized through legislation to enter a nuclear installation and surrounding area, at any time, and to request the information necessary for the purpose of the inspection. To enable the necessary inspections to be carried out, after operational interruptions or accidents, licensees are required to provide reports to DSA. Inspections are carried out by DSA also in response to the operator's request in cases of any intended changes in construction, operation or management which constitute a deviation from approved conditions. DSA inspections often focus on a specific activity or practice. DSA also carries out inspections according to Pollution Control Act and Radiation Protection Act.

The Nuclear Energy Act and the Pollution Control Act authorizes DSA to impose sanctions on operators in the event that safety standards are not maintained at an acceptable level. All DSA requirements can be appealed to the Ministry of Health and Care Services, or the Ministry of Climate and Environment, in case of releases to the environment and waste management; this is a general right in the Norwegian civil service system. DSA may at any time withdraw the licence to operate (for all or some facilities) as necessary if sanctions are not followed or safety standards are not adequate. DSA has the authority to impose fines, either as a one-time sum or on a per diem basis until the requirements has been fulfilled. In case of criminal activities, DSA reports to the police. A new legal provision has been passed by the Parliament that empowers the DSA to impose administrative fines. This provision will come in to force at the same time as a corresponding regulation.

DSA may at any time independently arrange for public hearings and by other means communicate regulatory requirements, decisions, and opinions to the public. It will, as appropriate, liaise with the regulatory bodies of other countries and with international organizations for cooperation and exchange of regulatory information. Public hearings are part of the assessment processes for a permit according to the Pollution Control Act and also for a licence under the Nuclear Energy Act, and the Public Administration Act.

According to the Nuclear Energy Act section 57, the ministry is the complaint body for DSA's decisions. The Nuclear Energy Act, however, states in section 10, that DSA is the highest specialist agency as far as questions of safety and security are concerned. This is an important provision because it has the implication that DSAs decisions on safety and security issues cannot be overruled by the ministry and, as such, is an important guarantee for the independence of DSA in its decision making. However, the Ministry of Health and Care Services stated, in a decision in November 2023, that the ministry could overrule safety or security decisions made by DSA. DSA is currently seeking clarification on this issue, noting that such an interpretation would not be in line with Norway's international obligations.

F. Other General Safety Provisions

Article 21. Responsibility of the licence holder

Spent fuel and radioactive waste management facilities are subject to authorization according to the Pollution Control Act and the Nuclear Energy Act. It is the responsibility of the licensee to ensure the safety of its facilities and activities during operation, decommissioning and closure of facilities, in accordance with licence requirements. A licence for operation is normally granted for a specific time period. At the end of a licence period, the operator can apply for a new licence. DSA evaluates compliance with the provisions in the legal framework and the licences and may for this purpose make such individual decisions as are necessary. As indicated above, the Nuclear Energy Act and the Pollution Control Act authorizes DSA to impose sanctions on operators in the event that safety standards are not maintained at an acceptable level.

Article 22. Human and financial resources

The licensee is responsible for providing the necessary financial and human resources for maintaining safety and radiation protection at an appropriate level, according to General Licence Conditions no. 5.1. Before a nuclear installation commences operation, the operator shall have obtained authorisation from DSA. Before granting such authorisation, DSA must be satisfied that the management and personnel of the installation have the necessary qualifications and clearly defined areas of responsibility.

IFE has reorganized its staff in the nuclear sector to address the changed priorities and challenges arising from permanent shutdown of the reactors and preparation for decommissioning, and in preparation for the planned future transfer of responsibilities to NND. It is expected that a significant number of IFE's nuclear staff will transfer at appropriate times to NND. The remainder of IFE has been divided into a research and development organization — continuing a range of research activities in areas such as renewable energy, climate and environment, material technology and digitization — and a daughter company Agilera for production and distribution of radiopharmaceuticals.

The Government established NND by Royal decree on 12 February 2018 as the organization that will be responsible for decommissioning of nuclear facilities and management of radioactive waste from the nuclear sector in Norway. NND is financed and instructed by the Ministry of Trade, Industry and Fisheries.

NND is currently building its organization to achieve the levels and areas of competence needed to assume the responsibility of operating the facilities currently operated by IFE. In order to obtain the licences to operate these facilities, NND will need DSA's approval, which will require demonstration that the necessary competences are in place to meet the general responsibilities and specific requirements of such licences. As part of their efforts to develop competence and maintain it in the future, NND is establishing a 'nuclear academy' as a central point within the organization for: identifying competence needs for NND to be able to meet its responsibilities; planning and providing training to help meet those needs; and transferring knowledge on critical competences from current resources to the next generations. NND's applications for licences to operate the Halden and Himdalen sites are currently being reviewed by DSA.

The Norwegian Nuclear Research Centre was established in 2023 as a partnership between the University of Oslo (UiO), the Norwegian University of Life Sciences (NMBU) and the research division of IFE, to increase Norway's competence within the fields of nuclear physics and nuclear chemistry. The new centre's work will include research on applications within the fields of medicine, energy, and preparedness, also involving a range of collaborators, including universities abroad and the nuclear industry in Norway.

DSA was tasked with considering the possible future structure of a technical support function in Norway. An evaluation was initiated focusing on DSA technical support capacity and its interactions with other organizations. The IAEA Technical Support Organization Self-Capability Assessment (TOSCA) process was an input to this process. Work is ongoing to implement a hybrid approach consisting of internal and external technical and scientific support functions. These will consist of internal functions within DSA; external support from institutions in Norway; support from external consultants, and support from international organizations.

Assessments of competence and resources are performed when DSA receives a licence application from a waste management facility under the Pollution Control Act. Before granting a licence, DSA must be satisfied that the management and personnel of the facility have the necessary qualifications and clearly defined areas of responsibility. DSA carries out regular inspections and audits to ensure that the requirements of a licence are fulfilled.

For the NORM waste disposal facilities, the cost of closure and future surveillance are estimated, and funds are held in a dedicated holding account. The owner of the facility is committed to continually assess the need to set aside more money for this purpose, according to needs identified in the facility's plans for closure and post-closure control, which must be updated every 5 years. For the repository run by Wergeland-Halsvik, a guarantee is additionally provided by the Ministry of Petroleum and Energy.

Article 23. Quality assurance (QA)

As required by its licences and permits, and the Internal Control Regulation, IFE has established a system for quality assurance to cover its facilities and activities. This QA system is reviewed by the regulatory body. As part of its application for licences to operate nuclear facilities, NND will be expected to demonstrate that it has an adequate system for quality assurance.

Article 24. Operational radiation protection

The national system for radiation dose control for workers is based on the regulatory requirements that all workers who may receive a dose exceeding 1 mSv per year are required to wear personal dosimeters. Radiation dose control for the public is based on the regulatory requirement that operators must limit exposure such that the dose constraint of 0.25 mSv per year is not exceeded.

Optimization of radiation protection is a general regulatory requirement in Norwegian legislation. In addition, provision is made for operational optimization through the regulations and several guidelines detailing specific technical solutions concerning shielding, work practices, protection devices, etc.

The Regulation on Radiation Protection and Use of Radiation of 16 December 2016, effective from 1 January 2017, is based on international standards including GSR Part 3, dose limits from ICRP 103, and the general requirements that radiation sources and equipment shall be made according to the latest version of applicable ISO and IEC standards. The Regulation contains a general requirement that organizations using such sources and equipment must possess adequate competence in radiation protection. This general requirement is further elaborated in several guidelines, where more specific training requirements in the various fields of work are given.

According to the Radiation Protection Regulation, the operator shall report radiation doses received by each worker annually to DSA. These doses must be kept below 20 mSv/y[12]. A dose limit of 1 mSv to the

[12] DSA may grant dispensation for individuals, where in consideration of the nature of the work, it is not practically possible to establish an annual limit of 20 mSv. In such cases, a licence to practise a limit of 100 mSv over a consecutive five-year period may be granted, if the dose does not exceed 50 mSv in any single year.

foetus for the remainder of the pregnancy is applied to pregnant workers, i.e. after the pregnancy has been declared.

Article 25. Emergency preparedness

Emergency planning in Norway is based upon the principles of responsibility, proximity, similarity and co-operation. This implies that:

- The organization which takes responsibility when extraordinary situations occur should be as similar as possible to the organization that maintains the responsibility in normal situations.
- Any crises shall be dealt with at the lowest possible level.
- The organization which is in daily operation shall to the greatest possible degree be similar to the organization which is planned for in a crisis situation.
- In a crisis situation, the involved organizations on all administrative levels shall co-operate.

The main element in the response organization is the Crisis Committee for Nuclear Preparedness and Response, headed by the Director General of DSA.

In general, the licensee is responsible for organizing plans for on-site emergency preparedness and response. EPR plans need to be revised and exercised regularly, at least once a year. Evaluation of exercises are evaluated by the licensee and the DSA to ensure compliance with licence conditions. The initial off-site response is planned by the local police authorities and coordinated with the response by the EPR organization.

The ministries are responsible for emergency preparedness within their areas of competence. To deal effectively with the early phase of a nuclear event, the ministries have transferred responsibility for remedial actions to the central authorities that cooperate in the Crisis Committee.

The Crisis Committee is responsible for implementing protective and mitigating actions in case of a nuclear event representing a potential threat to Norway, or Norwegian citizens and interests.

DSA is also mandated to make decisions on behalf of the Crisis Committee until the Committee is assembled. If time permits, the Crisis Committee must consult with the ministries before deciding on actions. DSA is also the Secretariat for the Crisis Committee and is responsible, inter alia, for alerting the Nuclear Emergency Organization, and relevant international bodies. The Secretariat organizes a 24/7 Officer on Duty Service.

Further information on emergency preparedness and response arrangements is provided in the report to the Convention on Nuclear Safety Review Meeting, with reference to Article 16 of the Convention on Nuclear Safety.

Article 26. Decommissioning

Facilities which were partially dismantled after cease of operation and awaiting final decommissioning are listed in D.5. The current licences for Halden and Kjeller do not permit decommissioning activities and final decommissioning plans needs to be developed. Following the decision to permanently shut down the last two operating research reactors in Norway, planning and preparation for decommissioning has intensified.

Facilities entering the decommissioning phase are still subject to the licensing regime under the Nuclear Energy Act. The GLCs include provisions for the licensee to ensure qualified staff and adequate financial resources, radiation protection and emergency planning. Provisions regarding discharges are addressed in

the Pollution Control Act and its regulations and in the licences issued under this Act. Provisions for record keeping are outlined in the GLCs and would be further detailed in specific licensing conditions as considered necessary.

DSA's procedures for issuing and enforcing licences, and performing inspections and other control measures, are essentially the same in the transition and decommissioning period, as during operation. However, the detailed application of these measures may change as decommissioning proceeds, taking account of the general reduction in hazards and temporary changes to activities (and the associated risks) during decommissioning.

The research reactors HBWR and JEEP II were permanently shut down in 2018 and 2019, respectively. At JEEP II, the fuel and heavy water have been removed from the reactor, while at HBWR, part of the fuel has been removed and the heavy water is still in place. HBWR and JEEP II, and all related support facilities, will become subject to decommissioning once final decommissioning plans have been developed by the licensee and authorized by the regulator. Decommissioning will also include completing the dismantling of the remaining parts of the historical research reactors JEEP I, N0RA and the uranium purification plant (Uranrenseanlegget), which were shut down and put into a safe condition in the 1960s, but not completely decommissioned according to today's standards and requirements.[13]

The facilities are still under operating licensing conditions. IFE Kjeller site licence is valid from 2019 until 2028 and IFE Halden site licence is valid from 2021 until 2030. New licences will be required for NND to operate these sites, and a modification to the licence for a site would be required before decommissioning activities could begin at that site.

The Government established NND by Royal decree on 12 February 2018 as the organization that will be responsible for decommissioning of nuclear facilities and management of radioactive waste from the nuclear sector in Norway. NND is financed and instructed by the Ministry of Trade, Industry and Fisheries. NND has applied for licences for ownership and to operate the Halden sites and for the operation and ownership of KLDRA Himdalen.

The General Licence Conditions require that the licensee maintains a comprehensive decommissioning plan for the site, and reviews and revises the plan at such times as the regulator may require and, in any event, no later than 5 years from the previous revision.

[13] JEEP I and N0RA were described as decommissioned in national reports prior to seventh Review Meeting. In reviewing the need for decommissioning at the Kjeller site following the decision to permanently shut down JEEP II, it became clear that they were decommissioned according to the standards and requirements of the time of shutdown, but that parts of the reactors remain.

G. Safety of Spent Fuel Management

Spent fuel management, as well as other nuclear activities, are mainly governed by three acts: the Nuclear Energy Act (12 May 1972), the Radiation Protection Act (12 May 2000) and the Pollution Control Act (13 March 1981) and their subordinate regulations. The operating site licences for Kjeller and Halden issued by the Government in accordance with the Nuclear Energy Act also include general conditions (GLCs)[14] and site specific conditions. Furthermore, detailed instructions, issued by DSA under any of the mentioned acts provide legally binding orders for the licence holder.

Norwegian safety requirements for the safety of spent fuel management follow the relevant IAEA Safety Requirements and, as far as possible, Safety Guides. The licence holder of a nuclear installation, currently IFE, is responsible for the management of spent fuel and the radioactive waste generated.

Measures to meet the principles and requirements for safety are addressed in operators' safety analysis reports (SARs). Any modifications which could have a safety implication, or result in changes to the SAR, need to be substantiated in a safety assessment by the operator and submitted for approval to DSA as the regulatory body. DSA performs review and assessment to inform decisions on the approval of modifications, which is needed for the operator to implement a modification.

Specific conditions are set out in the site licences as necessary to improve the safety of the facilities, to address any shortfalls identified as part of the review and assessment and authorization processes of DSA, as the regulatory body.

The General Licence Conditions (GLCs) set requirements and further clarify regulatory expectations with regard to safety relevant to facilities licensed under the Nuclear Energy Act. The GLCs were established in the context of the relicensing of the JEEP II reactor, in 2019, and were subsequently applied to the relicensing of HBWR in 2020. It is anticipated that these conditions will be applied in future licensing activities, notably for KDLRA Himdalen. General Licence Condition 13 regarding radioactive waste and spent fuel management states that:

"The licensee shall implement and maintain an adequate waste management programme documenting handling, processing, transportation, storage and safeguarding of radioactive wastes, including spent fuel and nuclear material that is declared as waste, mixed with any other hazardous substance."

Other GLCs address general safety issues for nuclear facilities that are also relevant to spent fuel management (the GLCs are reproduced in an Annex to this report). The GLCs may be supplemented by additional conditions in specific licences.

Regulatory guidance was published by DSA in 2022 to assist licensees in interpreting and implementing the GLCs.

Article 4. General safety requirements

Removal of residual heat, generated during spent fuel management, and criticality safety is assured by design of facilities and operation of facilities in accordance with the operational limits and conditions and operating procedures. This takes into account interdependencies between different steps in the fuel management process, for example fuel cooling down period and temperature control after removal from reactor before transfer to the dry storage. Design and operational limits and conditions (OLCs) are verified by the operating organization periodically through safety assessment of facilities. The safety assessment and OLCs form an important part of the basis for the authorization of the operating organization to

[14] Assuming that DSA's recommendation is followed when a new licence is issued for Halden.

operate the fuel management facilities. Authorization to operate fuel management facilities is granted in line with the GLCs and the Nuclear Energy Act.

A requirement for minimization of radioactive waste associated with spent fuel management is imposed by the Pollution Control Act, where the purpose of the act is stated as *to reduce the amount of waste and to promote better waste treatment.*

The regulations under the Pollution Control Act also establish provisions to consider interdependencies among the different steps in radioactive waste management. Recent steps to address interdependencies among the different stages in spent fuel management include the development of a national strategy on radioactive waste management that includes spent fuel, and DSA guidance on planning the clean-up of the Norwegian nuclear programme,

This is supported by several concept selection studies which evaluate the needs and identify different alternatives for treatment, conditioning, storage and disposal for the Norwegian spent fuel and radioactive waste (see, for example, section B.2). Specific efforts are being made to strengthen the consideration of alternative options, taking account of all aspects of each option and the interdependencies between them, to provide a sound basis for strategic decisions.

DSA has instructed IFE to enhance the spent fuel inventory information and safety assessment to support the safe management of spent fuel until a disposal solution is available. IFE has also been instructed to improve the condition of the existing spent fuel storage as well as establishing new storage capacity that can maintain safe and secure storage for an extended period of time. IFE has advanced in progressing spent fuel inventory development and in improving the safety assessment of spent fuel storage facilities and the conditions of the existing spent fuel storage facilities. IFE, together with NND, have started investigation of the possibility of constructing a new spent fuel storage facility, which would replace the existing storage facilities.

Provisions for effective protection of the environment are outlined in the Pollution Control Act and, in accordance also with the Radiation Protection Act, and the specific regulations on radioactive pollution and radioactive waste provides the legal basis for regulating radioactive waste management and discharges to the environment, including those arising from spent fuel management.

Provisions for management of both radioactive and hazardous waste are addressed in the Pollution Control Act. This promotes a holistic approach to waste management and ensures that biological, chemical and other hazards are accounted for in managing radioactive waste. In general, these aspects are addressed by the Norwegian Environment Agency (Miljødirektoratet), but for sites licensed under the Nuclear Energy Act they are regulated by DSA in consultation with the Norwegian Environment Agency.

A general requirement and overarching premise for both currently operating and new facilities is that future generations should not be exposed to risks from present-day nuclear activities greater than those permitted for the current generation.

Other burdens on future generations, from present-day spent fuel management, are required to be minimized by putting spent fuel into a passively safe form as soon as possible; providing storage for spent fuel that will be passively safe and secure until the spent fuel can be disposed of; and to dispose of spent fuel and decommission spent fuel management facilities as soon as can reasonably be achieved.

Article 5. Existing facilities

All of the facilities currently involved in spent fuel management existed before the Joint Convention entered into force for Norway in 2001. In general, the spent fuel management facilities are beyond their

intended design lifetimes, and when they were originally designed their continued use for the same purpose until the present was not envisaged.

The operating organization reviews the safety of facilities and periodically provides updated safety assessment documentation to the regulatory body for verification and approval during licensing process. The safety assessment forms an important part of the basis for the authorization of the operating organization to operate the fuel management facilities. The requirement to undertake periodic safety reviews of spent fuel management facilities forms a part of licence conditions for operation.

In reviewing safety documentation and inspection activities, DSA has identified deficiencies in the design of some spent fuel management facilities and instructed IFE to improve their safety, assess short term measures to enhance the safety of the facilities, and to establish new spent fuel management facilities, where the current facilities cannot be upgraded sufficiently to maintain safety for as long as they are now expected to operate. DSA has instructed IFE to improve storage facilities for spent fuel. IFE has applied short term measures to improve safety where it was feasible. In addition, IFE and NND are assessing different options for construction of a new spent fuel storage facility to replace existing storage facilities in the future. In addition, transport to a treatment facility abroad is also being considered.

DSA identified shortfalls in safety assessment documentation of some fuel management facilities and instructed the operating organization to improve safety assessment documentation and maintenance processes, and OLCs. IFE is in progress of implementing this instruction.

Article 6. Siting of proposed facilities

Siting of nuclear facilities is regulated primarily according to the Planning and Building Activities Act and the Regulation on Impact Assessment (see also section E.4). According to this Regulation, DSA determines the plan for the environmental impact assessment and undertakes assessment, review and approval of the assessment performed by the applicant. Regulatory review of the suitability of the site for a proposed facility is explicitly considered later, in relation to an application for a construction licence, but the environmental impact assessment would be considered in the context of the likelihood (or otherwise) that the site would be suitable. DSA is the competent authority for environmental impact assessment for new nuclear facilities, including facilities for treatment, storage and disposal of radioactive waste. The Regulation on Impact Assessment is currently under review, with the aim to update and harmonize the Norwegian regulations with the Strategic Environmental Impact Assessment Directive.

Involvement and consultation with interested parties is a key part of the decision-making process in accordance with the Act of 10 February 1967 relating to procedure in cases concerning the public administration (Public Administration Act). Chapter IV of the Act contains provisions for preparation of regulatory decisions:

- Section 16 establishes that interested parties shall be given advance notification before decisions are made and be given the opportunity to express their concerns within a stipulated time limit. Advance notification can be omitted under certain circumstances (section 16 a–c);
- Section 17 establishes that the administrative agency shall ensure that the case is clarified as thoroughly as possibly before decisions are made;
- Sections 18 establishes the right of interested parties to obtain access to relevant documents, with certain restrictions.

In addition, the Regulation on Impact Assessment, section 34, includes provisions for consultation with affected third-party countries.

Article 7. Design and construction of facilities

Design and construction of new nuclear facilities would be the result of a licensing process according to the Nuclear Energy Act following an impact assessment. In the licensing process, the IAEA Safety Requirements and guidance would be an important and integral part, and the obligations prescribed in Article 7 of the Joint Convention would be followed.

Article 8. Assessment of safety of facilities

A licence for construction is granted on the basis of a systematic safety assessment. The builder/owner of the facility is responsible for carrying out the assessments. The authorities then review the safety reports in connection with the licence application. Plans for later decommissioning of the facility are required as a part of the assessments.

Before the facility can be commissioned, the operator must apply for an operating licence. The application must describe the systems necessary for safe operation and how the authorities' requirements will be fulfilled.

Before the start of operation, updated and detailed versions of the safety assessments must be prepared, reviewed and approved by the authorities. Permission to start the operation of the facility can be granted by DSA only after all documentation is in place and approved.

Article 9. Operation of facilities

Some facilities, including some of the spent fuel management and radioactive waste management facilities, were constructed before the Nuclear Energy Act entered into force in 1972, so the original design and construction of the facilities were not regulated under the Act. Nevertheless, the design and construction of the Norwegian facilities was consistent with international practices at the time they were built. Later modifications have been subject to approval by DSA in accordance with the requirements stipulated in the licences.

The safety assessment of facilities is guided by the relevant IAEA recommendations. SARs are required to be updated on a regular basis and reported to the regulatory body. In line with the terms of the current licence, an environmental impact assessment for IFE's nuclear facilities has been conducted according to the Planning and Building Act. If changes are made to existing facilities that may have significant effect on the environment or society, or if storage facilities for radioactive waste are being built to last more than ten years, a new impact assessment has to be conducted related to the changes or the building of the storage facility.

At present, the OLCs and the operation and maintenance of the spent fuel facilities are considered as part of the operation of the research reactor facilities, regulated through the operating licence of the nuclear facilities. The licence has been granted on the basis of the submitted SARs. DSA performs inspections to ensure that OLCs and operation, monitoring and maintenance are in accordance with the licence requirements.

The radiation dose limit to the public for the operation of such facilities is a part of the total limit for any discharge from reactor sites. Constraints are set for permissible doses from the operation of each facility, and the fulfilment of these constraints is documented in the SARs. If and when another facility is put into operation, the operating procedures will become a part of the licence for that facility. Decommissioning plans are developed and updated during the licence period. In the case of a new facility, plans for decommissioning would be required at the planning stage.

Any incidents at nuclear facilities, including spent fuel management or radioactive waste management facilities, with potential consequences for safety must be reported directly to DSA, without delay.

Article 10. Disposal of spent fuel

The current plans for the spent fuel inventory are contained in recommendations from Government-commissioned concept evaluation studies. A decision on disposal of spent fuel has not yet been taken. See, for example, section B.2.

Some previous studies assumed that some of Norway's spent fuel would not be suitable for direct disposal, and that some form of treatment (e.g. reprocessing) therefore would be needed. However, technical assessments commissioned by DSA in 2018[9] indicated that it is likely that packaging and other disposal system features could be designed, and a disposal site found in Norway, suitable to allow safe direct disposal for the relatively small amounts of spent fuel concerned. Direct disposal may therefore be considered as one of the options for spent fuel management, subject to further assessment.

H. Safety of Radioactive Waste Management

Spent fuel in Norway is regarded as radioactive waste. The legal background for the management of radioactive waste management in Norway is therefore similar to that for spent fuel management, although some additional safety, security and safeguards requirements apply to spent fuel. To avoid excessive repetition of information, this chapter refers where appropriate to the corresponding information on spent fuel management in section G. Where the information for radioactive waste management is different from or additional to that for spent fuel management, the relevant information for radioactive waste management is in this chapter.

Article 11. General safety requirements

General safety requirements for radioactive waste management facilities are described in section G in this report.

Specific criteria for the safety of radioactive waste management are established by DSA on a site-specific basis in connection with periodic reviews of the operating licence, annual status reports and the permits for radioactive waste management and discharges. Specific requirements are addressed in the SARs for both the Radioactive Waste Facility at Kjeller and KLDRA Himdalen. IAEA safety standards are an important component of the preparation of the SARs and for their review and assessment as part of authorization activities.

Article 12. Existing facilities and past practices

With the exception of facilities for disposal of NORM waste, all of the facilities currently involved in radioactive waste management existed before the Joint Convention entered into force for Norway in 2001.

The Norwegian facilities for radioactive waste management were built 40–60 years ago, except KLDRA Himdalen, which was built during the 1990s and started operation in 1999. The Norwegian authorities have carried out regular inspections and reviewed and enforced safety procedures in connection with licence applications.

The current arrangements for radioactive waste management are that predisposal management, including conditioning of waste for disposal, is primarily carried out by IFE at the Radioactive Waste Facility on Kjeller site, and that KLDRA Himdalen receive conditioned waste for disposal. As operations are suspended in KLDRA Himdalen, radioactive waste in now treated at the Radioactive Waste Facility and then subsequently stored on-site at Kjeller. These arrangements between the Radioactive Waste Facility, as a waste reception and treatment facility, and the KLDRA Himdalen, as a reception and disposal facility, will need to be revised when NND becomes the licensee for KLDRA Himdalen.

DSA carried out an inspection of KLDRA Himdalen in November 2023. In view of identified deficiencies in the condition, operation, and safety assessment for KLDRA Himdalen (see Section H.2), disposal is currently suspended, pending completion of the PSR and satisfactory update of the SAR. DSA has also instructed IFE to take immediate actions to improve the conditions at the facility and to apply for an additional permit to store waste already placed in the facility.

NORM wastes are typically managed primarily at their disposal facilities. Some NORM-waste from construction waste is directly disposed in the vicinity of the contraction site if possible to do so in a safe, secure and environmentally sound manner.

Operators of radioactive waste management facilities must provide a yearly report which gives an overview of the amount of waste received, conditioned, and disposed of (or sent to KLDRA Himdalen for disposal),

and of waste stored on site. In addition, those required to have a permit under the Pollution Control Act, must also report on discharges from the facilities and results from environmental monitoring. Operators must also provide other details of significance to safety and the integrity of the facilities. Many of the general requirements for the management of waste (e.g. minimization of waste, application of the waste hierarchy) are similar to those for the operator of any facility with a permit under the Pollution Control Act. An updated set of general criteria for reporting were published (in Norwegian) on the DSA homepage in 2024, and facility-specific criteria are included in the respective permits.

Nuclear facilities have licence conditions requiring periodic safety reviews (PSRs). A PSR is in progress for the KLDRA Himdalen facility, and PSRs are expected to be required for the Kjeller and Halden sites in the context of the expected transfer of these sites to NND.

For radioactive waste facilities for NORM and alum shale wastes, there are currently no requirements to perform a periodic safety review. However, authorized parties are not permitted to deviate significantly from the conditions specified in their authorization application and there is generally a condition in permits to notify DSA in advance of any such changes or modifications. Furthermore, the permit may be withdrawn or altered if it is more than 10 years since it was issued. These situations may result in the need to re-apply for an authorization, which would be supported by a revised assessment. This process would involve DSA assessment, review, and approval.

H.1. Radioactive Waste Management Facilities at Kjeller

The Radioactive Waste Facility at the Kjeller site was built in 1959 and is currently operated by IFE. This is a facility for receiving, sorting, handling, treating, and conditioning radioactive waste. It receives all LILW generated by Norwegian industry, hospitals, universities, research organizations and military forces, in addition to waste from IFE. Waste containing naturally radioactive nuclides (NORM) is not received at this facility.

In normal operation, waste suitable for disposal at KLDRA Himdalen is characterized at the Radioactive Waste Facility, at Kjeller, where the waste volume is also reduced, where possible, and conditioned by immobilization in concrete in containers. The waste packages are then stored until they can be transferred to KLDRA Himdalen. In view of the current suspension of disposal at KLDRA Himdalen, waste packages are stored on-site at the Kjeller site, as are radioactive wastes that does not meet the accept criteria for disposal at KLDRA Himdalen.

Most of the remaining solutions of uranium containing plutonium and fission products from the historical pilot reprocessing facility at Kjeller have been solidified. The solidified uranium (yellow cake) is stored in the Radioactive Waste Facility at Kjeller until a suitable disposal facility will be available. There is still some solution left from the reprocessing test facility. The remaining solution is expected to have a low content of nuclear material, but the radiation level of the solution is high, which makes it a challenge to manage, especially since the content is not known in detail.

The Radioactive Waste Facility also contains a storage facility (storage building 1), built in 1965–66, for unconditioned waste awaiting treatment and conditioned waste awaiting transfer to storage building 2.

Storage building 2, built in 1977–78, is devoted to the storage of conditioned waste packages before transport to the disposal facility at Himdalen. It also serves as a store for wastes from the production of radiopharmaceuticals which are not suitable for disposal at KLDRA Himdalen (liquids awaiting solidification in a new facility).

In the light of the current suspension of disposal at KLDRA Himdalen (see Section H.2), IFE's existing permit under the Pollution Control Act does not permit extended storage of radioactive waste on site. DSA has instructed IFE to apply for a licence to store radioactive waste on the facility for 10 years +, while other options for for providing additional licensed storage capacity for radioactive waste are being evaluated.

H.2. Combined Disposal and Storage Facility at Himdalen (KLDRA)

The facility is built into a hillside in crystalline bedrock. It has four caverns for waste packages and one slightly inclined 150-metre long access tunnel for vehicles and personnel. All the caverns and the access tunnel have a monitored water drainage system. A service and control room with service functions for personnel and a visitors' room are located along the tunnel. The rock caverns were excavated in such a way that about 50 m of rock covering remains above the sarcophaguses containing waste. This natural geological covering provides protection against intruders, aeroplane crashes and other external events, although it is not intended to act as a main barrier in long-term safety calculations. Long-term safety is expected to rely largely on the engineered barriers.

In each cavern, two solid sarcophaguses have been constructed with a concrete floor and walls. Three caverns are used for waste disposal, with drums and containers stacked in four layers. When one layer in a sarcophagus section has been filled with waste packages, it is encased in concrete. When a section of the sarcophagus has been filled, a temporary waterproof membrane is affixed over that section, shaped to shed infiltrating groundwater. It is planned to construct a concrete roof over the sarcophaguses.

One of the caverns is used for storage for special waste packages, currently 166 drums of waste containing some plutonium (about 35 g in total), which was among the waste retrieved from a former disposal trench on the Kjeller site. The decision whether to retrieve the waste from the storage cavern or dispose of it in its current location by encasing it in concrete will be made on the basis of experience during the operational period and the safety reports to be prepared for closure of the facility and is still under consideration.

A review of the overall condition of KLDRA Himdalen, conducted for IFE by external consultants and NND, identified areas of concern related to the condition and operation of the facility and to the adequacy of the existing safety concept and SAR. Among the concerns, it was suggested that the inventory of long lived alpha emitting radionuclides disposed may have been significantly greater than assumed, and possibly greater than that allowed by the waste acceptance criteria (WAC). As a precaution, IFE stopped disposal of waste at KLDRA Himdalen, pending further investigation of the issues identified. In view of the findings of this review, and DSA's own observations, and the need for decisions about KLDRA Himdalen's future, DSA instructed IFE to carry out a PSR for the facility, leading to an updated SAR, and informed IFE that approval from DSA would be needed before disposal could be resumed. The PSR is in progress. NND is cooperating with IFE in the PSR, and responsibility to complete the review and follow-up actions is expected to be transferred to NND, on receiving a licence to operate KLDRA Himdalen.

An inspection of KLDRA Himdalen in November 2023, focused on ageing management of the facility and the waste packages, identified several breaches of licence conditions in maintenance and ageing management of the facility, and resulting deterioration in the conditions inside the facility. In the short term, this had led to inadequate conditions for the safe storage of waste within the facility, and in the longer term had the potential to adversely affect the long-term performance of the disposal system. IFE was required to prepare and implement an action plan to address the identified deficiencies, and if necessary, responsibility to complete the follow-up actions would be transferred to NND on receiving a licence to operate KLDRA Himdalen.

The capacity of KLDRA Himdalen was originally foreseen to provide capacity for operational LILW up to 2030. Concept evaluation studies indicate that the LILW generated due to decommissioning of the nuclear facilities at Kjeller and Halden will mean that new disposal capacity is likely to be needed earlier. Additional capacity could be provided either by constructing a new facility at a new location or, if the updated SAR indicates it could be done safely, by extending the existing KLDRA facility in Himdalen. The process of evaluating options for developing additional capacity is under way and will take account of developments relating to KLDRA Himdalen.

For the long-term safety of the facility, DSA has stipulated two basic principles to be followed:

- Future generations have the right to the same level of radiation protection as the present generation.
- Except for a certain period of institutional control of 300 years, the safety of the facility should not rely on future surveillance and maintenance.

More specific long term safety criteria were set by DSA during the design of KLDRA Himdalen. These are specific to KLDRA Himdalen, and are as follows:

- For the most likely scenarios, based on realistic calculations, doses to the most exposed individuals should not exceed 1 μSv per year.
- For other scenarios, a dose of 100 μSv per year to the potentially most exposed individuals should not be exceeded. These scenarios are assumed to include establishment of a well very close to the repository after the repository has filled with water, or drilling through the repository.

The dose criteria are recognized to be lower than those used and recommended internationally and also lower than those allowed generally in Norwegian radiation protection legislation. The criteria were considered to be reasonably achievable in the specific context of KLDRA Himdalen, due to the relatively small amount and low level of activity of the inventory.

The waste acceptance criteria for disposal at KLDRA Himdalen are based on these dose criteria, and include a limit on activity of long lived alpha emitting radionuclides of 400 Bq/g on average and 4000 Bq/g in any drum. This is consistent with the IAEA's recommended classification of waste suitable for near surface disposal. The main contributors to the disposal inventory are fission and activation products with half-lives of 30 years or less and therefore radiological impacts after a 300-year period of institutional control are likely to be (and are shown to be in the SAR) very low.

H.3. NORM Waste

Norway has several facilities managing NORM waste from the oil and gas industry, but also from processing industry and construction work in areas with alum shale.

The Gulen repository for radioactive waste from the oil and gas industry and land. Based NORM industries is operated by Wergeland Halsvik AS and is situated in an underground rock formation. It consists of an entry tunnel, a tunnel for reception and storage of NORM waste as well as two tunnels for waste disposal, with a total capacity for disposal of 7000 tonnes of NORM waste. The waste arrives at the facility in waste-drums. Before the drums are deposited, the drums are weighed and opened for visual inspections. The drums are filled with sand or oil absorbent material to fill void space in the barrels or to reduce the oil percentage if it is too high before they are sealed. The intention is that the repository tunnels will be filled with waste-drums, cemented in concrete mould castings.

There are four physical barriers to stop the spread of radioactivity from the disposed waste. The first barrier consists of the plastic drum in which the waste is disposed. The concrete walls of the permanent

mold casting constitute the second barrier, whilst the third barrier is the cement around the castings. The final barrier is the surrounding rock formation itself.

For long term safety analyses the repository has been assessed in relation to possible impacts from e.g. flooding, mud slides, earthquakes, breakdown of barrier, and human intrusion. Wergland Hallsvik, the operator of the Gulen facility, has applied for an expansion of the facility. The application is currently being processed by DSA and the Norwegian Environment Agency.

The other NORM facilities are landfill type repositories, with various types of requirements for use of membranes and/or natural geological barriers and buffer masses, depending on the type of NORM waste that are being disposed of.

H.4. Legacy Wastes

In 1970, IFE, with the regulatory permission required at the time, buried barrels of LILW in a trench on the Kjeller site. A total of 997 drums of waste and 19 pieces of equipment was disposed of in the trench. In 1993–94, some drums were excavated and found to have degraded, and it was subsequently decided to retrieve the waste from the trench. The drums were retrieved in August 2001. Of the 997 drums, 166 were designated as “plutonium drums”, containing a total of 35 grams of plutonium-239/240 originating from the treatment of spent fuel from the JEEP I reactor at the former pilot reprocessing plant. In accordance with a parliamentary decision, these plutonium drums have been placed in the storage hall of the KLDRA facility at Himdalen. The decision whether to retrieve the waste from the storage cavern or dispose of it by encasing it in concrete will be made on the basis of experience during the operational period and the on-going periodic safety review and associated safety reports and the final plan for closure of the facility.

In 2000, IFE Kjeller removed approximately 180 m^3 (45 drums) of sediment from the riverbed of the nearby Nitelva River which was contaminated by plutonium from liquid discharges from the pilot reprocessing plant in the late 1960s. In 2001, IFE retrieved a 900 metre long section of a disused liquid discharge pipeline buried in the bed of the Nitelva River. Waste retrieved in these clean-up operations that was not suitable for disposal at KLDRA Himdalen is stored at Kjeller.

Remediation is regulated under permits that require that remedial and protective actions are justified, and that protection is optimized. The Pollution Control Act provides the basis for the regulation of remediation of sites due to radionuclides as well as other pollutants, which allows the approaches to regulate and remediate sites that are contaminated with both radionuclides and other pollutants to be harmonized. Remediation of non-radioactive contaminated sites is regulated by Norwegian Environment Agency and DSA works in cooperation with this agency, where appropriate.

NND has been given the task of cleaning up the site of the Søve disused niobium mine in Telemark County, on behalf of the Ministry of Trade, Industry and Fisheries. This includes managing the NORM waste buried at the site. A procurement process is in progress to identify appropriate contractors to provide remediation solutions for the site.

Article 13. Siting of proposed facilities

The framework for siting radioactive waste management facilities, and provision for involvement of the public in such decisions, is essentially the same as for spent fuel management facilities, as reported in section G.

KLDRA Himdalen was designed for disposal of legacy and operational LILW, and it was recognized that the waste from nuclear decommissioning would exceed its disposal capacity. Decommissioning will also

substantially increase the volumes of higher activity and/or longer-lived radioactive waste requiring disposal in a deeper facility. As noted above, it is recognized that new capacity for the disposal of LILW is needed, either in the form of a new facility or extension of the existing KLDRA facility in Himdalen. Decisions regarding the future of KLDRA Himdalen are expected to be taken after completion of the current PSR process (see section H.2), including follow-up actions and updating of the SAR and upon NND taking over the licence of the facility.

The national radioactive waste management strategy indicates that storage and disposal facilities for all types of radioactive waste, including higher activity wastes, will be needed and that, given the expected long duration of such a project, that work towards siting should start soon. Additional facilities may also be needed for predisposal management of wastes arising from decommissioning, and for the disposal of large volumes of very low-level waste from decommissioning.

NND is responsible for developing and operating such new facilities. NND will be responsible for site selection, including for any new disposal facilities. NND is working on building capacities and criteria for site selection.

Several aspects of a siting process will be covered by the different laws. DSA has provided guidance on the site selection process as the regulator of the proposed facility. DSA is developing guidance document on the information and assessment that will be needed for the siting stages of developing radioactive waste management facilities.

Article 14. Design and construction of facilities

Most of the framework for designing and constructing radioactive waste management facilities is essentially the same as for spent fuel management facilities, as reported in section G.

Before any new facilities for nuclear activities can be built in Norway, all obligations in these articles must be met, and decommissioning (or closure) plans prepared. Among these obligations is the requirement to consult the relevant Convention Contracting Parties. For the design and construction of a major facility for radioactive waste management, the same procedures as described in section G are to be followed.

Assumptions were made about the future closure of KLDRA Himdalen when it was designed and constructed, and these are reflected in the SAR for the facility. This foresees sealing the caverns and access tunnel but not backfilling the whole void space in the facility. A closure plan is required to be submitted to DSA for approval five years before proposed closure of the facility, and this may confirm the original plan for closure or present a modified plan. The closure plan will need to be supported by a safety assessment that is based on the proposed closure arrangements.

Article 15. Assessment of safety of facilities

Most of the considerations for safety assessment of radioactive waste management facilities are essentially the same as for spent fuel management facilities, as reported in section G.

The radioactive waste management facilities on the Kjeller site are included in the licence and permit for that site, but they have a separate SAR. IFE must apply for a new permit under the Pollution Control Act to store radioactive waste at the Radioactive Waste Facility at Kjeller that includes an updated safety assessment.

The KLDRA Himdalen facility has a separate licence and permit, and a separate SAR. The main SAR for the operation of KLDRA Himdalen has a similar form to those for other facilities but is supplemented by a more

extensive assessment of post-closure safety. As noted above, a PSR of KLDRA Himdalen is currently in progress, and is expected to lead to significant revision of the SAR.

IFE's current licence for KLDRA Himdalen is valid until 28 April 2028, with the condition that the facility's SAR will be reviewed and updated periodically every five years. The expected update of the SAR following the PSR currently in progress is expected to take the place of such a periodic update.

Article 16. Operation of facilities

Most of the considerations for operation of radioactive waste management facilities are essentially the same as for spent fuel management facilities, as reported in section G.

Radioactive waste must be adequately characterized both with regard to the radionuclide inventory and other aspects such as physical and chemical states. The producer of the waste is responsible for this characterization. All relevant information about the waste must be recorded by the producer of the waste and the form containing this information must follow the waste, and ultimately be submitted to the relevant authority (DSA or the Norwegian Environment Agency) when the waste has been disposed of.

Section 16 of the Regulation of 1 June 2004 on the Recycling and Management of Waste under the Pollution Control Act (Waste Regulation) states that radioactive waste cannot be mixed with other wastes in order to produce waste below the criteria defining radioactive waste or radioactive waste subject to a disposal requirement, and waste containing one radionuclide should not be mixed with wastes with other radionuclides if this makes it unsafe to store or difficult to handle. In addition, the permit for KLDRA Himdalen states that the operator must keep a journal of the radionuclide inventory of each waste drum and its location in the facility.

Permits under the Pollution Control Act state that a closure plan has to be developed and submitted at a certain time (usually five years) prior to planned closure. The closure plan must be provided to the relevant authority (DSA or the Norwegian Environment Agency), which has to approve it. It is expected that NND will take decisions about the possible closure of the KLDRA Himdalen facility when they are the licence holder and after completion of the current PSR process (see section H.2), including follow-up actions and updating of the SAR.

Regulation of radioactive waste with NORM is generally equal to the regulation of radioactive waste with anthropogenic nuclides, but it is adjusted according to the risk of effects on humans and the environment. Hence similar assessments are performed for facilities for waste with NORM as reported for other facilities, although they are adapted to address the specific risks of waste with NORM.

Article 17. Institutional measures after closure

The KLDRA Himdalen disposal facility is currently owned by the Norwegian Directorate of Public Construction and Property (Statsbygg). NND has applied for ownership to be transferred to them at the time when they receive a licence to operate the facility. NND is owned by the state and the responsibility for post-closure measures will still rest with the state, independent of whether the owner is Statsbygg or NND.

Permits under the Pollution Control Act require that the operator keep updated records of the inventory of the facility. These records shall be kept by the operator's enterprise as long as it exists. If the enterprise ceases to exist, the records must be transferred to DSA. Documentation received by the regulator as a part of case handling is regulated by the Archives Act, which states that the relevant party (i.e. DSA) must have an archive that keeps documents for the present and the future. The Archives Act also states that

archived documents cannot be deleted without permit from the National Archives unless certain criteria are fulfilled.

The operator of the facility is required make a post-closure plan in due time (as specified in the permit) before closure, taking account of operational experience and current requirements at that time. An institutional control period of 300 years is currently assumed for the KLDRA Himdalen disposal facility, but the exact length of the period will need to be determined and justified in the closure plan and confirmed at the time of closure. During the institutional control period, there will be monitoring of the disposal system and local area, and restrictions on land-use in the area. The responsibility for post-closure management currently rests with the owner of the facility.

The operator of the facility is responsible for safety throughout the lifetime of the facility. The permit under the Pollution Control Act states that if during the post-closure institutional control, measurements indicate discharges of radionuclides to the environment from the facility, necessary intervention must be performed.

The duration of any post-closure institutional control period for disposal facilities for NORM waste is not specifically defined in the permit for the operating phase from DSA. Plans for closure and post-closure control of the facility are required to be updated every 5 years.

I. Transboundary Movement

Article 27. Transboundary movement.

Transboundary movements of radioactive waste and spent nuclear fuel are regulated under the Nuclear Energy Act, the Radiation Protection Act, and the Pollution Control Act, in addition to their respective associated regulations.

Moreover, transboundary movement of radioactive material, which includes radioactive waste and spent nuclear fuel, is regulated in Norway by international transport regulations, including the Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), the Regulations concerning the International Carriage of Dangerous Goods by Rail (RID), the International code for the Maritime transport of Dangerous Goods in packaged form (IMDG-code), and the technical Instructions For The Safe Transport of Dangerous Goods by Air (ICAO-TI). The transboundary movement of radioactive material shall adhere to pertinent international regulations corresponding to the specific modes of transport employed.

Transit through Norway of nuclear material is not permitted without a permit according to both the Nuclear Energy Act and the Regulations on the Possession, Sale and Transport of Nuclear Material and Dual-Use Goods. Additionally, import and export of radioactive waste is subject to the prior approval (permit) by DSA. This is regulated under the Regulation on the Recycling and Management of Waste (Waste Regulations). When issuing a permit to export, an assessment shall be made whether it is considered necessary to ensure environmentally sound treatment of the radioactive waste, based on an overall assessment of available treatment solutions in Norway, the nature of the waste, and environmental risks associated with various alternatives. It shall also be demonstrated that the waste will be soundly handled from an environmental perspective at the destination. Additionally, it is required that the authorities in the importing country, and potentially in transit countries, have given permission for the reception of the waste and, if applicable, for transit. The exporter assumes full responsibility until the waste is taken over by the party responsible for handling it at the destination. The requirements that have to be fulfilled in order for DSA to give permit to import or export is explained and elaborated in a guidance document published by DSA in 2023.

All transfers must be consistent with the requirements set out in the Joint Convention and also comply with the provisions of the Convention on the Physical Protection of Nuclear Material, and its Amendment, the safeguards agreements between Norway and the IAEA, international requirements for safe transport and other relevant standards and agreements.

DSA has established a close working relationship with the Norwegian Customs Service and the Norwegian Coastal Administration, as well as with other relevant authorities, to monitor transboundary movements across Norwegian borders. This close cooperation between national authorities includes periodic monitoring of transboundary shipments records to ensure that the required approvals were obtained for shipments according to national and international legislation.

Since the Halden reactor was shut down permanently in 2018, the OECD Halden project for fuel and materials research linked to it ended in 2023[15]. Additionally, the research reactor at Kjeller was shut down in 2019. Norway does not currently export spent nuclear fuel or radioactive waste. However, some options under consideration for the management of Norway's spent fuel (or some of it) would involve treatment of the spent fuel in other countries in the future. Such a solution would be an exception to the general rule that radioactive waste must be handled nationally. If it were demonstrated that treatment abroad is necessary to ensure a safe and environmentally sound solution for the fuel, and that it is demonstrated to

[15] Extended to 2026 to allow completion of post-irradiation studies.

be the best option, then it would, in principle, be possible to export such spent fuel and to import the products of the treatment.

Radioactive waste with NORM has in some cases been imported to Norway during the decommissioning of disused offshore installations for extraction of oil and gas by other countries in the North Sea-area. These imports require a permit for import of radioactive waste. The permits specify, what is the general rule, that the radioactive waste extracted from disused installation must be returned to country of origin. The Norwegian regulations allow for exceptions to the general rule, so in some cases, under to strict conditions, the waste can enter the Norwegian waste stream.

J. Disused Sealed Sources

Article 28 Disused sealed sources

The Radiation Protection Regulation specifies the regulatory aspects of handling radioactive sources (except for waste handling, which is covered by the Pollution Control Act and the regulations on waste). This regulation distinguishes between very low, medium and high activity sealed sources:

- Authorization from DSA is needed before using a high activity sealed source, which is defined as a source of activity exceeding 2 million times the exemption value given in the Regulation (which values are those specified in GSR Part 3 for exemption of moderate amounts of material).
- Notification must be sent to DSA in case of use of a medium activity source (more than the exemption value but less than 2 million times that value): these are typically industrial gauges.
- For very low activity sources, no authorization or notification is needed; such sources are below the regulatory exemption levels.

DSA maintains electronic records of sealed sources above exemption levels, including sources used in industrial radiography, oil and gas well logging, medical therapy, and industrial gauges. The information on sealed sources is stored in a web-based register which enables the owners and users of radiation sources to make notifications to DSA directly electronically. Owners and users are also able to register, check and verify the information associated with their enterprise.

Starting with the entry into force of the Radiation Protection Regulation in 2011, all import and export of IAEA category 1 and 2 sources requires authorization from the DSA.

Distributors of medium and high activity sources are required to have authorization from DSA. When DSA issues authorizations for companies to buy, sell, lease or use sealed sources, it is with the requirement that disused sources are to be returned to the manufacturer. However, if no viable options for a licence holder in Norway are available, the source is to be sent to IFE for treatment and for storage or disposal at KLDRA Himdalen. As described earlier, the disposal at KLDRA Himdalen is currently suspended, so the sources are stored at the Radioactive Waste Facility at Kjeller.

It is the responsibility of the licence holder to ensure that disused sealed sources are handled in a safe manner and that they are ultimately returned to the manufacturer, or if that is not possible to dispose of them at KLDRA Himdalen. If the licence holder is in financial difficulty or out of business, safety and proper disposal of the disused sealed sources will be handled by a case-by-case basis. DSA may take the responsibility for the source(s). Licence holders are generally not required to provide financial assurance for the decommissioning of their facility and disposal of disused sources when applying for a licence.

Practical implementation of the return requirement means that the sources are re-exported to a manufacturer abroad, or if not possible sent to IFE Kjeller for treatment and for storage, or disposal at KLDRA Himdalen if the source complies with the waste acceptance requirements. The same regulatory requirements as for other radioactive wastes are in force for long-term storage facilities for disused sealed sources. The same safety precautions, including monitoring activities, are required during handling of disused sealed sources.

IFE has been the only producer of radioactive sources in Norway, producing sources at the JEEP II reactor. IFE's licence for this production was part of the general licence to own and operate nuclear installations and a permit for the production is given by the DSA with statutory basis in the Radiation Protection Act and associated regulations. The licence contains comprehensive requirements for radiation protection, safety and security. As a distributor of radioactive sources, IFE was also required to provide annual reports

to DSA specifying sources, activities, names of buyers etc. In view of the permanent shutdown of JEEP II, this production has stopped.

Norwegian authorities allow re-entry of disused sealed sources on a case-by-case basis. Norwegian-produced instruments containing sealed sources produced in a third country, are permitted re-entry to Norway if this is preferable to removing the source and returning it to the third country.

Orphan sources have been identified in Norway. For example, there have been several instances where sources have been removed or sent to other companies without proper notification. If an orphan source is found, the normal procedure is that DSA attempts to find the owner, and, if relevant, also reports the case to the police. If the owner is not found, DSA makes sure the source is handled properly as radioactive waste. If the source is found to be orphaned, deliberately or by an act of negligence, the police will consider prosecution and further actions. Fines up to NOK 2 million (€ 250 000) have been given.

At the Storskog border point between Norway and the Russian Federation, monitoring portals have been in operation since 2004, and the whole system has since been upgraded. The Norwegian customs service also has handheld radiation monitors across the country. Some other governmental organizations have similar handheld equipment, for example the coastguard and civil defence organizations. DSA assists them (as a second-line service) in case of alarms. Most private companies dealing with scrap metal, or other businesses that might inadvertently receive contaminated waste, have portal monitors to detect such sources before they are sent to a foundry or melted down. Several orphan sources have been detected this way.

In 2023, the Norwegian Customs and the DSA started a project to strengthen the national detection capabilities in strategic locations. This includes the mapping of radioactive imports and exports and an assessment of current capacities and the need for equipment and training for the customs officers.

Norway has made a commitment adhere to the “Code of Conduct on the Safety and Security of Radioactive Sources” and its supplementary guidance, the “Guidance on the Import and Export of Radioactive Sources”. In 2024, the Norwegian government decided to also make a commitment to adhere to the Code of Conduct’s other guidance document, the “Guidance on the Management of Disused Radioactive Sources”, published in 2018.

K. General Efforts to Improve Safety

K.1. Overarching Issues Identified at the Seventh Review Meeting

At the seventh Review Meeting, Contracting Parties agreed that National Reports for the eighth Review Meeting should address four overarching issues. These issues are primarily addressed under the relevant headings above. However, a summary is provided below under each heading, for ease of reference.

Competence and staffing linked to timetable for spent fuel and radioactive waste management programmes

As described in Section F in relation to Article 22:

- NND is currently building its organization to achieve the levels and areas of competence needed to assume the responsibility of operating the facilities currently operated by IFE. NND is establishing a 'nuclear academy' as a central point within the organization for: identifying competence needs for NND to be able to meet its responsibilities; planning and providing training to help meet those needs; and transferring knowledge on critical competences from current resources to the next generations.
- The Norwegian Nuclear Research Centre was established in 2023 as a partnership between the University of Oslo (UiO), the Norwegian University of Life Sciences (NMBU) and the research division of IFE, to increase Norway's competence within the fields of nuclear physics and nuclear chemistry. The new centre's work will include research on applications within the fields of medicine, energy, and preparedness, also involving a range of collaborators, including universities abroad and the nuclear industry in Norway.
- DSA had been tasked with assessing the possible future structure of, a technical support function in Norway. An evaluation was initiated focusing on DSA technical support capacity and its interactions with other organizations. The IAEA Technical Support Organization Self-Capability Assessment (TOSCA) process was an input to this process.

Inclusive public engagement on radioactive waste management and on spent fuel management programmes

As described in Section K.5., provisions for the involvement of interested parties and for their input to decision making is ensured by the general requirements laid down in the Public Administration Act and, in the case of new facilities, the Planning and Building Act. Hearings are performed for licensing and are mandatory under the Pollution Control Act. Such hearings are advertised on the DSA website and in the local media of new activities requiring a permit or licence. Two public hearing meetings have been carried out in 2024 as part of DSA's processing of NND's application for the licence for the Halden site and the KLDRA Himdalen.

The Environmental Information Act of 9 May 2003 Relating to the Right to Environmental Information and Public Participation in Decision-making Processes Relating to the Environment also ensures public access to environmental information.

Furthermore, DSA has established a communication strategy, which relates to communications with relevant ministries and governmental agencies/authorities, as well as counties and municipalities. DSA also carries out a public survey and the general perception and trust of DSA in the Norwegian public is good.

Ageing management of packages and facilities for radioactive waste and spent fuel, considering extended storage periods

As indicated in Section D, and in the section above, there are on-going activities to assess and ensure the safety of the long-term management of spent fuel. Actions have been initiated to improve the SARs for the current fuel storage facilities and to assess and plan for longer-term storage arrangements. The design lifetime of existing and new or upgraded facilities will be important considerations in this process. The options for treatment and disposal of the various types of spent fuel have been the subject of recent analyses and these issues are being considered by the Government.

Long term management of disused sealed radioactive sources, including sustainable options for regional as well as multinational solutions

As indicated in Section J, it is the responsibility of the licence holder to ensure that disused sealed sources are handled in a safe manner and that they are ultimately returned to the manufacturer, or if that is not possible to storage or disposal at KLDRA Himdalen.

Regulatory mechanisms to encourage the return of disused sealed sources have been in place for some time and are being further developed. In addition, options for the disposal of high activity sealed sources, which are not suitable for disposal at KLDRA Himdalen, are included as part of the national strategy for the management of spent fuel and radioactive waste.

K.2. Challenges for Norway Identified at the Seventh Review Meeting

During the seventh review meeting of the Joint Convention, 2022, four challenges were identified for Norway: Information on these is given below and in the previous sections of the report. No suggestions were identified.

Finalizing (approval and implementation) national policy and strategy for spent fuel management and radioactive waste management

The Norwegian Government has continued development work on the national strategy and plans for spent fuel and radioactive waste management, building on the results of the concept evaluation studies described in previous reports.

A White Paper to Parliament (Stortingsmelding) was issued in 2021 setting out the Government's overall intentions and strategy for the safe decommissioning of Norwegian nuclear facilities and management of nuclear waste.

A National Strategy for the Safe, Secure and Environmentally Sound Management of Radioactive Waste in Norway and was published on 3 July 2024.

DSA has published guidance on planning the clean-up of the Norwegian nuclear programme, outlining the milestones that will need to be achieved — to maintain the safety of existing facilities and prepare them for decommissioning, to establish and license new facilities needed for decommissioning and to carry out decommissioning — and the regulatory expectations that will need to be met for each milestone. DSA has also published guidance on the regulations pertaining to import and export of radioactive waste in Norway.

NND is developing more specific strategies and plans consistent with the above, supported by concept evaluation studies, for implementation of the various aspects of decommissioning and radioactive waste management.

Ensuring the long-term safety and security of all forms of spent fuel, including upgrading storage conditions and associated safety assessments

As indicated in Section D, and in the section above, there are on-going activities to assess and ensure the safety of the long-term management of spent fuel. Actions have been initiated to improve the SARs for the current fuel storage facilities and to assess and plan for longer-term storage arrangements. The design lifetime of existing and new or upgraded facilities will be important considerations in this process. The options for treatment and disposal of the various types of spent fuel have been the subject of recent analyses and these issues are being considered by the Government.

DSA is committed to ensuring that IAEA's guidelines for safeguards by design will be taken into account in the process of planning and construction of new stores for spent fuel. An early consideration of safeguards in the design process will allow informed design choices that are optimized concerning economy, operation, safety, security and safeguards.

Preparing for decommissioning

The HBWR and JEEP II research reactors were shut down permanently earlier than expected, and preparations for decommissioning were not as advanced at the time of shutdown as would have been anticipated. During the current transition phase from operation to decommissioning, particular focus is being given to:

- Establishing national policy and strategy for the decommissioning of Norway's nuclear facilities and for management of radioactive waste, and more specific strategies and plans for the decommissioning programme (as described in section B);
- Establishing resources and competence of operators and regulator (as described particularly in sections E.5 and F);
- Updating relevant regulations and guides and procedures, including assessment of environmental impact for and licensing of new and modified facilities (as described in section E);
- Establishing safe and secure storage for all spent fuel during decommissioning, until further management of the fuel can proceed; and
- Characterization of facilities and improving inventory information (as described in section D).

Ensuring sufficient capacity for radioactive wastes, including from decommissioning

This has been addressed in the national strategy and plans for spent fuel and radioactive waste management, building on the results of a reanalysis of expected volumes of waste and the concept evaluation studies described in previous reports.

K.3. International Peer Reviews

A full-scope Integrated Regulatory Review Service (IRRS) mission to Norway took place in June 2019. The mission report has been made publicly available[16]. In this report, the IRRS Team stated that it "was positively impressed by the extensive preparation, expertise and dedication of DSA. The IRRS Team was extended full cooperation in the regulatory, technical, and policy discussions with the management and staff of DSA, in a very open and transparent manner."

The IRRS Team identified a number of recommendations and suggestions to improve the Norwegian regulatory system and the effectiveness of the regulatory functions in line with IAEA safety standards,

[16] https://www.iaea.org/sites/default/files/documents/review-missions/irrs_norway_2019.pdf

many of which confirmed the actions for further improvement that were identified in DSA´s self-assessment. In summary, the IRRS Team concluded that “the following issues are representative of those which, if addressed by the Government of Norway and DSA, should further enhance the overall performance of the regulatory system.

"The Government should:

- Establish a comprehensive national policy and strategy for safety;
- Update and further develop the national framework for safety and security;
- Establish a national policy and a strategy for spent fuel and radioactive waste management including decommissioning;
- Make provisions to provide DSA with the necessary resources to fulfil its obligations;
- Establish provisions regarding national competence in nuclear and radiation safety.

The regulatory body, DSA, should:

- Develop an integrated management system to ensure safety, addressing the whole organization;
- Implement a human resource plan and training programme based on an analysis of the necessary competence and skills;
- Take action for the further development of regulation and guides in order to ensure a comprehensive regulatory framework;
- Establish and implement an enforcement policy;
- Introduce and implement the concept of clearance;
- Implement an inspection programme based on a systematic graded approach.”

Norway prepared a plan of action, based on these recommendations and suggestions and some of the developments are outlined in preceding sections. Norway has requested an IRRS follow-up mission to review its measures to further improve its regulatory system and the performance of regulatory functions, and particularly to address the findings of the IRRS Team. The follow-up mission is expected to take place in November 2025.

K.4. Current Practices and Improvement Measures

The focus of current activities and measures for improvement are heavily influenced by the early shut down of the research reactors and the need to prioritize issues related to preparations for decommissioning and the associated management of spent fuel and radioactive waste.

The recommendations from the IRRS mission are being taken into account and work to further develop the national policy and strategy for the management of spent fuel and radioactive waste has been a particular focus, as indicated in Section B.1.

The IRRS mission recommendations related to DSA are reflected in the current overall programme of work. For example, work to establish an integrated management system has been ongoing for some time and human resource and competence planning has been identified as high priority. DSA is working towards developing a policy and strategy for competence management, including a human resource plan. These issues were also addressed in the recent internal reorganization of DSA, one of the aims of which was to further enhance DSA’s organizational structure to respond to present and future regulatory challenges,

notably those associated with decommissioning and the management of spent fuel and radioactive waste management.

DSA had been given the task of considering the possible future structure of a model for technical support functions in Norway. An evaluation was initiated focusing on DSA technical support capacity and its interactions with other organizations. The IAEA Technical Support Organization Self-Capability Assessment (TOSCA) has been an important input to this process. The proposed model consists of three elements that will need to be further developed and strengthened in the coming years. The three elements are: 1) internal functions in DSA, e.g. the role as an intelligent customer, 2) a knowledge centre and scientific community consisting of several Norwegian collaborating partners, led by the Norwegian University of Life Sciences, and 3) framework agreements with international consultants.

In addition, DSA has re-established and extended its Advisory Committee on Radiation and Nuclear Safety, comprising international experts and representatives from regulatory bodies from other countries to, among other things, review a wider range of relevant work undertaken by DSA or for DSA.

Key features of the IRRS recommendations particularly relevant present and future DSA activities related to the management of spent nuclear fuel and radioactive waste management include:

- Development and implementation of a national policy and strategy for spent fuel and radioactive waste management, to reflect national priorities and to form the basis for long-term decision making with respect to the decommissioning of facilities, management of spent fuel, predisposal waste management and disposal of radioactive waste, including the necessary financial provisions;
- Ensuring that the regulatory framework fully addresses the early stages of development of nuclear installations and decommissioning, as stages requiring authorization, are suitably addressed;
- Development of specific regulations and guidance related to preparation and maintenance of safety cases during construction and operation of spent fuel and radioactive waste management facilities;
- Further development of processes for the release (clearance) of materials from regulatory control.

Significant work has been undertaken in the intervening period on the first of these recommendations, in particular, which is described in more detail in section B.1, and work is also in progress to address the other recommendations. For example, a review of international guidance on clearance and its application to the situation in Norway has been undertaken and relevant guidance is in the process of being developed.

DSA has established General Licence Conditions (GLCs) that are closely linked to both the Nuclear Energy Act and to international standards, and relevant guidance, with the objective of clarifying the regulatory requirements related to nuclear facilities and activities. Additional guidance on the application of the GLCs has also been prepared on the principles, requirements and associated criteria for safety upon which DSA's regulatory decisions and actions are based. Additional specific guidance will provide additional guidance for particular types of facility that are, or could be, licensed under the Nuclear Energy Act (e.g. spent fuel treatment and storage facilities and radioactive waste management facilities).

K.5. Activities to Enhance Openness and Transparency

Provisions for the involvement of interested parties and for their input to decision making follows and is ensured by the general requirements laid down in the Public Administration Act and, in the case of new facilities, the Planning and Building Act. Hearings are performed for licensing and are mandatory under the Pollution Control Act for permits. Such hearings are advertised on the DSA website and in the local media of new activities requiring a permit or licence.

The Environmental Information Act of 9 May 2003 Relating to the Right to Environmental Information and Public Participation in Decision-making Processes Relating to the Environment also ensures public access to environmental information.

According to a Directive from the Ministry of Health and Care Services, DSA has a responsibility to disseminate updated knowledge to relevant authorities and the public. DSA has established a communication strategy, which relates to communications with relevant ministries and governmental agencies/authorities, as well as counties and municipalities. This strategy also commits DSA to taking an active role in communicating its regulatory practices with licensees, registrants and other stakeholders.

DSA aims to be a transparent and credible authority, by actively communicating knowledge within its field of expertise to target groups in an understandable and consistent manner. DSA communicates new knowledge to all affected audiences through the strategic use of communication channels, including maintaining a proactive dialogue with the media. As part of its communication strategy, reports and information of interest to the public are published on DSA's webpages, including documents relevant to decision-making processes. In addition, DSA publishes press briefings and news, including information concerning incidents, accidents and abnormal events. Inspection reports are also published on the webpage.

Mechanisms and legal provisions are therefore in place for DSA to inform and consult interested parties and the public about the possible radiation risks associated with facilities and activities, and about the processes and decisions of the regulatory body. The Freedom of Information Act provides an additional mechanism for ensuring the public access to information held by public authorities.

L. Annexes

L.1. References to National Laws, Regulations, Requirements, Guides etc.

Act of 12 May 1972 No. 28 Concerning Nuclear Energy Activities (Nuclear Energy Act):

- Regulation of 2 November 1984 No. 1809on the Physical Protection of Nuclear Material (as amended 20 December 2018).
- Regulation of 15 November 1985 No. 1912on Exemption from the Act on Atomic Energy Activity for Small Amounts of Nuclear Material.
- Regulation of 12 May 2000 No. 433 on Possession, Transfer and Transportation of Nuclear Material and Dual-use Equipment.
- Regulation of 14 December 2001 No. 1809 on Economical Compensation after Nuclear Accidents

Act of 12 May 2000 Concerning Radiation Protection and Use of Radiation No. 36 (Radiation Protection Act):

- Regulation on Radiation Protection and Use of Radiation of 16 December 2016No. 1659.

Act of 13 March 1981 No. 6 Concerning Pollution Protection and Waste (Pollution Control Act);

- Regulation of 1 November 2010 No. 1394 on the Application of the Pollution Control Act to Radioactive Pollution and Radioactive Waste
- Regulation of 1 June 2004 No. 930 on the Recycling and Management of Waste (Waste Regulation)
- Regulation of 1 June 2004 No. 931 on Pollution Control

White paper to Parliament no. 8 (2020-2021) «Trygg nedbygging av norske atomanlegg og håndtering av atomavfall»

Norwegian Radiation and Nuclear Safety Authority, Norway's Report to the joint 8th and 9th Review Meeting of the Convention on Nuclear Safety. DSA-rapport 2023:03..

Norwegian Radiation Protection Authority, Norwegian work on establishing a combined storage and disposal facility for low and intermediate level waste (Report 1995:10), IAEA-WATRP review team, (1995).

Norwegian Radiation and Nuclear Safety Authority (DSA), Veileder for planlegging av opprydding etter de norske atomanleggene, DSA Veileder nr. 15 (2023).

Norwegian Radiation and Nuclear Safety Authority (DSA), Veiledning om eksport og import av radioaktivt avfall. DSA Veileder nr. 16 (2023).

National Strategy for the Safe, Secure and Environmentally Sound Management of Radioactive Waste.

Report of the Integrated Regulatory Review Service (IRRS) Mission to Kingdom of Norway (2019) (https://www.iaea.org/sites/default/files/documents/review-missions/irrs_norway_2019.pdf)

Norwegian Nuclear Decommissioning, Draft Decommissioning Strategy: Integrated Strategy for Decommissioning the Nuclear Facilities at Halden and Kjeller (2019) (in Norwegian) https://www.norskdekommisjonering.no/wp-content/uploads/2019/12/Dekommisjoneringsstrategi.pdf

Norwegian Nuclear Decommissioning, Draft Waste Strategy (2019) (in Norwegian)
https://www.norskdekommisjonering.no/wp-content/uploads/2019/12/Avfallsstrategi.pdf

NOU 2001:30 (Official Norwegian Report), Evaluation of strategies for final disposal of high level reactor fuel (2001) (in Norwegian).

Technical Committee on Storage and Disposal of Metallic Uranium Fuel and Al-clad Fuels, Recommendations for the Conditioning of Spent Metallic Uranium Fuel and Aluminium Clad fuel for Interim Storage and Disposal (2010) (in English)
(http://www.regjeringen.no/upload/NHD/Vedlegg/rapporter_2010/tekniskutvalgsrapport2010.pdf).

NOU 2011:2 (Official Norwegian Report) Interim storage solution for spent nuclear fuel and long-lived intermediate level waste (2011) (in Norwegian)
http://www.regjeringen.no/pages/15663778/PDFS/NOU201120110002000DDDPDFS.pdf

KVU1: The future decommissioning of the nuclear reactors in Norway (2015) (in Norwegian)
(https://www.regjeringen.no/contentassets/9ed6b7a312ea48c6a2b6705d1fcd82c3/kvu-dekommisjonering-rapport-og-vedlegg-5-11.pdf).

KVU2: The handling of Norwegian Spent Fuel and other Radioactive Waste (2015) (in Norwegian)
(https://www.regjeringen.no/no/dokumenter/oppbevaring-av-norsk-radioaktivt-avfall/id2365157/).

KS1 Quality assurance of the future decommissioning of the nuclear reactors in Norway (2016) (in Norwegian) (https://www.regjeringen.no/contentassets/73601c56109e4bcf9a2dab33df2c0a90/rapport-ks1-fremtidig-dekommisjonering-av-de-nukleare-anleggene-i-norge.pdf)

KS1 Quality assurance of the handling of Norwegian spent nuclear fuel and other radioactive waste (2016) (in Norwegian) (https://www.regjeringen.no/contentassets/3184f416f1ec443083d69e7a8e711706/rapport-ks1-oppbevaring-av-norsk-radioaktivt-avfall.pdf).

KVU Step 2: Future decommissioning of IFE's nuclear facilities (2019) (in Norwegian)
(https://www.norskdekommisjonering.no/wp-content/uploads/2020/05/KVU-trinn-2-Fremtidig-dekommisjonering-av-IFEs-nukleære-anlegg.pdf)

KS1 Quality assurance of KVU Step 2: Future decommissioning of IFE's nuclear facilities (2020) (in Norwegian)
(https://www.norskdekommisjonering.no/wp-content/uploads/2020/05/KS1-Fremtidig-dekommisjonering-av-IFEs-nukleære-anlegg-offentlig.pdf)

Limited concept investigation on the handling of Norwegian spent reactor fuel (2020) (in Norwegian)
(https://www.norskdekommisjonering.no/wp-content/uploads/2020/06/Begrenset-konseptvalgutredning-om-behandling-av-norsk-brukt-reaktorbrensel.pdf)

L.2. Overview Matrix

Type of Liability	Long-Term Management Policy[17]	Funding of Liabilities	Current Practice / Facilities	Planned Facilities
Spent Fuel	Regarded as radioactive waste. Ongoing assessment of alternative options, including treatment options. New or upgraded facilities needed for storage and disposal.	Government / operator.	Storage at reactor sites (Kjeller and Halden).	New or improved storage capacity needed at both sites. Different options being considered. Disposal solutions are needed and are being assessed.
Nuclear Fuel Cycle Wastes	Disposed of LILW at KLDRA Himdalen, subsequently at a new facility. New facility needed for disposal of higher activity waste.	Government / operator.	Disposed at KLDRA Himdalen[18] or storage at Kjeller or KLDRA.	• New disposal facility for spent fuel and/or higher activity waste are being investigated and planned for
Application Wastes	Disposal of LILV in an extended KLDRA or new facility.	Government, and fees from users.	Storage at Kjeller Radwaste facility .	New facilities being assessed by NND
Decommissioning	White Paper to Parliament 8 (2020-2021) is Norway's decommissioning strategy Current plans based on achieving unrestricted use of sites	Government / operator.	Reactors permanently shut down. Final plans for decommissioning being developed.	New storage and disposal facilities are needed (plans on going).
Disused Sealed Sources	Return to manufacturer, or Disposal in KLDRA Himdalen or new facility for higher activities.	Fees from users / Government	Return to manufacturer, or storage at Kjeller awaiting new storage facilities.	New disposal facility for spent fuel and/or higher activity waste.
NORM Wastes	Disposal at licensed repositories.	Operators	Disposal at Gulen, three other licensed facilities accepting alum shale and at Bjorstaddalen accepting phosphate sand	None, but some operators have expressed an interest in expanding existing facilities or establishing new ones.

[17] All elements of radioactive waste management are addressed in the national Strategy for the Safe, Secure and Environmentally Sound Management of Radioactive Waste.
[18] Disposal at KLDRA Himdalen is currently suspended. Wastes are currently stored pending resumption or alternative disposal route.

L.3. General Licence Conditions (GLCs)

Interpretation: This document sets out the conditions used by the Norwegian Radiation and Nuclear Safety Authority (DSA) in forming its recommendations to the Norwegian Government regarding the issue of licences to own and operate nuclear facilities in accordance with the Nuclear Energy Activities Act. These conditions have been included in licences for IFE Kjeller and Halden and are intended to be included in further licences under the Nuclear Energy Act.

There are 25 conditions, listed below. Each condition is set out thereafter.

1	Control of the Site	13	Radioactive Waste and Spent Fuel Management
2	Documents and Records	14	Emergency Planning
3	Insurance / Guarantee	15	Management System
4	Restrictions on Nuclear Material, Radioactive Material and Radioactive Waste	16	New Nuclear Facilities
5	Resources	17	Safety of Operations
6	Safety Analysis Report (SAR)	18	Design and Safety Classification
7	Incidents on the Site	19	Maintenance
8	Occupational Health and Safety Programme	20	Configuration Management Programme
9	Decommissioning	21	Shutdown or Cessation of Operations
10	Safety Committee	22	Periodic Safety Review
11	Training	23	Nuclear Material Accountancy and Safeguards
12	Radiological Protection (RP) Programme	24	Nuclear Security
		25	Commissioning

1 **Control of the Site**

1.1 The licensee shall make and implement adequate arrangements to control all property transactions affecting the licensed site to ensure that the licensee remains in overall control of the site.

1.2 The licensee shall mark the boundaries of the licensed site by fences, or other appropriate means, and shall ensure that all such boundaries are properly maintained.

1.3 The licensee shall make and implement adequate arrangements to prevent unauthorized persons from entering the licensed site.

2 **Documents and Records**

2.1 The licensee shall make adequate arrangements to demonstrate compliance with any of the conditions attached to this licence. All documentation relevant to the issuing of a licence shall be recorded and preserved by the licensee for the lifetime of the installation or activity, and for any specified period beyond such lifetime, that DSA may specify.

2.2 If so directed by DSA, the licensee shall submit any written arrangements made in support of any licence condition to DSA as DSA may specify.

3 **Insurance / Guarantee**

3.1 The licensee shall maintain the necessary insurance arrangements or other securities, cf. Nuclear Energy Activities Act, § 11 No. 2, letter © and §§ 35 and 37.

4 **Restrictions on Nuclear Material, Radioactive Material and Radioactive Waste**

4.1 The licensee shall ensure that no nuclear material or radioactive material (including such material which has been declared as waste) is brought onto the licenced facility except in accordance with adequate arrangements made by the licensee for this purpose.

4.2 The licensee shall not consign nuclear material or radioactive material (other than radioactive waste) to any place in Norway other than an approved site except with the written agreement of DSA.

4.3 The licensee shall keep a record of all nuclear material, radioactive material and radioactive waste consigned from the licenced facility detailing the amount, type and form of such nuclear material, the manner in which it was packed, the name and address of the person to whom it was consigned and the date when it left the licenced facility.

4.4 The licensee shall ensure that the previously mentioned record is preserved in accordance with condition 2.1.

5 **Resources**

5.1 The licensee shall provide and maintain adequate financial and human resources to ensure the safe operation of the licensed facility.

5.2 The licensee shall make and implement adequate arrangements to control any change to its organizational structure or resources that may affect safety.

5.3 These arrangements shall provide for the classification of changes to the organizational structure or resources according to their safety significance.

5.4 The licensee shall at all times have sufficient personnel in possession of adequate expertise at all levels of the organization.

5.5 The management of the licensee shall encourage and work to foster and maintain a healthy safety culture.

6 **Safety Analysis Report (SAR)**

6.1 The licensee shall conduct and maintain safety analyses that use a graded approach of appropriate detail for the complexity of the facility or process analysed.

6.2 The safety analyses, and changes to the safety analyses, shall be reviewed and subject to approval by DSA.

7 Incidents on the Site

7.1 The licensee shall make and implement adequate arrangements for the notification, recording, investigation and reporting of unplanned situations or events occurring on the site.

8 Occupational Health and Safety Programme

8.1 The licensee shall implement and maintain an occupational health and safety program for the site.

9 Decommissioning

9.1 The licensee shall maintain a comprehensive decommissioning plan for the site, and shall review and revise the plan at such times as the DSA may require and in any event, no later than 5 years from the previous revision.

10 Safety Committee

10.1 The licensee shall maintain a safety committee with an established mandate and procedures approved by the DSA.

11 Training

11.1 The licensee shall establish and maintain an overall training policy and initial and continuing training programs on the basis of long-term qualifications and competencies required for performing all jobs, and training goals that acknowledge the critical role of safety.

12 Radiological Protection (RP) Programme

12.1 The licensee shall implement and maintain an adequate radiological protection programme at the site.

13 Radioactive Waste and Spent Fuel Management

13.1 The licensee shall implement and maintain an adequate waste management program documenting handling, processing, transportation, storage and safeguarding of radioactive wastes, including spent fuel and nuclear material that is declared as waste, mixed with any other hazardous substance.

14 Emergency Planning

14.1 The licensee shall implement and maintain adequate Emergency Planning to prepare for and respond to emergency events, including fires, initiating at or affecting the licensed site, and for dealing with both the on-site and off-site effects of such emergencies.

15 Management System

15.1 The licensee shall implement and maintain an adequate management system, including a written safety policy that places safety paramount within the management system, overriding all other demands, for activities carried out under this licence.

16 **New Nuclear Facilities**

16.1 The licensee shall only carry out construction and/or operation activities of any new nuclear facility at site with the prior approval of the DSA.

17 **Safety of Operations**

17.1 The licensee shall, in respect of any operation that may affect safety, ensure that safety analyses identify the conditions and limits necessary in the interests of safety.

17.2 The licensee shall ensure that all operations, which may affect safety, including those, which ensure that any conditions, and limits necessary in the interests of safety are met, are implemented.

17.3 Operating procedures should be periodically reviewed and updated in accordance with predetermined process and known to operating personnel. The appropriate operating procedures should be prepared, reviewed and approved prior to the start of any new activities.

17.4 The licensee shall ensure that adequate records are made of the operation, inspection and maintenance of any facility, which may affect safety. These shall include records of the amount and location of all radioactive material, including nuclear fuel and radioactive waste, used, processed, stored or accumulated at the licensed facility at any time.

17.5 The licensee shall ensure that no operations are carried out which may affect safety except under the control and supervision of suitably qualified and experienced persons appointed for that purpose by the licensee.

18 **Design and Safety Classification**

18.1 The licensee shall identify all items important to safety and classify them based on their safety function and their safety significance.

18.2 The licensee shall ensure that a plant equipment is not operated, inspected, maintained or tested unless suitable and sufficient safety mechanisms, devices and circuits are safely connected and in good working order.

18.3 The licensee shall ensure that all structures, systems and components important to safety shall be designed to be calibrated, tested, maintained, repaired or replaced, inspected and monitored as required to ensure their capability of performing their functions and to maintain their integrity in all conditions specified in their design basis.

18.4 The licensee shall adopt the single failure criteria approach. No single failure of a component can result in loss of capability of a system to perform its safety function.

18.5 The licensee shall ensure that design features include automatic initiation of the protection system to ensure safe operations for the full range of postulated initiating events.

18.6 The licensee shall ensure that all structures, systems and components operate within with specified safety limits and safety margins during all operational states.

19 **Maintenance**

19.1 The licensee shall make and implement adequate arrangements for the regular and systematic examination, inspection, maintenance and testing of all plant equipment which may affect safety. These arrangements shall provide for the preparation of a maintenance schedule for each relevant component. The licensee shall submit all or part of this maintenance schedule to DSA for approval as DSA as may specify.

19.2 The licensee shall ensure, in the interests of safety, that every examination, inspection, maintenance and test of any plant equipment or any part thereof is carried out:

(a) by suitably qualified and experienced persons;

(b) in accordance with schemes laid down in written procedures;

© within the intervals specified in the maintenance schedule; and

(d) under the control and supervision of a suitably qualified and experienced person appointed by the licensee for that purpose.

19.3 DSA may agree to an extension of any interval specified in the maintenance schedule.

19.4 The preventive maintenance programme shall cover all structures, systems and components important to licensed facility safety.

19.5 The licensee shall provide written procedures for examination, inspection, maintenance and testing based on the safety analysis and manufacturer's recommendations.

19.6 The licensee shall ensure that all measuring and test equipment used has been properly calibrated, subject to controlled use and tagged/removed from service when out of tolerance.

19.7 The licensee shall ensure that a full and accurate report of every examination, inspection, maintenance or test of any part of plant equipment, dated and signed by the appointed suitably qualified and experienced person, is made to DSA immediately on completion.

19.8 The licensee shall carry out such tests, inspections and examinations in connection with any plant equipment (in addition to any carried out under the maintenance schedule) as DSA may specify after consultation with the licensee.

20 **Configuration Management Programme**

20.1 The licensee shall make and implement adequate arrangements to control any modification, temporary modification or experiment carried out on any part of the existing facility or processes that may affect safety.

20.2 These arrangements shall provide for the classification of modifications, temporary modifications or experiments according to their safety significance. The arrangements shall, where appropriate, divide the modification, temporary modification or experiment into stages. Where DSA so specifies, the licensee shall not commence or proceed from one stage to the next without the documented agreement of DSA.

21 **Shutdown or Cessation of Operations**

21.1 When necessary, for the purpose of enabling any examination, inspection, maintenance or testing of any plant equipment or process to take place, the licensee shall ensure that any such plant equipment or process shall be shut down or cease operation in accordance with the requirements of its maintenance schedule unless DSA has agreed in advance to an extension of its operating period.

21.2 The licensee shall, if so specified by DSA, ensure that when any plant equipment or process is shutdown in accordance with the above condition it shall not be started up again without the agreement of DSA.

21.3 The licensee shall, if so directed by DSA, shut down or cease operation of any plant equipment or process on the licensed facility within such period as DSA may specify and then shall not start it again without the agreement of DSA.

22 **Periodic Safety Review**

22.1 The licensee shall, as necessary or at intervals to be specified by the DSA, carry out a safety review of compliance monitoring and operational performance to confirm that the nuclear installation remains fit to continue operation.

22.2 The licensee shall submit reports of these safety reviews to DSA.

23 **Nuclear Material Accountancy and Safeguards**

23.1 The licensee shall implement adequate arrangements for nuclear material accountancy and safeguards.

23.2 The licensee shall submit such parts of the arrangements to DSA as DSA may specify.

24 **Nuclear Security**

24.1 The licensee shall implement adequate arrangements for ensuring the security of nuclear material, radioactive material and radioactive waste on the licensed site.

24.2 The licensee shall submit such parts of the arrangements to DSA as DSA may specify.

25 **Commissioning**

25.1 The licensee shall make and implement adequate arrangements for the commissioning of any plant or process which may affect safety.

L.4. Abbreviations

DSA	Direktoratet for strålevern og atomsikkerhet (Norwegian Radiation and Nuclear Safety Authority)
GLC	General Licence Condition
HBWR	Halden boiling water reactor
IFE	Institutt for energiteknikk (Institute for Energy Technology)
INSARR	Integrated Safety Assessment of Research Rectors
IRRS	Integrated Regulatory Review Service
ISCA	Independent Safety Culture Assessment
JEEP	Joint Establishment Experimental Pile
KLDRA	Kombinert lager og deponi for lav- og middels radioaktivt avfall (Combined Storage and Disposal Facility for Low and Intermediate Level Radioactive Waste)
KS1	Kvalitetssikring av konseptvalg (Quality assurance of concept selection)
KVU	Konseptvalgutredning (Concept evaluation study)
LILW	Low and intermediate level radioactive waste
NND	Norsk nukleær dekommisjonering (Norwegian Nuclear Decommissioning)
NOK	Norwegian krone
NORA	Norwegian Zero-effect Reactor Assembly
NORM	Naturally occurring radioactive material
NRPA	Norwegian Radiation Protection Authority (now DSA)
OLCs	Operational limits and conditions
PIE	Post-irradiation examination
ROS analyse	Risiko- og sårbarshetsanalyse (risk and vulnerability analysis)
SAR	Safety analysis report
Statsbygg	Directorate for Public Construction and Property

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