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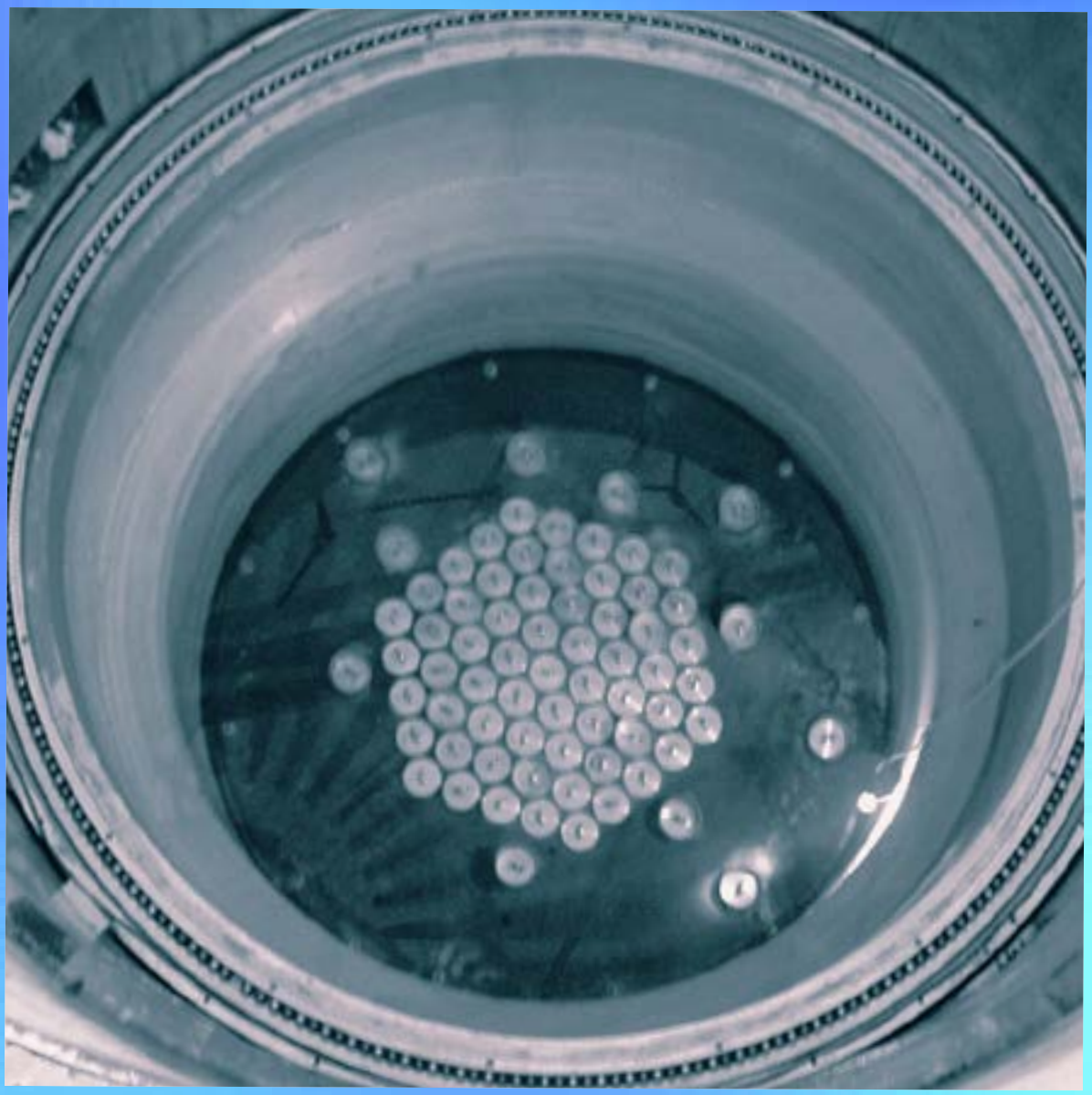
Implementation of the obligations of the Convention on Nuclear Safety in Norway

The Eighth Norwegian Report in Accordance with Article 5 of the Convention



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Norwegian Radiation and Nuclear Safety Authority

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Resymé
Norge har signert Kjernesikkerhetskonvensjonen, og er dermed forpliktet til å sende en rapport om status for sine nukleære anlegg hvert tredje år. Dette er Norges åttende rapport under konvensjonen.

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Abstract
Norway has signed the Convention on Nuclear Safety and is therefore obliged to report on the status of the nuclear facilities in Norway every third year. This is Norway's eighth report under the convention.

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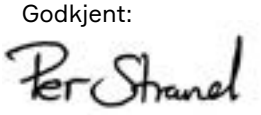

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Implementation of the obligations of the Convention on Nuclear Safety in Norway

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Table of Contents

1 Introduction

1.1 About this Report

Norway signed and ratified the Convention on Nuclear Safety (CNS) on 20 September 1994. This report constitutes the eighth Norwegian report issued in accordance with Article 5 of the CNS.

The report describes the nuclear activities in Norway and how Norway fulfils the articles in the CNS.

This Introduction (section 1) provides information about the national policy and an overview of the nuclear programme in Norway. The Summary (section 2) summarizes updated information on matters that have developed since the last Norwegian Report to the CNS in 2017. The reporting article by article (section 3) shows how Norway complies with the articles the CNS. At the time of the last CNS Review Meeting in 2017 Norway had two research reactors in operation. These were permanently shut down in 2018 (HBWR) and 2019 (JEEP II) respectively. Norway has no 'nuclear installations', according to definition in Article 2 of the CNS. There are also no plans to build nuclear power plants, and therefore compliance with Articles 7, 8, 9, 10, 15 and 16 is presented, in accordance with the guidelines in INFCIRC 572/Rev. 6, section II.E.

The three principles from the Vienna Declaration have been taken into account where applicable. Principle 1 on design, siting and construction of new nuclear power plants is addressed in section 1.2; principle 2 on on-going safety assessments is addressed in section 3.4; and, principle 3 on the application of IAEA Safety Standards is addressed in section 3.1.2.

1.2 National Policy towards Nuclear Activities

Norway had plans to build nuclear power plants in Norway in the 1960s and 1970s, but in 1979 there was a parliamentary decision to postpone these plans following the Three Mile Island accident. In 1986 there was a parliament decision not to build nuclear power plants, following the Chernobyl accident. Currently, Norway has no plans to build nuclear power plants.

1.3 Main Safety Issues Addressed in the National Report

There have been two main safety issues since the CNS meeting in 2017, one in the HBWR in 2018 and one in the JEEP II in 2019. In the HBWR a functional problem with a safety valve was encountered, while in the JEEP II corrosion was found on several components important for safety. These issues are described in more detail in section 2.2.

1.4 Overview of the National Nuclear Programme

1.4.1 Nuclear Facilities

It should be noted that according to the Norwegian legislation both research reactors and facilities for handling and storage of nuclear material are defined as "nuclear installation", which is different from the definition of "nuclear installation" in the CNS.

Research Reactors

The Norwegian nuclear activities started in 1948 by the establishment of Institutt for Atomenergi (now renamed Institute for Energy Technology) at Kjeller northeast of Oslo. The first research reactor JEEP I (Joint Establishment Experimental Pile), reached criticality in July 1951. It was followed by the HBWR (Halden Boiling Water Reactor) in 1959 (part of the OECD Halden Reactor Project), a boiling heavy water reactor with maximum thermal power of 25 MW. The N0RA (Norwegian zero effect Reactor Assembly) reactor at Kjeller came into operation in 1961 and was a joint project between Norway and IAEA. The JEEP I and the N0RA reactors were shut down and decommissioned in 1967 and 1968, respectively. The JEEP II reactor was built in 1965-66 and reached criticality in December 1966. JEEP II is a heavy water pool reactor with thermal power of 2 MW.

The HBWR and JEEP II were permanently shut down in 2018 and in 2019, respectively, and will now be decommissioned. In the JEEP II all the fuel and heavy water has been removed from the primary system, while in HBWR only part of the fuel has been removed from the reactor pressure vessel and the heavy water is still in place.

Storage and Disposal of Spent Nuclear Fuel

All spent nuclear fuel is presently stored on site in Halden and at Kjeller. The strategy for storage and final disposal of spent nuclear fuel has been under development since the first official report on possible strategies was issued in December 2001. The two latest governmental reports (concept evaluation studies (KVU)) with corresponding quality assurance reports, form the basis of the current Norwegian strategy for storage and disposal of spent nuclear fuel:

1. Future Decommissioning of nuclear facilities in Norway [1]
2. Handling of spent nuclear fuel and other radioactive waste in Norway [2]

According to the strategy, reprocessing abroad is identified as one of the main options for stabilizing metallic fuel, but other options are also being considered. Additional studies are underway before the final decision on treatment of metallic fuel and disposal is made.

The Ministry for Trade, Industry and Fisheries has given the Directorate of Public Construction and Property (Statsbygg) an assignment to initialize a conceptual design, localization analysis and cost estimate for a new central storage facility for spent fuel, co-located with a new repository for low and intermediate level waste.

KLDRA Himdalen is a combined storage and repository for low and medium level radioactive waste which is located in Himdalen 25 km southeast of Kjeller. The capacity is about 10,000 barrels of waste (1 barrel is 220 litres), and it is expected to be filled around 2030.

Further updates on the progress in the development of the policy for the management of spent fuel and radioactive waste will be reported under the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*.

1.4.2 Organisations

Norwegian Radiation Protection and Nuclear Safety Authority (DSA)

As of 1 January 2019, Norway's regulatory body, formerly known as the Norwegian Radiation Protection Authority (NRPA), changed its name to the Norwegian Radiation and Nuclear Safety Authority (DSA). DSA is the regulatory body in Norway in the areas of radiation protection, safety, security and safeguards. DSA is organised under the Ministry of Health and Care Services (HOD) but also undertakes work for and is

funded by the Ministry of Foreign Affairs (MFA) and the Ministry of Climate and Environment (KLD). DSA is described further in Article 8.

Institute for Energy Technology (IFE)

The Institute for Energy Technology (IFE) is an independent research foundation for energy and nuclear technology. Part of its budget is financed by the Government through the Ministry of Trade, Industry and Fisheries and the rest is from research contracts with industry and other research institutions.

IFE owns and operates Norway's two research reactors, which are now preparing for decommissioning. IFE is also the operator of KLDRA Himdalen. IFE is responsible for handling, storage and final disposal of radioactive waste, excluding NORM which is disposed of at other waste repositories.

Before the research reactors were closed, around 30 persons were employed for reactor operation at JEEP II and around 60 persons at HBWR. IFE is in the process of transitioning to decommissioning at both the Kjeller and Halden sites. This includes training these staff to perform different tasks to support the next phase in the lifetime of these facilities.

Norwegian Nuclear Decommissioning (NND)

The Government established Norwegian Nuclear Decommissioning (NND) by a Royal decree 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 [3]. NND is financed by the Ministry of Trade, Industry and Fisheries, and it is planned to be fully operational from 2021 with a stepwise transfer of responsibility from the current operator for decommissioning and radioactive waste management for the nuclear facilities in Norway.

1.4.3 Legislative and Regulatory Framework

The nuclear activities are mainly governed by three acts: the Nuclear Energy Activities Act (12 May 1972), the Radiation Protection Act (12 May 2000) and the Pollution Control Act (13 March 1981). IFE have operating licences for the Halden site, including HBWR, until the end of 2020; for the Kjeller site, including JEEP II, until the end of 2028; and, for the Himdalen site including KLDRA Himdalen, until the end of April 2028.

The Norwegian legislative and regulatory framework is described in more detail in Article 7.

2 Summary

2.1 Significant Changes to the National Nuclear and Regulatory Program

Following a scheduled maintenance inspection at the HBWR, a functional problem with a safety valve requiring a considerable repair cost was identified by IFE (see section 2.2.1). IFE decided in June 2018 to permanently shut down the reactor, and IFE is now preparing for decommissioning.

IFEs site at Kjeller and the Fuel Instrumentation Workshop in Halden was re-licenced according to the Nuclear Energy Activities Act from 1 January 2019 for 10 years of operation. However, IFE decided in April 2019 to permanently shut down the JEEP II reactor at Kjeller following scheduled maintenance and control. During the maintenance and control, corrosion was identified on several key components requiring a long-term shut down period and considerable repair cost (see section 2.2.2). The reactor is shut down, and the fuel and heavy water have been removed from the reactor. IFE is now preparing for decommissioning of the JEEP II reactor.

Norwegian Nuclear Decommissioning (NND) was established 12 February 2018 (see section 1.4.2).

Developments have been made to the regulatory framework in the past three years. General licence conditions have been introduced in the operating licence for the Kjeller site, with the intention to apply these to Halden and Himdalen in the future. Enforcement capabilities have been introduced in the Nuclear Energy Activities Act. In addition, DSA have also developed and strengthened procedures relating to core regulatory functions, such as for authorisation and review and assessment.

DSA has also enhanced its inspection programme in the recent years, for example by including measures to follow international recommendations and best practice more closely, improve competence and capacity of DSA staff, enhance the quality of regulatory functions, and improve the operators' understanding of the regulatory requirements.

Norway had an IRRS mission in June 2019 (see section 2.6.2) and recommendations and suggestions from the IRRS-team provided an important input to DSA's action plan on how the legal and regulatory framework will be developed further in the coming years.

2.2 Important Safety Issues since the Last Report

2.2.1 Halden Boiling Water Reactor

In March 2018, IFE informed DSA that following a scheduled maintenance inspection, they had encountered a functional problem with a safety valve of the HBWR in Halden and there was leakage of heavy water through the valve when closed.

The safety valve is placed on the outlet pipe under the reactor pressure vessel and is designed to isolate the reactor pressure vessel in case of leakage of the primary cooling circuit. The reactor could not be operated if the safety valve was not fully functional.

IFE performed inspections during the spring 2018 to identify the root cause of the malfunction. The inspection identified that the valve was not fully closing, but the definite reason could only be established if the valve was removed. Several possible reasons for the leakage were identified, e.g. corrosion, cavitation, internal damage, or some foreign object.

The safety valve was last replaced in 2005, and based on that experience, IFE was aware that repairing or replacing the valve would be a time-consuming and complicated operation which would require comprehensive analysis and risk-assessments. One reason was that there are not enough safe positions in fuel storage facilities available to fully unload the fuel reactor core. This means that the heavy water must remain in the reactor pressure vessel making valve replacement and/or repair complicated from a safety perspective. Also, the time of delivery for spare parts and a new valve was estimated to be long.

DSA revoked the operating permit, i.e. permission to bring the reactor to power, until the safety function of the valve could be fully restored. In June 2018 IFE's Board announced their decision on the permanent shutdown of the Halden reactor [4].

2.2.2 JEEP II Reactor

The JEEP II reactor shut down in December 2018 for scheduled maintenance and control. In January 2019, as part of planned ageing management inspections, IFE identified corrosion on several components important for the safety of the reactor. IFE considered this to be a potential safety related issue that had to be further assessed prior to restarting the JEEP II reactor. The nuclear fuel and the heavy water had already been removed as part of the planned maintenance outage.

In January 2019 DSA instructed IFE that they must not return the reactor to power until IFE had demonstrated that safe operation was assured and that the identified risks had been mitigated.

Further investigations during the spring 2019 showed that there was local corrosion of the external surface of the inlet pipework to the reactor pressure vessel, including the control stations. IFE estimated that the repair would require a long-term shutdown of the reactor with considerable repair costs in excess of IFE's financial capabilities. Based on an overall technical and economical assessment IFE's board decided in April 2019 to permanently shut down the reactor [5].

2.3 Events and Accidents

In October 2016, there was an incident at the HBWR in Halden. The incident occurred after the Norwegian report for seventh Review Meeting of the CNS had been submitted. Although the incident was not reported in the national report, details were presented and discussed during the seventh Review Meeting.

The Halden Boiling Water Reactor was in planned shutdown from 9 October 2016. The planned outage tasks included to search for a fuel failure that had been discovered in July and the unloading of an experimental flask for analysis of material specimens with results to be delivered to a customer. The flask was equipped with booster fuel with higher enrichment. It was also possible that the booster fuel was the candidate for fuel failure. Some of the material specimens had fallen down in the flask, and the fuel was therefore removed from the experimental flask.

On 17 October the booster fuel was placed in a basket in the fuel service compartment. Radiation Levels of I-131, I-132 and noble gasses in the reactor hall increased in the following days. On 21 October the fuel in the fuel service compartment was inspected and several faults on fuel pins were detected. These were moved to an airtight storage container on 24 October, however the container was discovered to not be leak tight. The levels of I-131 and I-132 and noble gasses in the reactor hall still increased. The following day the radiation levels had not decreased as expected. The radiation levels were still high until 31 October when IFE mounted extra sealing to the container. The total release to air was approximately 150.6 MBq I-131, and 27.1 MBq I-132, as well as noble gasses. The total release to water was 27.6 MBq I-131. The incident was rated 2 on the INES scale.

DSA has had several inspections during and after the event. The follow-up showed that there was a need to enhance the safety culture, as all procedures were not followed, including that DSA was not informed according to the procedure. After the event IFE has initiated a process to enhance the safety culture in general, see section 2.6.1.

2.4 Planned Safety Related Activities

After the decisions to shut down both research reactors in Norway, the operating organisation (IFE), the regulatory authority (DSA) and the newly established organization responsible for decommissioning and management of radioactive waste from the nuclear sector (NND), are now preparing for decommissioning. IFE are preparing final decommissioning plans and the transfer of undertakings to NND.

Furthermore, there are planned activities to improve the storage conditions for spent fuel. DSA has instructed IFE to upgrade existing storage facilities for spent fuel and to increase the storage capacity. There are also plans to establish a new central storage facility co-located with a new repository for low and intermediate level waste (se section 1.4.1).

DSA will follow-up the recommendations from the IRRS mission in June 2019 with an action plan (see section 2.6.2).

DSA has applied an intensified inspection programme of IFE following a system audit in 2014-2016 (see section 2.6.1). The system audit was an inspection of the entire organisation, and revealed a number of discrepancies, which are still not fully resolved, and the intensified inspection programme is therefore planned to continue as long as required.

2.5 Suggestions and Challenges from the Last Review Meeting

2.5.1 Challenges

Two challenges were identified for Norway at the Review Meeting in 2017:

→ Challenge 1: Complete actions to establish an effective aging management program, including an inspection program for JEEP II.

Actions have been implemented to establish an effective ageing management program for the JEEP II reactor. This is described in more detail in section 2.6.7.

→ Challenge 2: Continue to improve safety culture taking into account the results of the upcoming INSARR and ISCA reviews.

INSARR and ISCA missions were held in Norway in 2017 and 2018, respectively. Safety culture is described in section 2.6.1. The international peer reviews are described in 2.6.2.

2.5.2 Suggestions

The Country Group identified the following Suggestion for Norway:

→ Suggestion 1: Participate in the EU topical peer review on aging management.

Norway participated in EU Topical Peer Review in 2017. This is described in section 2.6.2.

2.6 Issues and Topics from the Organizational Meeting

After the seventh Review Meeting there were nine common issues identified from the country group discussion (cf. The Summary Report of the Seventh Review Meeting, 7 April 2017, paragraph 26-34) [6]. At the Eighth Organizational Meeting of the Contracting Parties, these issues were requested to be taken into account when drafting the national reports (cf. The Summary Report from the Eighth Organizational Meeting of the Contracting Parties, 17 October 2018, paragraph 12). These nine issues are addressed below.

2.6.1 Safety Culture

Safety Culture at DSA
A commitment to safety from managers at all levels in DSA is demonstrated through use of a Strategic Action Plan 2018-2020 in decision-making processes, meetings, discussions and day-to-day activities.

To maintain focus on safety in the decision making DSA has developed a "Safety Culture Policy Statement". The policy statement establishes DSA's expectation on individuals and organizations engaged in nuclear activities to establish and maintain a healthy safety culture, and describe the commitment to nuclear safety. It is implemented via management processes. It requires all leaders and personnel to support and demonstrate the behaviour outlined in the policy and the commitment of all individuals to consider safety and security as a core part of their day-to-day activities.

Safety Culture at IFE and Safety Culture Oversight by DSA
In addition to the regular inspections, DSA performed in the period 2014 - 2016 a system audit of the nuclear facilities operated by IFE. The system audit revealed a number of discrepancies, related to management of responsibilities, human resources and expertise to deal with security, safety, the role of the safety committee, and management of deviations, knowledge transfer and document management. DSA concluded that there were serious shortcomings in the management system and especially in the management of the business and the follow-up of deviations.

Since the system audit, DSA has intensified its inspection programme for IFE. As a part of this, DSA has performed regular inspections of the work in the Safety Committee since 2014. Identified discrepancies and the work to correct them have been followed up by DSA. DSA has concluded that the preventive safety culture at IFE is developing though there are areas for improvement, a finding which also was confirmed by the ISCA mission in 2018 (see section 2.6.2).

2.6.2 International Peer Reviews

Norway has had three IAEA peer review missions since the CNS meeting in 2017, an INSARR (Integrated Safety Assessment of Research Reactors) mission in 2017, an ISCA (Independent Safety Culture Assessment) mission in 2018 and an IRRS (Integrated Regulatory Review Service) mission in 2019. Norway also participated in the EU Topical Peer Review in 2017-18.

EU Topical Peer Review
According to the EU Nuclear Safety Directive, all EU member states shall perform a national assessment on nuclear safety, called a Topical Peer Review (TPR). EU invited neighbouring countries to participate in the review, which started in 2017, and Norway volunteered to participate. The topic for the first TPR review was ageing and ageing management, and included nuclear power reactors and research reactors with a thermal power of more than 1 MW. Thus, both Norwegian research reactors were included in the review. Norway submitted a report according to the guidelines from the European Nuclear Safety Regulators

Group (ENSREG) and Western European Nuclear Regulators Association (WENRA). Norway participated in the peer review process, and submitted a report [7] which was reviewed during a workshop in May 2018.

The feedback to Norway following the review was one "good practice"[1], which was use of external peer review services to assess and review the ageing management programme. There was also one "area for improvement"[2], which was systematic and comprehensive ageing management programme to be implemented for the research reactors, in accordance with the graded approach, the applicable national requirements, international safety standards and best practices [8, 9]. The need to improve the ageing management programme was also an identified challenge from CNS review meeting in 2017 (see section 2.5), and how this has been followed up is described in section 2.6.7.

Participating in the TPR review process was a suggestion from the CNS Review Meeting in 2017 (see section 2.5).

INSARR 2017

An INSARR mission was performed at IFE's research reactor, JEEP II, in October 2017 [10]. The list of recommendations included the need for improvements in: safety management and organisational aspects; safety analysis and safety documents, and the operating programme and technical modifications. The INSARR team also noted the competence of IFE staff, and the on-going improvement in the effectiveness of the IFE safety committee, emergency preparedness and the implementation of an effective maintenance programme.

The findings from the mission were taken into account when DSA prepared recommendations on IFE's license application in 2018, and have been considered during inspections. IFE has established a plan to follow up the recommendations.

ISCA 2018

IFE invited IAEA for an ISCA mission, which was held in March 2018. The ISCA team concluded that the safety culture at IFE is under development and is improving. However, several areas for improvement were identified, for example, it was recommended that IFE management should ensure that roles and responsibilities are documented in the management system, and that a better quality and management system and more standardised training should be developed. In addition, it was recommended that IFE should establish a system to learn from both external and internal events, and should establish procedures for better communication, both internally and between IFE and DSA.

The findings from the mission were taken into account when DSA prepared recommendations on IFE's license application in 2018, and have been considered during inspections. IFE has established a plan to follow up the recommendations.

IRRS 2019

DSA invited IAEA for an IRRS mission, which took place in June 2019. The mission report had not been finalized when this report was submitted. The main findings will be presented at the CNS meeting in 2020.

[1] "A good practice is an aspect of ageing management which is considered to go beyond what is required in meeting the appropriate international standard." (ENSREG, 1st Topical Peer Review, Country Specific Findings), October 2018

[2] "A "TPR expected level of performance" for ageing management is the level of performance that should be reached to ensure consistent and acceptable management of ageing throughout Europe. These findings were allocated to participating countries (the country specific findings). The "TPR expected levels of performance" are considered as a good performance for those countries which already meet this expectation and as an area for improvement for the others.» (ENSREG, 1st Topical Peer Review, Country Specific Findings), October 2018

2.6.3 Legal Framework and Independence of Regulatory Body

The legal framework is described in more detail under Article 7, see section 3.1.

There has been developments concerning the independence of the regulatory body in the recent years. DSA (then NRPA) was established in 1993, following the merger of two inspectorates into one regulatory body. To ensure independence in its safety related decisions, DSA was organized as a directorate under the Ministry of Health and Care Services. DSA currently undertakes work for and is funded by three ministries HOD, KLD and MFA. In addition, DSA also undertakes some tasks for the Ministry of Defense. The Ministry of Trade and Fisheries is responsible for the nuclear operators is Norway, thus there is no conflict of interest at the ministerial level that might affect the independence of DSA.

From 1 January 2016, the Norwegian Government decided to organize DSA as an agency under the Norwegian Directorate of Health (NDH) under HOD. This was partly implemented, but reversed on 1 July 2017, in large part due to Norway's international legal commitments through IAEA Conventions. During the CNS meeting in 2017 the issues related to the independence of DSA were presented and discussed.

As a directorate, DSA is an independent decision-making authority, laid down under the legislative framework covering DSA's areas of responsibilities.

2.6.4 Financial and Human Resources

The Director General of DSA has the power to employ the necessary staff within the budgetary frames provided by the three responsible ministries (HOD, KLD and MFA). DSA has identified the need to develop a systematic human resource plan that identifies the number and the necessary qualifications and competence of staff needed to carry out its functions and discharge its responsibilities that is fully commensurate with the nature and number of facilities and activities regulated.

The external reorganization of governmental health authorities (including DSA) initiated by the Ministry of Health and Care Services in 2016 (see section 2.6.3) had an impact on the staffing situation at DSA. This external reorganization was part of the Government's efficiency programme with the aim to reduce costs and to streamline the public sector. In this process, in 2016, DSA was reorganized and became an agency with a separate Director General and budget under the Norwegian Directorate of Health, under HOD. In addition, support functions such as the library, archive and IT were outsourced and centralized over the time period from 2016-2018. In addition, public authorities (including DSA) were instructed to reduce their workforce by 5% and a recruitment freeze was introduced.

2.6.5 Knowledge Management

There is a on-going process at DSA to recruit staff with relevant knowledge as the research reactors now enter the decommissioning phase. The transfer of knowledge from employees leaving DSA is not formalized and is dependent on the staff involved. However, initial training and knowledge management is facilitated by delegation of an experienced colleague, in addition to attendance at relevant courses.

Following the decision to permanently shut down the research reactors there is a risk for IFE of losing relevant personnel and their competence. IFE has performed surveys amongst their staff in order to map the competence and analyse potential risk of losing relevant information and knowledge. Several risks have been identified, such as an ageing staff and low staffing in some areas such as decommissioning, waste management and assistance to projects. However, IFE has not yet developed a knowledge management programme. IFE are considering how to keep key members of staff, how to recruit new staff

with necessary competence, minimum staffing level, and transfer of knowledge to a new operating organisation.

2.6.6 Supply Chain

IFE manufactures much of their equipment in their own workshops. This practice reduces the problem of non-availability of identical replacement parts, the risk of counterfeit or fraudulent items and problems of finding certified suppliers, even if they are not completely eliminated. There are internal processes when safety-related equipment need to be purchased, some of which have been formalized recently. IFE also prioritise buying equipment from certified producers. However, IFE have no formal processes to identify counterfeit or fraudulent items. IFE has also on occasion experienced long delivery times due to limited capacity from producers.

2.6.7 Ageing Management

Taking into account the age of the research reactors in Norway, DSA has in recent years increased the focus on ageing management, for example through the authorization process.

HBWR
There is an established and comprehensive ageing management programme at HBWR which includes systems, structures and components (SSCs) which are either important for safety or which could influence the long term availability of the facility. The material surveillance program was established in 1958 and samples of the original vessel material have been irradiated since then to be able to predict the behaviour of the reactor pressure vessel. In addition, a Service Inspection Programme has been established and implemented in accordance with the applicable ASME Code. External experts are consulted by the operator for independent investigation and assessment of the condition of the reactor pressure vessel.

JEEP II
One of the challenges for Norway from the CNS review meeting in 2017 was to complete actions to establish an effective aging management program, including an inspection program for JEEP II (see section 2.5). Both the INSARR mission to JEEP II in 2017 and the Topical Peer Review in 2017-2018 (section 2.6.2) noted the need to improve the ageing management programme.

A maintenance program has been in place for JEEP II since the reactor came into operation in 1966. The ageing management programme (AMP) was formally established in 2016 and was focused on the reactor pressure vessel and the primary coolant circuit, but did not include all SSCs relevant to safety. Since, the AMP has been revised further, e.g. by including in-service inspection, periodic testing, and minimizing the ageing effects on SSCs through operational practices. To establish a comprehensive management program is a specific license condition in the license for the JEEP II reactor for 2019-2028. Thus, measures have been taken to address this challenge.

2.6.8 Emergency Preparedness

Norway has contributed and adhered to the Nordic Manual (NORMAN) 2015, which outlines the Co-operation between the Nordic Authorities in Response to and Preparedness for Nuclear and Radiological Emergencies and Incidents. Further Norway adheres to the Nordic guidelines and recommendations, 2014 given by the Nordic radiological and nuclear regulative bodies for protective measures in early and intermediary phases of a radiological or nuclear emergency (Nordic Flagbook). The document gives generic guidelines that cover all types of scenarios, irrespective of whether they arise as accidents or intentional

acts. The Nordic Flagbook is due to be revised in 2020. This work will be led by SSM in Sweden. Further Norway follows the HERCA/WENRA Approach for better cross-border coordination of protective actions during the early phase of a nuclear accident.

The emergency preparedness plans undergo regular updating, including plans to cover simultaneous events. External hazardshas also been addressed through cooperation with Norwegian Security authorities. This will be further reported on in the Security forums at the IAEA.

Emergency preparedness in Norway is described in more detail under Article 16 in section 3.6.

2.6.9 Stakeholder Consultation and Communication

DSA has a communication strategy to improve transparency and communication with the public, stakeholder consultation and communication. This includes for example measures to make reports from peer review missions available. This is further described under Article 8, see section 3.2.10.

2.7 Emergency Drills and Exercises

Norwegian emergency response arrangements are exercised on the national, regional, and local levels. Relevant scenarios include: nuclear power plant accidents in neighbouring countries or at own research reactors, satellite crash, nuclear submarine accidents, nuclear ice-breaker accidents, transport accidents, dirty bombs, etc. Orphan sources are found every now and then, helping to maintain a high awareness of such incidents.

DSA contributes to exercise activity on many levels of the response organisation. In previous years there has been a major focus on enhancing the competence of nuclear and radiological response on the regional and local level. Lessons learned from exercises are followed up through internal processes.

IFE has adapted emergency plans for each site. Each site holds exercises regularly, and has an exercise where emergency preparedness is the main theme every third year at the minimum. DSA performs inspections during IFE exercises and lessons learned are identified in an inspection report.

More information about exercises is included in section 3.6.1.

3 Reporting Article by Article

As mentioned above, Norway does not have nuclear installations, according to the CNS definition. This report therefore covers compliance with Articles 7, 8, 9, 10, 15 and 16, in accordance with the guidelines in INFCIRC 572/Rev. 6, section II.E.

3.1 Article 7: LEGISLATIVE AND REGULATORY FRAMEWORK

3.1.1 Overview

All nuclear activities are regulated by three legal instruments, the Nuclear Energy Activities Act 12 May 1972, the Radiation Protection Act 12 May 2000 and the Pollution Control Act 13 March 1981.

The Nuclear Energy Activities Act
The Nuclear Energy Activities Act regulates the licensing system, general requirements for licences, inspection programme and the legal basis for the regulatory body. The Act also establishes the liability system according to the Paris Convention of 29 July 1960 as amended and related international legal instruments. The Act regulates confidentiality and penalties in case of non-compliance.

Pursuant to the Nuclear Energy Activities Act, there are four regulations issued:

- *Regulations 2 November 1984 on the Physical Protection of Nuclear Material and Nuclear Facilities (amended 29 June 2007).* These regulations establish requirements for the physical protection of nuclear material and nuclear facilities. These regulations implement Nuclear Security Series 13 and the obligations of the Convention of the Physical Protection of Nuclear Material and Nuclear Facilities as amended 2005.
- *Regulations 15 November 1985 on Exemption from the Nuclear Energy Activities Act for Small Amounts of Nuclear Material.* These regulation exempt small amounts of nuclear material from Chapter III of the Act and thus from the liability system.
- *Regulations 12 May 2000 on Possession, Transfer and Transportation of Nuclear Material and Dual-use Equipment.* These regulations regulate the control and accountancy of nuclear material as required in the Additional Protocol to the Safeguards Agreement between Norway and IAEA.
- *Regulations 14 December 2001 on Economical Compensation after Nuclear Accidents.* These regulate 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 to the Norwegian legislation.

The Radiation Protection Act
The Radiation Protection Act constitutes the legal basis for regulating the use of ionising and non-ionising radiation, radiation protection requirements, medical use of radiation, contingency planning, waste management and discharges to the environment. The Act itself establishes the framework, given in more detail in the Regulations on Radiation Protection and Use of Radiation of 29 October 2010.

The Pollution Control Act

The Pollution Control Act regulates the risk of pollution[3], and is the basis for authorisation of discharges of radioactive substances and the management of radioactive waste and contamination. The application of this act is stipulated in regulations of which the most relevant one to the CNS are: Regulations 1 November 2010 on the Application of the Pollution Control Act on Radioactive Pollution and Radioactive Waste. Further description of these regulations is found in our national report to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Royal Decree on Emergency Preparedness

The Royal Decree of 23 August 2013 describes the organisation and mandate of the emergency preparedness and response system in Norway. This is further described under Article 16.

3.1.2 Establishing and Revising Regulatory Requirements

A need for regulatory revision may be identified due to new scientific knowledge or new international recommendations. DSA uses IAEA Safety Standards as important guidelines when national laws and regulations are developed, reviewed and updated. Changes in regulations must be approved by the Government or by the relevant ministry. Revision of regulations must follow the provisions laid down in the Public Administration Act. All laws or regulations must be sent to public hearing, according to the provisions of the Public Administration Act and other requirements included in the Acts mentioned above. The public hearing process involves publishing the proposed regulation, along with a justification of the changes made, and the positive and negative consequences, including economic and administrative consequences, that these changes might have.

The general regulatory requirements, specified in the Nuclear Energy Activities Act and the Pollution Control Act and associated Regulations, are developed with the intent to be implemented in individual authorization or licence conditions, on a case-by-case basis, rather than in generic regulations or guidance. This facilitates detailed application of ALARA, BAT and a graded approach. Accordingly, also the procedures for such decisions are described in the Public Administration Act. An individual decision is “an administrative decision relating to the rights or duties of one or more specified persons” (Public Administration Act, section 2 b) and since they are legally binding there are requirements on such decisions; they have to be mandated in a law or a regulation according to the law and they shall inter alia be well informed, grounded and can be appealed.

DSA may clarify and interpret laws and regulations in guidance documents as needed. Such general guidance for applicants is available, based on general requirements in the above mentioned acts and regulations. In addition, DSA gives specific guidance on implementation in the documentation of the individual decision.

In the operating license for the JEEP II reactor for 2019-2028 General Licence Conditions (GLCs) were developed for the first time [11], with the intention that these will be applicable to all nuclear installations in Norway that are subject to licensing under the Nuclear Energy Activities Act. The GLCs are applied through the Nuclear Energy Activities Act and are based on international safety standards. The GLCs are intended to be comprehensive relating to the requirements placed on the operating organisation or applicant for a licence but are not prescriptive in terms of how safety should be achieved. The GLCs clarify the regulatory requirements related to nuclear facilities and activities and are intended to facilitate the operators’ understanding of regulatory expectations. The Licence Conditions are site-based, rather than

[3] Pollution is defined in the Pollution Control Act 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; 4. effects on temperature which cause or may cause damage or nuisance to the environment.

installation-based, following international practice. The GLCs are published and are publicly available on the DSA web page.

3.1.3 Licensing

The nuclear facilities are required to have a licence under the Nuclear Energy Activities Act. IFE is currently the only licensee under the Nuclear Energy Activities Act. IFE holds a licence for the HBWR and other facilities at the Halden site for the period 2015-2020, and a licence for the IFE Kjeller site, and the Fuel Instrumentation Workshop in Halden, for the period 2019-2028.

Licensing under the Nuclear Energy Activities Act is a process that may take up to two years. After receiving a request from HOD and the licence application and associated documents, DSA and the operator hold a start-up meeting, where the operator presents the justification for and details of the licence application. DSA describes how the application will be processed and meetings and inspections related to the application are planned.

During the licence application review and assessment process, DSA carries out further meetings with the operator to clarify any issues identified, and to discuss progress of the review and assessment process. DSA carries out inspections to clarify safety issues based on a graded approach.

To strengthen the review and assessment process, DSA use technical support from independent external consultants. The consultants may assist DSA in inspections in order to clarify identified safety issues. If relevant, DSA also uses information from external contributors, such as IAEA missions, and evaluation or peer review reports in safety, security and safety culture areas. DSA review and assess the application, and perform site visits, inspections, use of external experts etc. as needed.

The application from the operator for a license is sent on public hearing to relevant stakeholders (see chapter 3.2.10), according to the Public Administration Act. When the results and the conclusion of the licence application review and assessment process are clear, DSA presents it to the DSA Nuclear Safety and Radioactive Waste Advisory Committee for advice.

Based on findings, observations and comments from the review and assessment process, feedback from external stakeholders, and the DSA Nuclear Safety and Radioactive Waste Advisory Committee, DSA prepares a Recommendation Report, which is submitted to The Ministry of Health and Care Services, and recommend whether to grant or renew the licence to own and operate the nuclear installation. DSA also provides recommendations on licence conditions that need to be fulfilled in order to operate the nuclear facilities.

However, since both research reactors have been shut down permanently and going into decommissioning phase, the operator will have to apply for new licences which covers the change in scope from operation to decommissioning.

3.1.4 Inspections

Norwegian legislation provides DSA with the necessary legal basis for inspection activities covering all nuclear installations in Norway. According to the Pollution Control Act, the Radiation Protection Act and the Nuclear Energy Activities Act, DSA shall be given free access to all relevant information and to sites, facilities and activities. DSA may perform both announced and unannounced inspections.

DSA has developed an inspection strategy for the period 2016-2020. The strategy ensures implementation of IAEA-requirements for performing inspections. The strategy states that inspections shall be risk-based, both with regard to the frequency of inspections and to the facilities or activities inspected.

DSA has processes for inspections which include inspection guidelines, procedures and templates. The inspection procedures describe the practical inspection activities, including the responsibilities of inspectors, case handlers and section heads. The procedures also include templates for writing notice letters and inspection reports, and templates for opening/closure meetings. Within most areas, checklists and question lists have been established. The checklists are adapted to each inspection. During inspections, DSA typically assess the management system, accident handling, safety assessment and risk assessments, competence, education and training, quality controls, and the radiation protectionprogramme.

DSA performs several different types of inspections, which include programmed and reactive inspections, both announced and unannounced. Normally DSA perform 15-20 inspections per year under the Nuclear Energy Activities Act. In 2018, DSA performed 14 inspections at IFE's facilities under this Act.

Under the Nuclear Energy Activities Act, there are inspections in the areas of nuclear safety, nuclear security, safeguards, waste, and emergency preparedness. The areas of inspection to be included in the inspection plan are selected based on the experience and judgment of DSA staff. When the inspection plan is developed, the areas of inspection are general, covering a specific facility or activity. The details for each inspection are developed in the period before the inspection. The facilities associated with the highest safety risks are prioritized, and that might relate to age or the status of the facility, incidents at the facility or the planning of special operations or changes. Focus of inspections the last years has also focused on the management system, the internal control and the safety and security culture of the operator, including the work of its safety committee, as part of the intensified inspection programme, which was initiated in 2014 (see section 2.6.1).

DSA is in the progress of implementing organizational changes to improve the regulatory nuclear oversight in general. The measures that have been taken, or are planned, include: increasing the number of inspections, establishment of an advisory committee involving international experts and representatives from the regulatory bodies of other countries, reassignment and recruitment of human resources, extended use of external consultancy services to fulfil the Technical Support Organization function to support implementation of regulatory functions, and development of a management system with clear and defined processes and procedures to implement regulatory functions in a systematic manner.

3.1.5 Enforcement

The Radiation Protection Act, the Nuclear Energy Activities Act and the Pollution Control Act provide enforcement powers to DSA. Through different sections of the legislation, these Acts empower DSA to amend or revoke an operating permit, shutdown a facility or stop an activity, require further information to be provided, or require a modification of a facility to be performed. If, and when, these enforcement powers are used, DSA must do so in a manner that is consistent with the Public Administration Act.

DSA staff assess compliance with the various Acts and their associated regulations. When non-compliance is identified, DSA may decide to implement different levels of enforcement action, from giving the licensee a remark or a deviation to a decree/order to stop the operation. There will also be written correspondence identifying the legal basis for the non-compliance, and a time for rectification, which is transmitted to the licensee. A variety of enforcement options are available to DSA. These are daily coercive fines, a direction to stop conducting an activity, and the capacity to confiscate equipment. All non-compliance of the three acts, regulations and decisions made in accordance with them, is a criminal offence.

DSA has, as described above, access to a variety of measures that can be used in a non-compliance situation. DSA will make an assessment of which corrective action to choose on a case by case basis.

According to the Nuclear Energy Activities Act, DSA has authority to enforce any non-compliance of the act or regulations and decisions given in accordance with the act, through the competent enforcement authorities or with help from the police. If deemed necessary by DSA, DSA can enforce any safety measures on its own. DSA can also decide to close down any nuclear facility if deemed necessary by DSA. A new section in the Nuclear Energy Activities Act that entered into force in November 2018 gives DSA the mandate to issue coercive fines.

The Radiation Protection Act regulates all use of ionizing radiation for both workers and the public. If there is substantial health hazard, DSA can stop any activity or confiscate radioactive material and equipment with help from the police. There is a new section about coercive fines in Radiation Protection Act, although it has not entered into force yet.

The Pollution Act regulates radioactive pollution (see footnote in section 3.1.2) and radioactive waste. If there is radioactive pollution or risk of radioactive pollution, DSA can require measures by the polluter to prevent further pollution and to clean up the pollution. If such measures are not executed by the licensee, or if there is risk associated with delaying clean-up measures, DSA can ensure that the measures are executed.

It is one of the main tasks of DSA to control and enforce the obligations of three acts and the regulations and decisions made in accordance to the act.

3.1.6 International Conventions and Legal Instruments Related to Nuclear Safety

Norway has signed, ratified and implemented the following international conventions related to nuclear safety:

- → Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;
- → Convention on Nuclear Safety;
- → Convention on Early Notification of a Nuclear Accident;
- → Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency
- → Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention);
- → Norway has also made a political commitment with regard to the Code of Conduct on the Safety of Research Reactors.

3.2 Article 8: REGULATORY BODY

3.2.1 Legal Foundations and Statute of the Regulatory Body

The Nuclear Energy Activities Act states that DSA is the highest specialist agency as far as questions of safety and security are concerned. It functions as the institution making recommendations and giving advice to the ministry concerned. DSA shall prepare and submit recommendations to the Government or the relevant ministry on all applications concerning licences under the Nuclear Energy Activities Act, and shall on its own initiative put into effect all such measures as it deems necessary for safety reasons. It shall be the duty of DSA to ensure that all rules and conditions pertaining to safety precautions are complied

with and put into effect, as well as such orders that are given in pursuance of the Nuclear Energy Activities Act.

The Radiation Protection Act states that DSA is the dedicated authority to follow up compliance with provisions laid down in or pursuant to the Radiation Protection Act and can, for this purpose, make such individual decisions as are necessary. DSA shall be given free access to perform supervision and shall be provided with information to perform its functions under the provisions of the Radiation Protection Act. DSA shall be given access to undertake measurements and investigations.

KLD has assigned to DSA to act and fulfil its regulatory obligations for the control of facilities and activities under the Pollution Control Act. The regulations relevant to radioactivity under the Act and the delegation decision given on the 30 December 2010 gives DSA the legal authority necessary to enable it to fulfil its regulatory obligations for control of pollution and waste according to the Pollution Control Act.

3.2.2 Mandate, Mission and Tasks

DSA carries out assignments on behalf of three ministries: the Ministry of Health and Care Services, the Ministry of Foreign Affairs and the Ministry of Climate and Environment.

In addition to the national mandate for safety, security, and safeguards, DSA undertakes international tasks related to promoting radiation protection, nuclear security, nuclear safety, disarmament and non-proliferation.

DSA chair and serve as the secretariat for the Crisis Committee, which coordinates nuclear and radiological emergency preparedness and response. This is described in more detail under Article 16, see section 3.6.1.

3.2.3 Authorities and Responsibilities

DSA is the responsible national regulatory body for the use of radiation sources, radiation protection, nuclear safety, security, safeguards, emergency preparedness, transport, radioactive waste and radioactive discharge to the environment, natural radiation, and non-ionizing radiation. The annual Directive for DSA describes DSA's authority and responsibilities as a directorate for the Ministry of Health and Care Services, the Ministry of Climate and Environment and the Ministry of Foreign Affairs. The primary legal basis for DSA's regulatory work is the Radiation Protection Act, Nuclear Energy Activities Act and the Act on Pollution Control and their underlying regulations.

In addition, DSA act as an authority connected to Ministry of Defence for regulatory work, including the licensing process, inspections and emergency preparedness arrangements, for military reactor powered vessels entering Norwegian waters or ports.

There is an effective separation between the regulatory body and organizations concerned with promotion or utilization of nuclear energy. DSA serves the three ministries mentioned above, while the Ministry of Trade and Fisheries is responsible for IFE and NND.

Concerning nuclear emergency preparedness in Norway, DSA is by Royal Decree given the responsibility to provide a secretariat for the national Crisis Committee. The Director General of DSA leads the Committee, which has the mandate to handle the acute phase of the crises, and has the power according to the law to implement measures to reduce the impact and safeguard people and the environment. It comprises

representatives from a range of agencies and organizations with responsibilities for emergency preparedness and response, as described in more detail under Article 16.

The Government has also given DSA a key role in the implementation of international conventions, agreements, governmental strategies to which Norway has ratified, signed and additional tasks and responsibilities are provided in a number of international conventions and agreements.

DSA is also responsible for coordination and inspection related to the security of sensitive entities[4] that fall within DSA's areas of responsibility according to the Nuclear Energy Act. These facilities are regulated under the Security Act and the underlying regulation. The Security Act is administered by The Norwegian National Security Authority (NSM), which reports to the Minister of Defence and Minister of Justice and Public Security. A Government Forum for the Protection of Nuclear Installations and Nuclear Fuel in Norway was established in 2016. The aim of the Government Forum is to secure cooperation between national authorities and agencies and to produce, summarize and disseminate knowledge about how best to secure nuclear installations and nuclear fuel in Norway.

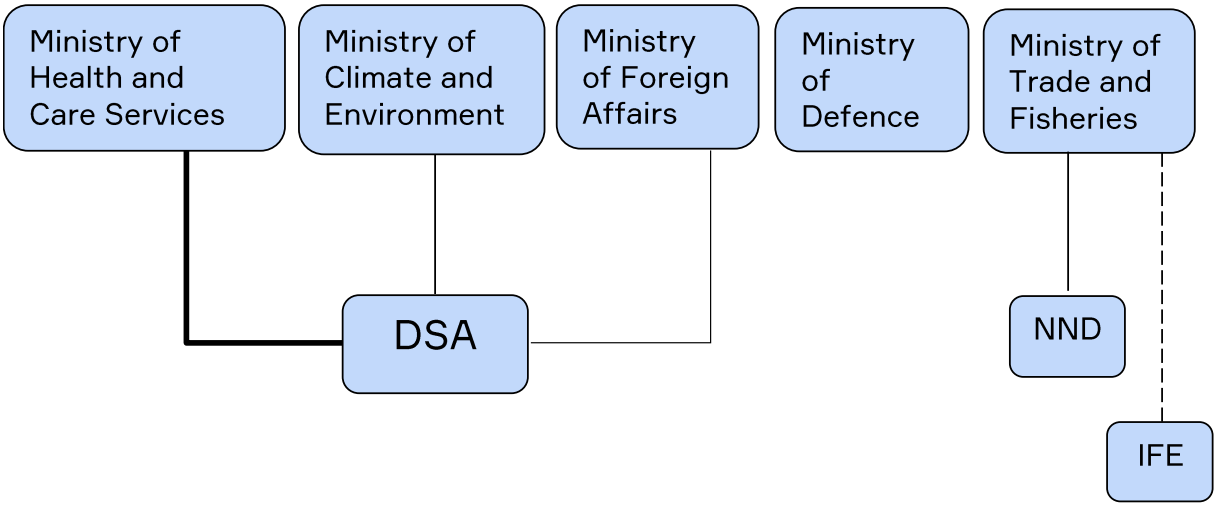

Figure 1: *Relationship of governmental bodies and operators.*

3.2.4 Organizational Structure of the Regulatory Body

DSA has two departments responsible for topical subject areas and one department responsible for planning and administration.

The Department for Nuclear Safety and Environmental Protection is responsible for the supervision of safety, security and safeguards of the nuclear facilities; and the regulation of environmental and health related consequences of discharges of radioactive substances from nuclear, industrial and medical facilities. Staff from this department also act as the secretariat for the Crisis Committee. The Department is organised in five sections and has 61 employees in total. At the department, 6.5 man-year are allocated per year for the nuclear sector under the Nuclear Energy Activities Act and 4 man-years are allocated per year for the Pollution Control Act. The civilian nuclear safety work is fully financed by fees from the operator.

[4] A sensitive entity is defined in the Security Act as "property that must be protected against activity that poses a threat to security in the interests of the security of the realm or of allies or other vital national security interests."

The Department for Radiation Protection and Measurement services is responsible for the supervision of industrial and medical use of radiation and radiation protection. The department is organised in three sections and have 43 employees.

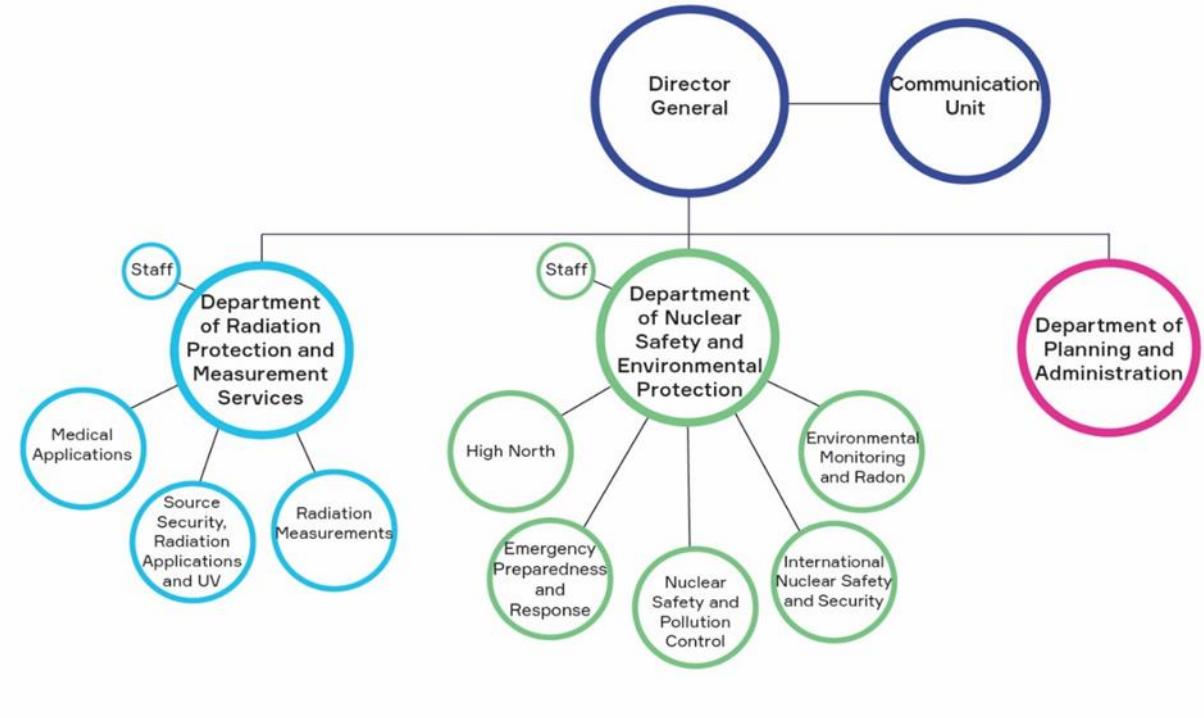

Figure 2: *Organisation chart of DSA*

3.2.5 Development and Maintenance of Human Resources

The Director General of DSA has the mandate to employ the staff needed to conduct the tasks given by the Government. At the ministerial level there is no detailed human resource plan related to underlying directorates or regulatory authorities.

DSA plans its activities and allocation of resources in the annual Operation Plans, in accordance to the Strategic Action Plan.

In the nuclear field, recruiting competent personnel with the necessary qualifications is challenging due to the limited scale of the nuclear programme in Norway and to the relatively few candidates with relevant expertise. Due to this, DSA has recently recruited employees from other European countries with the necessary knowledge and experience, though these staff require additional training related to language and understanding the Norwegian legal context.

3.2.6 Measures to Develop and Maintain Competence

DSA develops and maintains competence through participation in relevant international processes, and work within its area of responsibility, DSA contributes to the implementation of Norway's international obligations and evaluates the implementation of international recommendations. This work also contributes to maintaining and further developing DSA's competence and national regulatory practices.

DSA's overview of the state of knowledge provides a basis for management, supervision, emergency preparedness and for safeguarding national and international obligations. Further, DSA coordinates national surveillance of radioactive pollution in the environment, participates in coordinating national environmental data, collates and publishes relevant information about emissions and waste from Norwegian activities, as well as the occurrence and effects of radioactive material in the environment.

DSA staff participate in the development of IAEA safety standards through participation in the IAEA's Safety Standards Committees (NUSSC, WASSC, RASSC, TRANSSC, NSGC and EPReSC), and in consultancy meetings for the development of safety standards. When developing licence conditions, requirements and guides, the IAEA safety standards are one of the main bases.

DSA participates in several international networks, fora and cooperation projects, to both share and receive information and international experience. The results on this information exchange are taken into account in the regulatory work and procedures of DSA.

DSA is now in the process to consider establishing a human resource plan that will identify the number of staff necessary and the essential knowledge, skills and abilities for them to perform all the necessary regulatory functions and other tasks necessary to discharge DSA's responsibilities. The human resource plan will take into account of the nature and number of facilities and activities regulated by DSA and will be guided by the more systematic application of a graded approach that reflects the associated risks. DSA also intends to develop a formal process, including a training programme, for developing and maintaining the necessary competence and skills of its staff. The human resource plan, system of knowledge management and training programme will be included in the new integrated management system, which will facilitate its frequent review and updating.

3.2.7 Developments with Respect to Financial Resources

DSA receives funding according to an annual budget that is decided by the parliament, based on proposals from the Ministry of Health and Care Services, the Ministry of Climate and Environment, the Ministry of Foreign affairs and taking account of the overall priorities established in the national budget. These proposals are developed taking account of input from DSA on the risk-based priorities for its work programme over the next year. Following parliamentary agreement on the budget, the ministries allocate the budget and assign specific tasks within their areas of responsibility (for health, including nuclear safety, environment issues and international work) to DSA in the annual letter of commitment. In addition, resources are available from fees in connection with the Nuclear Energy Activities Act and the Pollution Control Act. The budget and associated tasks are then distributed within DSA in December each year, according to an established internal process.

3.2.8 Statement of Adequacy of Resources

Licensing under Nuclear Energy Activities Act is financed by fees. Connected to the new phase in the lifetime of the facilities that Norway will need to address in the coming years, there is a process to evaluate the adequacy of resources going forward.

3.2.9 Quality Management System of the Regulatory Body

At present, DSA operates two parallel management systems containing all relevant procedures, templates and instructions related to DSA's regulatory activities. However, a new integrated management system is

under development and the intention is to merge the content of the relevant documents in the two existing systems into one.

The integrated management system under development will follow ISO 9001 and address the requirements listed in IAEA GSR Part 2 for an integrated management system.

3.2.10 Openness, Transparency and Communication with the Public

DSA

Mechanisms and legal provisions are 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 is also an essential mechanism for ensuring the public access to information.

According to the Public Administration Act, the administrative agency must ensure that the case, e.g. application for a licence, is as well investigated as possible before a decision is made. In order to secure a basis for its own recommendations and the basis for further processing and decision-making, DSA requests relevant stakeholders to come forward with views on the licence application. Stakeholders include state authorities, national organizations, municipalities councils and the general public.

The DSA website is an important tool for providing information to the public and other interested parties. DSA's Communication Strategy commits it to take an active role in communicating its regulatory practices with licensees, registrants and other stakeholders. The Communication strategy states that DSA shall have regular contact with Ministries, agencies, institutions and organizations linked to our work, and that such contacts should be performed in a professional and service-minded manner. As part of DSA's Communication Strategy, reports and information of interest to the pubic are published on DSA's webpages, including documents relevant to the decision-making process. In addition, DSA publishes press briefings and news, including information concerning incidents, accidents and abnormal events. Inspection reports are also published on the webpage. Relevant information concerning public hearings in the licensing process of nuclear facilities is also published on the webpage. DSA also actively uses social media platforms such as Facebook and Twitter in its communication with the public. In addition, DSA considers the media to be an important communication channel. DSA keeps a proactive dialogue with the media, and provides several national editorial offices with news.

All international review reports and Norway's national reports under the *Convention for Nuclear Safety* and the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* are published on the DSA website.

IFE

IFE arrange public meetings with the local communities. These are often arranged when needed, often in connection with some specific event or other development.

Communication with external parties during an event is described in IFEs emergency preparedness plans. There are regular exercises of the emergency plans, which includes communication with external parties such as the local and national authorities and the police.

3.2.11 External Technical Support

DSA often uses external support organisations (e.g. consultancy services) to fulfil the function of a TSO to support development and implementation of regulatory functions related to nuclear safety and security

(e.g. review and assessment of authorization applications, inspections of nuclear facilities and activities). These activities are administered through a contract framework that has been established following an internal DSA process to identify the additional competences necessary to support its work.

An independent expert Advisory Committee on Nuclear Safety and Radioactive Waste Management has been established to provide advice on international developments and to review relevant work undertaken by DSA. The Committee comprises international experts in the field, including representatives from regulatory bodies of other countries.

3.2.12 Reporting Obligations

DSA prepares a work program for the following year following the annual letter of commitment from the Ministries where the budget and tasks are specified. During the year, DSA report on the progress of the work, after 6 months and at the end of the year. In addition, DSA and the Ministry of Health and Care Services, the Ministry of Climate and Environment, and the Ministry of Foreign affairs have agency management meetings, at least twice a year.

3.3 Article 9: RESPONSIBILITY OF THE LICENCE HOLDER

3.3.1 Prime Responsibility for Safety

The prime responsibility for safety for facilities and activities is specified in the Nuclear Energy Activities Act and the Pollution Control Act, and the respective regulations. For nuclear facilities and activities, the Nuclear Energy Activities Act states that the licensee has the prime responsibility for safety. The Nuclear Energy Activities Act, section 15 states “It shall be the duty of the operator of a nuclear installation to maintain the installation and equipment in sound and proper condition and to take all necessary measures to ensure that no damage will be caused as a result of radioactivity or other hazardous features of nuclear fuel or radioactive products found on the installation site, or which are removed or discharged therefrom, or which are undergoing transportation on the operator's behalf.»

A person or organization, responsible for safety for a facility or activity, is required to document how safety issues and responsibilities are described in its organizational structure, management system and quality assurance system.

The responsibility for safety is absolute, it cannot be transferred, delegated, outsourced, or contracted to any other party.

DSA has published a number of guidelines describing how licence holders should comply or demonstrate compliance with the regulations and legal requirements. DSA performs inspections to review how the licence holder assures compliance with regulatory requirements and how it discharges its prime responsibility for safety. Safety improvements as expressed in regulatory requirements provide a continuing process for improvement that shall be documented and may be reviewed during inspections. If inspections identify deviations from the general regulatory requirements or conditions set in a specific licence or permit, the legislation enables DSA to order corrections and, if appropriate, sanctions to enforce corrective actions. In recent years, the focus of the inspection programme for the research reactors has been on the importance of building a strong safety culture within the licensed organization, as a prerequisite for maintaining prime responsibility for safety.

3.3.2 The Licence Holder's Communication with the Public

Mechanisms and legal provisions are in place for license holder to inform and consult the public about the possible radiation risks associated with facilities and activities. The Freedom of Information Act is an essential mechanism for ensuring the public access to information.

3.3.3 Appropriate Resources and Powers for the Licensee for Effective On-site Management of an Accident and Mitigation of its Consequences

The regulatory framework provides requirements for the operation of nuclear installations. For example, according to the license conditions, the licensee shall provide and maintain adequate financial and human resources to ensure the safe operation of the licensed facility. IFE distribute financial and human resources internally when making the annual budget. The resources are distributed to ensure safe operation and to keep the emergency preparedness on an adequate level.

3.4 Article 10: PRIORITY TO SAFETY

3.4.1 Priority to Safety by the Licence Holder

Policies and Programmes
According to the licence conditions, the licensee of a nuclear facility is required to establish a management system, including a written safety policy that places safety paramount within the management system, overriding all other demands. The operating organization is also required to have a SAR which must be updated.

The licence conditions also states that the licensee should make adequate arrangements for periodic and systematic review of the SAR. Currently, the license conditions apply only to the Kjeller site but the intention is that they will be made legally for all nuclear facilities in the future. The SAR and the description of the management system is main part of the documentation required to support an application for authorization for operation of a nuclear facility.

Authorization for modifications is described in the Nuclear Energy Activities Act and in the license conditions. All safety significant modifications to the installation, operating organization or management changes, changes in the Safety Analysis Report and operational limits and conditions (OLCs) must be authorized by DSA. Authorization for safety significant modifications are handled by DSA as cases under the existing licence of the operating organisation.

One of the license conditions is that the licensee of a research reactor shall carry out a periodic safety review, at intervals to be specified by DSA. However, this license condition was first legally binding in January 2019 and until now no periodic safety review has been undertaken.

According to the Nuclear Energy Activities Act, DSA shall be satisfied that the nuclear installation's management and personnel have the necessary qualifications and clear responsibilities, before the installation is granted an authorization to operate. DSA has also has power to stop operation if there are safety concerns. 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.

The licensee of a nuclear installation shall establish and maintain a Safety Committee.

Implementation of Safety

IFE gives the safety a high priority, both for the reactor safety and for the radiation protection of the staff. The main tool for keeping the doses to the staff as low as reasonably achievable has been planning of the work and intensive monitoring, but also review of previous work and learning from experience.

Research projects have been undertaken at both the Halden and Kjeller sites to enhance safety at civilian nuclear facilities worldwide. This includes research into fuels and materials used, or proposed to be used in civilian nuclear reactors and human factors research.

According to the licence requirements, IFE organises the necessary training and refresher courses for their staff at Kjeller and in Halden. DSA ensures through inspections and audits that the resources and training/retraining provided are adequate.

IFE has established a system for quality management of health, safety and environment including the research reactors and the waste repository. The follow-up of DSA system audit (see section 2.6.1), and the subsequent developments at IFE on safety culture has contributed to improve the quality management system at IFE.

Fire protection has been improved by a thorough fire protection analysis, installation of additional fire detectors and minimizing the amount of combustible material in the facility.

The safety culture at IFE is describe in section 2.6.1.

3.4.2 Priority to Safety by the Regulator

DSA receives regularly reports (weekly, bimonthly, annual) from IFE concerning the operation of the nuclear facilities. There are weekly reports from the operation of the research reactors, bimonthly reporting on radiation doses, annual reports on discharges of radioactivity to the environment, and annual reports from the different nuclear facilities.

DSA regularly performs inspections to the nuclear facilities to ensure that safety is a priority.

DSA prioritizes safety in its own activities by ensuring at the review and assessment of facilities and activities is implemented on graded approach assuring relevant human, financial resources and time to more safety significant issues and risk. Furthermore, the authorization process is graded on bases of safety significance and risk, through the provisions of the Nuclear Energy Activities Act.

Reassignment and recruitment of human resources, working towards strengthening the supervision of nuclear facilities and activities based on graded approach.

3.5 Article 15: RADIATION PROTECTION

In accordance with the Radiation Protection Act with regulations, any user of ionising radiation is committed to measure the radiation doses to workers that have been exposed to ionising radiation. The annual dose for each worker should be assessed and kept below the limits specified in the Radiation Protection Regulations, which are consistent with those recommended by ICRP in their Publication No. 103. IFE is, as a nuclear operator, responsible for its own dose registration system.

IFE measures individual whole-body dose, skin dose, finger dose, eye-dose and internal dose. The whole-body dose for the last 12 months is reported to DSA bimonthly for each worker, while the other dose measurements are reported annually to DSA.

There are provisions on radiation protection in the Radiation Protection Act and the Radiation Protection Regulation. The General License Conditions requires the licensee to implement and maintain an adequate radiological protection programme at the site.

IFE has a system for work planning to keep the doses to the staff as low as reasonably achievable especially during maintenance work. A substantial reduction of the dose burden to the staff involved in maintenance work was achieved when this was introduced. The dose burden to the workers has stayed at this level, and a reduction of the dose burden is sought wherever possible.

As a part of the conditions associated with discharge authorisations, doses to members of the public from releases of radioactivity have to be kept below 1 μSv/y for releases to the aquatic environment. For discharges to the air, the dose limit is 100 μSv/y. These are applicable to each of the facilities individually. DSA establish release limits in Bq/y according to this, and the actual releases are a fraction of the limits. DSA perform inspections to review and control activities at the nuclear facilities in Norway. This is described in section 3.1.4.

3.6 Article 16: EMERGENCY PREPAREDNESS

3.6.1 The National System

General
DSA has been assigned the sole and full authority and responsibility to regulate on-site radiological and nuclear emergency arrangements of the operating organizations. This role includes developing, or advising on regulation and guides and verification of compliance for notification, approval, instruction and training, protective measures, and planning and response to radiological and nuclear emergencies.

The DSA approach to EPR regulation is based on a graded approach where most effort and resources are given to regulation of IFE. The regulatory system in place for IFE includes requirements for EPR and is executed through review and assessment of documentation during the licensing procedure, inspections of EPR plans and arrangements and observation and evaluation of EPR exercises.

In general, the licensee is responsible for organising plans for on-site emergency preparedness and response. IFE has adapted plans for each site, and these are exercised regularly. The off-site response is planned by the local police authorities and coordinated with the Crisis Committee (see below).

Based on the Royal Decree 23 August 2013, the Government has established a national response organisation made up of representatives from the following entities:

- → the relevant ministries;
- → the Ministerial Coordination Committee;
- → the Crisis Committee for Nuclear Preparedness (CCNP);
- → the Advisors to the Crisis Committee;
- → the Secretariat for the Crisis Committee (DSA);
- → the regional emergency organisations (County Governors).

The Ministries

The ministries are responsible for emergency preparedness within their area of competence. In order to deal effectively with the early phase of a nuclear event, the ministries have transferred responsibility for protective actions to the Crisis Committee.

In the annual budget from the ministries, resources are allocated specifically for EPR purposes and for nuclear safety.

The Ministerial Coordination Committee

The Ministerial Coordination Committee is responsible for ensuring cooperation and coordination between the different ministries. The Ministry of Health and Care Services heads the Committee.

The Crisis Committee

According to the Royal Decree on Nuclear Preparedness issued in August 2013, DSA is assigned the role of chair of the Crisis Committee for Nuclear and Radiological Emergency Preparedness and Response. If a nuclear or radiological accident or incident has either occurred or cannot be ruled out, and such an event can affect either Norwegian territory or Norwegian interests, the Crisis Committee shall ensure that the incident is addressed with coordinated measures and coordinated information to the public. DSA is the chair, has membership, and is the secretariat for the Crisis Committee, as stated in the Royal Decree.

The Crisis Committee consists of representatives from the following institutions:

- the Norwegian Radiation and Nuclear Safety Authority;
- the National Police Directorate;
- the Norwegian Defence Staff;
- the Directorate for Civil Protection and Emergency Planning;
- the Directorate for Health and Social Affairs
- the Norwegian Food Safety Authority.
- the Norwegian Coastal Administration
- the Royal Ministry of Foreign Affairs

The roles and responsibilities of all the members of the Crisis Committee are clearly defined in EPR plans for the Committee. The sections of this plan also cover: preparedness levels; notification, summoning and attendance; accident/incident management; competence, training and exercises; and detailed descriptions of tasks and responsibilities of each member of the Committee.

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

- to initiate the evacuation of the population if the situation represents a direct threat to health and life;
- advice on sheltering and intake of stable iodine,
- cordoning of contaminated areas;
- in the short term restrict production and distribution of foodstuffs;
- advice on dietary restrictions and other dose-reducing actions.

International Arrangements

No countermeasures are automatically implemented on the basis of declared levels of emergency. Rather, they are implemented based on the type of dimensioning scenario faced as well as the assessment of the situation (see below).

Countermeasures are also implemented according to the recommendations of the Nordic Flag book. Countermeasures on a national level are decided by the Crisis Committee.

The Advisors to the Crisis Committee

The Advisors to the Crisis Committee are made up of representatives from organisations and institutions, with expertise and responsibility required for an emergency organisation, with regards to the management of nuclear accident situations, and for further development and maintenance of emergency preparedness.

During an event, the tasks of the Advisors are to:

- → submit and share all information, data, and measurements of relevance to the event
- → forecast radioactive dispersion, fallout, and radiation doses to the public
- → advise the Crisis Committee on preventing or reducing the radiological, societal and economic consequences of a nuclear accident affecting Norway, or Norwegian interests.

The Secretariat for the Crisis Committee

The Secretariat for the Crisis Committee (DSA) is responsible, *inter alia*, for alerting the Nuclear Emergency Organisation, and relevant international bodies. The Secretariat organises a 24/7 Officer on Duty Service.

During events encompassed by the Crisis Committee's mandate, the secretariat shall:

- → assist the Crisis Committee to make its assessments of the situation
- → assist institutions and authorities at all levels address relevant issues
- → manage smaller incidents in line with guidelines provided by the Crisis Committee; and run the operations centre and its communications system.

Some examples of the continuous work the Secretariat is to:

- → assist the Crisis Committee develop information strategies
- → Participate in the continuous work on preparedness of disseminating information: Information must be coordinated, fast, comprehensive; relevant, transparent and adapted for relevant groups; help to maintain and strengthen the Crisis Committee as the preferred source for information on the accident/incident.

The Regional Emergency Organisations

The Country Governors direct the regional emergency organisations. They coordinate regional and local emergency preparedness and response. Their responsibilities include: planning and initiating countermeasures in accordance with local needs and demands, and to continuously liaise with the Crisis Committee.

The Licensee

The operators are responsible for any mitigating actions on-site, while DSA and the Crisis Committee are responsible for mitigating actions off-site. DSA has not been assigned responsibilities in response to an emergency that might compromise or conflict with the discharge of authority to regulate the safety of facilities and activities.

DSA requires EPR plans to be in place by the operator before a licence or authorization is given and every time a change in the activity takes place that may require a revision of such.

Operators are required to have a quality management system; perform risk assessments; take any and all preventative measures to mitigate risks; develop and continually revise an EPR plan; have suitably trained personnel, have in place procedures for timely notification to authorities; necessary equipment, means of communication on and off-site; take necessary mitigating actions on site; etc.

Integration between on-site arrangements and those of relevant off-site response organizations is one of the questions raised in the safety-related inspections of operating organizations. For IFE, more detailed plans and procedures are in place under DSA requirements and through the cooperation with first responder organizations.

Standing Preparedness

Norway operates a national automatic gamma monitoring network, consisting of 34 continuously run stations. One station is operated by the Norwegian Defence, however, DSA has access to the data. Several mobile monitoring units are also available. The data acquired is directly available to the competent authority, the emergency response organisation, and the public via radnett.dsa.no.

In addition, Norway has 6 high volume air samplers, where 4 have alarm capabilities with GM-counters on top of the filters.

DSA participates in various international networks for radiation monitoring and is the Norwegian counterpart for the IAEA RANET capabilities.

Norway has established bilateral agreements on early notification with Finland, Germany, Lithuania, the Netherlands, Poland, Russia, Sweden, Ukraine, and United Kingdom. The agreements differ slightly in wording, but are based on the IAEA Convention of Early Notification from 1986. These agreements will ensure an early notification if an event occurs at a facility covered by the agreements.

Exercises

DSA holds internal exercises to ensure that the organization is prepared to handle emergencies. For example: in conjunction with the Convex 3 held in 2017 DSA exercised for 36 hours to ensure that all available personnel were exercised, that changes of shift were exercised, and to test the robustness of the organization at the DSA. Lessons learned was that a prolonged exercise such as this is useful to DSA to test the endurance of the EPR organization.

DSA also observes national and international exercises. In 2018, DSA arranged, together with the Armed Forces, a radiological field exercise for the NATO CBRN battalion during the NATO exercise Trident Juncture. DSA will also send participants to the Swedish national exercise C-Eagle in September 2019.

DSA requires that the operators' emergency arrangements are coordinated with those of other organizations and that they are integrated with contingency plans and security plans established for nuclear security purposes. Compliance is confirmed through both inspections and observation and evaluation of exercises. DSA also requires that the operators exercise their EPR plans regularly, and that they also incorporate their lessons learned into revised plans.

3.6.2 Dimensioning Scenarios

The Crisis Committee has recommended six dimensioning scenarios as a basis for the national emergency planning:

1. large airborne release from foreign facility;
2. large airborne release from domestic facility;
3. local event with mobile source;
4. local event that develops over time;
5. release (or rumour of release) to marine environment;
6. serious accident abroad that can affect Norwegian interests, but not territory.

These scenarios have been approved at a ministerial level. The dimensioning scenarios are meant to assist the Crisis Committee in prioritising, meet the needs, and plan for a best possible emergency preparedness. Dimensioning scenarios take into account the consequences to life, health, environment, society, and economy. Communication plans have been developed for each scenario.

3.6.3 Emergency Preparedness and Response and Post-Accident Management (Off-Site)

DSA has conducted an evaluation of its own performance during the event in Fukushima and have taken due note of the findings. The review included a survey among main actors in the media, analysing their interaction with DSA, and the information they received during the crisis. In addition, a survey among the general public was conducted. The conclusions were largely that DSA was able to manage the crisis to the satisfaction of the concerned stakeholders; the media, governmental bodies, and the public.

The results of the stress testing of the Norwegian facilities indicated that there are no real changes in the threat assessment. Major changes in the emergency organisation are thus not necessary.

3.6.4 Severe Accident Management and Recovery (On-Site)

The analysis of the consequences of the most severe accident have also been reviewed, resulting from the loss of coolant with simultaneous loss of several emergency systems. Such an event would lead to release to the environment surrounding the reactor facility. The calculations have so far shown doses to members of the public below the IAEA recommended guidelines for emergency situations. These results were confirmed in the present review.

The plans for emergency preparedness are based on the scenarios described in the safety reports. IFE concludes that there is no need for any major changes as a result of the analysis.

4 Conclusion

Based on the presentation in this report, it is concluded that Norway continue to be in compliance with the obligations of the Convention on Nuclear Safety.

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6 List of Abbreviations

ALARA	As Low As Reasonably Achievable
ASME	American Society of Mechanical Engineers
BAT	Best Available Technique
DSA	Norwegian Radiation and Nuclear Safety Authority
EPR	Emergency Preparedness and Response
EPReSC	Emergency Preparedness and Response Standards Committee
HBWR	Halden Boiling Water Reactor
HERCA	Heads of the European Radiological Protection Competent Authorities
HOD	Ministry of Health and Care Services
IFE	Institute for Energy Technology
INES	International Nuclear Event Scale
INSARR	Integrated Safety Assessment of Research Reactors
IRRS	Integrated Regulatory Review Service
ISCA	Independent Safety Culture Assessment
JEEP	Joint Establishment Experimental Pile
KLD	Ministry of Climate and Environment
KLDRA Himdalen	Combined disposal and storage facility for low and intermediate level waste in Himdalen
MFA	Ministry of Foreign Affairs
MTO	Man, Technology and Organisation
NHN	Norsk Helsenett
NND	Norwegian Nuclear Decommissioning
NORM	Naturally Occuring Radioactive Material
NORMAN	Nordic Manual
NRPA	Norwegian Radiation Protection Authority
NSGC	Nuclear Security Guidance Committee
NSM	Norwegian National Security Authority
NUSSC	Nuclear Safety Standards Committee
OECD	Organisation for Economic Co-operation and Development
OLC	Operational Limits and Conditions
RASSC	Radiation Safety Standards Committee
SAR	Safety Analysis Report
SSC	Systems, structures and components
TPR	Topical Peer Review
TRANSSC	Transport Safety Standards Committee
TSO	Technical Support Organisation
WASSC	Waste Safety Standards Committee
WENRA	Western European Nuclear Regulators Association

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