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

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

Statens strålevern
Norwegian Radiation Protection Authority

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Norwegian Radiation
Protection Authority
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Table of Contents

1	**Introduction**	**5**
1.1	General	5
1.2	Nuclear Activities in Norway	5
1.3	The Institute for Energy Technology	5
1.4	The Regulatory Body	6
1.5	Other Activities in the Nuclear Field	6
2	**Compliance with Articles 4 to 19**	**7**
3	**CONCLUSION**	**15**

A Introduction

A.1 General

This report is issued according to Article 5 of the Convention on Nuclear Safety. Norway signed and ratified the Convention on 20 September 1994.

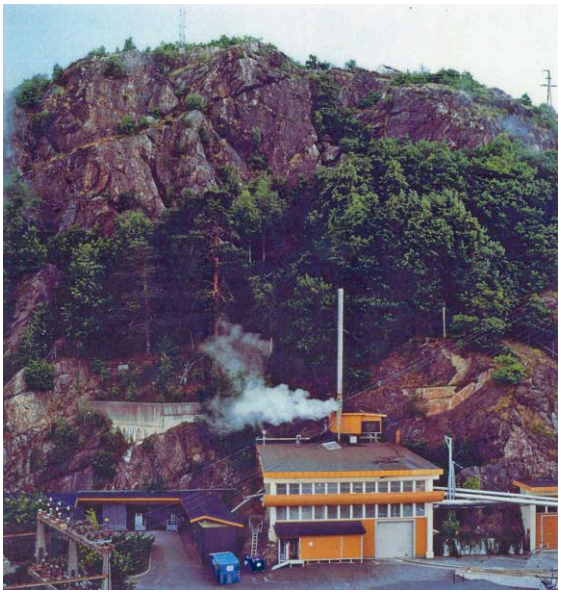
As Norway is not a nuclear state according to the terms of the Convention, this report will give a brief overview over the nuclear research activities in Norway and describe briefly how the different Articles are applied to that activity. Part A of the report provides general information about the situation in Norway and Part B provides the article-by-article approach to show the compliance with the Convention in accordance with the guidelines provided in INFCIRC/572 Rev. 4 Part II.E. *Changes in the situation which have occurred since the fifth report in 2011 are written in italics*. Relevant parts of the report to the 2nd Extraordinary Meeting have been included in the present report.

A.2 Nuclear Activities in Norway

The Norwegian nuclear activities were started in 1948 by the establishment of Institutt for Atomenergi (at present Institute for Energy Technology) at Kjeller north-east of Oslo. The first research reactor JEEP[1] I, reached criticality in July 1951. It was followed by the Halden Boiling Heavy Water Reactor, HBWR, in 1959 (the OECD Halden Reactor Project). The N0RA reactor at Kjeller came into operation in 1961. It was shut down in 1968 and later decommissioned, the same had happened to JEEP I in 1967. JEEP II was built in 1965-66 and reached criticality in December 1966. At present, the JEEP II at Kjeller and the HBWR in Halden are in operation. JEEP II has a thermal capacity of 2 MW. HBWR has a thermal capacity of 25 MW, but it is usually operated at less than 20 MW. Both reactors are owned and operated by the Institute for Energy Technology.

[1] Joint Establishment Experimental Pile

JEEP II at Kjeller (Photo: NRPA).



Halden Boiling Water Reactor (Photo: IFE).

A.3 The Institute for Energy Technology

The Institute for Energy Technology, IFE, is an independent foundation devoted to research in all fields of energy technology. Part of its budget is financed by the Government through the Ministry of Trade and Industry and the rest is from research contracts with industry and other research institutions.

IFE has a total turnover in 2011 of around 760 MNOK (96 M€), of which around 20 % is governmental funding. With this basis, enough financial resources and staff are available for the safe operation of the two research reactors. At present, around 28 persons are employed at JEEP II and around 60 persons at HBWR.

A.4 The Regulatory Body

The regulatory body is the Norwegian Radiation Protection Authority, NRPA. It is organised as a directorate under the Ministry of Health and Care Services and The Ministry of the Environment. It has the responsibility for nuclear safety, for national nuclear and radiological emergency preparedness and response and for radiation protection. It is organised in four departments:

- *Department for Radiation Applications*
- *Department for Nuclear Safety and Environmental Radioactivity*
- *Department for Monitoring and Research*
- Department for Planning and Administration

The departments are further divided into specialised sections. NRPA acts as a directorate under the Ministry of Foreign Affairs in carrying out the plan of action for cooperation with the Russian Federation.

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

A.5 Implications of Extreme Events

After the Fukushima accident, Norway has assessed possible implications of extreme events. The so called "stress tests" were performed by the operator and assessed by NRPA. It is concluded that the safety functions of the Norwegian nuclear facilities are robust enough to withstand severe accident scenarios without unacceptable consequences for the public or the environment.

A.6 Other Activities in the Nuclear Field

IFE is responsible for handling, storage and final disposal of radioactive waste excluding NORM, and for that purpose, the institute also operates the Combined Storage and Repository for Low and Medium Level Radioactive Waste in Himdalen 25 km south-east of Kjeller. The capacity is about 10 000 barrels of waste, and it is expected to be filled around 2030.

The strategy for storage and final disposal of spent nuclear fuel is under development after the first official report on possible strategies issued in December 2001. The main recommendation in this report was to build a storage facility for temporary storage of spent fuel and intermediate level long-lived waste. This has thereafter been assessed by a working group to establish technical specifications for such a storage facility. Two governmental commissions were appointed in 2009, one technical subcommittee to investigate the disposal of spent metallic fuel and one main commission to investigate the siting of the storage facility. The subcommittee presented its results in 2010 recommending reprocessing as the optimum solution. *The main commission presented its findings in 2011, supporting the recommendations made by the subcommittee and pointing to the HBWR site in Halden as the preferred site for an intermediate storage facility*. Further details of the waste management system are reported under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

The Combined Storage and Repository for Low and Medium Level Radioactive Waste in Himdalen Photo: NRPA)

A.7 International Cooperation

In 1995, The Government of Norway issued its first plan of action to enhance safety and reduce the threat to the environment from the nuclear activities in the former Soviet Union, especially in the north-west region of the Russian Federation. The plan has been updated several times, most recently in 2013. The work is funded through the Royal Ministry of Foreign Affairs and NRPA is responsible for

managing the funds. The main objectives of this work are to minimize the risk of accidents and preventing radioactive material of falling into the wrong hands.

After the Chernobyl accident, Norway was affected by considerable fallout from the accident. Our experiences from the remediation efforts over 25 years have been made available to Japan to assist them in their efforts to handle the effects of radioactive releases after the Fukushima accident.

Norway has strongly supported the Action Plan on Nuclear Safety issued by the IAEA Board of Governors in 2011. It is of paramount importance that the existing mechanisms and international conventions remain vital, and Norway will continue its active participation in these forums and will continue to support all actions that are aimed at enhancing nuclear safety worldwide. We see the coming CNS meeting and a possible discussion on how to strengthen the international regimes for nuclear safety through i.e. the Convention on Nuclear Safety as very important in the future work.

NRPA has been engaged in several other projects within nuclear safety, the most prominent one at present is a cooperation project with the Romanian nuclear authority, which is implemented in close cooperation with IAEA. NRPA also takes part in activities under OECD/NEA, WENRA etc.

B Compliance with Articles 4 to 19

Article 4: IMPLEMENTING MEASURES

The measures to fulfil the obligations of the Convention are discussed in this report.

Article 5: REPORTING

The present report constitutes the *sixth* Norwegian report issued in accordance with Article 5.

Article 6: EXISTING NUCLEAR INSTALLATIONS

According to the terms of the Convention, Norway has no nuclear installations. However, there are two research reactors:

1. JEEP II at Kjeller. Heavy water pool reactor with thermal capacity 2 MW.
2. HBWR in Halden. Boiling heavy water reactor with maximum thermal capacity of 25 MW.

Article 7: LEGISLATIVE AND REGULATORY FRAMEWORK

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

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

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

- Regulations 2 November 1984 on the Physical Protection of Nuclear Material and Nuclear Facilities (amended 29 June 2007).

- Regulations 15 November 1985 on Exemption from the Act on Atomic Energy Activity for Small Amounts of Nuclear Material.
- Regulations 12 May 2000 on Possession, Transfer and Transportation of Nuclear Material and Dual-use Equipment.
- Regulations 14 December 2001 on Economical Compensation after Nuclear Accidents.

The regulations 2 November 1984 establish requirements for the physical protection of nuclear material and nuclear facilities. The regulations implement the obligations of the Convention of the Physical Protection of Nuclear Material and Nuclear Facilities as amended 2005.

The regulations 15 November 1985 exempt small amounts of nuclear material from Chapter III of the Act and thus from the liability regime.

The regulations 12 May 2000 regulate the control and accountancy of nuclear material as required in the Additional Protocol to the Safeguards Agreement between Norway and IAEA.

The regulations 14 December 2001 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.

Royal Decree 28 November 2008 on Licence for Operation of Nuclear Installations pursuant to the Atomic Energy Act issued to the Institute for Energy Technology. The licence expires 31 December 2018 except for the licence for HBWR which expires 31 December 2014. The main basis for the licence is the Safety Analysis Reports for the two reactors and the connected auxiliary facilities.

The Radiation Protection Act constitutes the legal basis for regulating the use of ionising and non-ionising radiation, radiation protection requirements, the medical use of radiation, contingency planning, waste management and discharges to the environment. The Act itself establishes the framework which is spelled out in further details by the Regulations on Radiation Protection and Use of Radiation of *29 October 2010.*

The Pollution Control Act regulates the risk of pollution, the authorisation regime for discharges of radioactive substances and the waste treatment regime. The application of this act is stipulated in regulations of which the most relevant one to the Convention on Nuclear Safety 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.

The Royal Decree of 17 February 2006 describes the organisation of the emergency preparedness and response system in Norway. This is further described under Article 16.

Article 8: REGULATORY BODY

Organisation

The regulatory body is the Norwegian Radiation Protection Authority. It is organised as a directorate under the Ministry of Health and Care Services and The Ministry of the Environment. NRPA has the responsibility for nuclear safety, for national nuclear and radiological emergency preparedness and response and for radiation protection. NRPA is organised in four departments:

- *Department for Radiation Applications*
- *Department for Nuclear Safety and Environmental Radioactivity*
- *Department for Monitoring and Research*
- Department for Planning and Administration

The Department for Radiation Applications is responsible for the supervision of industrial and medical use of radiation and radiation protection.

The Department for Nuclear Safety and Environmental Radioactivity acts as the secretariat for the emergency preparedness

organisation against nuclear accidents, ref. article 16. It is also responsible for the supervision of the safety, security and safeguards of the nuclear facilities, regulation of environmental and health consequences of discharges of radioactive substances from nuclear, industrial and medical facilities. The 4 to 5 people mainly engaged in nuclear safety regulation belong to this department.

The Department for Monitoring and Research is responsible for the environmental monitoring and assessment as well as research projects in the same area.

The departments are further divided into specialised sections.

NRPA is mainly funded through the government, i.e. the budget chapters of the Ministry of Health and Social Care and the Ministry of the Environment. Fees are taken from the operator of the nuclear facilities for license hearing and assessment and for inspection activities. However, this constitutes a minor part of the total budget.

By the end of 2012, NRPA had a total staff of 123 persons and a total annual budget of around 140 MNOK (18.5 M€). NRPA acts as a directorate under the Ministry of Foreign Affairs in carrying out the plan of action for cooperation with the Russian Federation. In addition to this, NRPA is funded from other governmental sources for miscellaneous projects.

Licensing activities

Applications for licences and renewals of licences for the operation of nuclear facilities are submitted to the Ministry of Health and Care Services. On behalf of the ministry, NRPA assess the applications. The assessment with recommendations is then sent to the ministry for further hearing and decision. Licence is finally given by the Government. NRPA also carries out regular inspections and audits to ensure that the requirements of a licence are fulfilled.

As a part of the relicensing procedure, an INSARR-mission was organised by IAEA on request from NRPA in June 2007 to HBWR site in Halden. In September 2010, a follow-up mission was organised.

The general conclusion of the INSARR-team was that there are no major safety issues that prevent continued operation of HBWR. The implementation of the recommendations from the INSARR-team is reported under article 10.

The INSARR reports are available to the public at www.nrpa.no.

Inspection activities

Taking a graded approach into account, the inspection regime for two research reactors is far smaller than for power reactors. NRPA is continuously monitoring the operation of the reactor facilities through weekly reporting of the operation, monthly/bimonthly reporting on radiation doses to the staff and annual reports on the operation of all nuclear facilities. The safety of the facilities is supervised by inspections and assessments as deemed necessary between the reporting milestones mentioned under Article 9. Regular meetings between NRPA and IFE to coordinate the inspection activities are conducted on a quarterly basis.

NRPA avails itself of the possibility to engage external consultants when reviewing the safety of the reactor facilities and other aspects of the activities on the two sites. In line with this, an IPPAS-mission organised by IAEA was carried out in September/October 2003 and an INSARR-mission was carried out in 2007 with a follow-up in 2010.

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

Training and external cooperation

On the job training is used extensively together with different kinds of seminars. The Nordic Committee for Nuclear Safety Research has in this respect for a long time been a part of the portfolio of NRPA, for the recent time mostly for emergency preparedness.

NRPA is also engaged in bilateral cooperation with the French authority, ASN.

Staff from NRPA regularly takes part in training courses and seminars to enhance its competence.

Article 9: RESPONSIBILITY OF THE LICENCE HOLDER

The Institute for Energy Technology is the licence holder for the two research reactors and for the operation of the waste repository. It is their responsibility to keep the safety as high as possible and in accordance with the licence requirements and appropriate international standards and to provide the necessary financial and human resources needed for keeping the safety at an appropriate level.

A Safety Analysis Report, SAR, of the facilities is the basis for the license application. The SAR follow the recommendations given in IAEA Safety Standards Series NS-R-4 and IAEA Safety Series No. 35-G-1 and covers *inter alia* a description of the facilities (including OLCs and safety systems), radiation protection work, emergency preparedness, management system, administrative rules and organization.

As all licences are reviewed at least every ten years, this means a more or less continuous revision of the SAR. This updating is an important requirement in the licence. The experimental programmes have to be kept within the safety requirements of the licence and the SAR. If new experiments outside this framework are to be carried out, IFE must apply for appropriate changes in the license conditions.

As a license requirement, a status report on the safety of the installations is to be issued annually. This report is issued to confirm that the safety of the facilities still conforms to the requirements set up in the licence documents which are based on the Safety Analysis Reports for the facilities. Verification by analysis, surveillance, testing and inspection is also a part of the licensing process. This type of verifications also constitutes a part of the preparation of the reactors before every start up for a new experimental cycle.

For HBWR, the ageing management is primarily related to the reactor pressure vessel and the primary system. A material surveillance program was established in 1958 and samples of the original vessel have been irradiated since then to be able to predict the behaviour of the reactor tank. In addition, a Service Inspection Programme is established and implemented in accordance with the applicable ASME[2] Code. External experts are consulted for independent investigation and assessment of the condition of the reactor pressure vessel. Although most other parts have been changed since the construction of the reactor, the ageing management system extends to these parts of the facility as well. The management system is supervised by the Directorate for Civil Protection and Emergency Planning in addition to supervision by the NRPA.

Article 10: PRIORITY TO SAFETY

IFE invests considerable resources in safety and by this shows that the safety has a high priority, both for the reactor safety and for the radiation protection of the staff. Long shut down periods to prepare for experimental work gives room for improvements of the safety as well. The main tool for keeping the doses to the staff as low as reasonably achievable has been intensive monitoring and planning of the work.

The research projects run at the HBWR are all aimed at enhancing the nuclear safety at civilian nuclear facilities worldwide. In addition to the OECD NEA Halden Reactor Project which has run since 1959, there are numerous bilateral projects which aim at better understanding of fuel and reactor materials behaviour at high burn-up.

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

IFE has established a comprehensive system for quality management of health, safety and environment including the research reactors and the waste repository. This management system takes care of all aspects of operating a nuclear facility as well as the general labour safety issues.

The management system is supervised and audited by NRPA, as well as other safety authorities being responsible for the non-nuclear part of the activity at the Institute. Audits of the management system are also

[2] American Society of Mechanical Engineers

performed by customers as a part of commercial research contracts.

Recommendations from the INSARR-team

The INSARR-team concluded with a list of recommendations to the HBWR, the most serious was a need to perform a new comprehensive fire analysis and to implement improvements in the fire protective measures. From the fifth review meeting, implementation of these recommendations was noted as challenges.

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 has been kept to a high standard by an increased awareness of the subject.

The improvement of the radiation protection zoning has taken much time as the limited space in the entrance tunnel required considerable rearrangement of equipment to accommodate an acceptable solution for the barriers and changing rooms between the radiation protection zones.

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 kept below the ICRP limits as set out in their Publications 103. IFE is, as a nuclear operator, responsible for its own dose registration system.

IFE measures individual whole-body dose, skin dose, finger dose and internal dose. The whole-body dose for the last 12 months is reported monthly for each worker, while the other dose measurements are reported annually to NRPA. NRPA is currently planning to establish a national dose register.

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 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 discharge authorisation, 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. Operational release limits in Becquerel are set according to this, and the real releases are a fraction of the limits. *A new regime is under way, where dose limits are replaced by release limits in Becquerel.*

Article 16: EMERGENCY PREPAREDNESS

A: The National System

General

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 17 February 2006, 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 (NRPA);
- the regional emergency organisations.

The Royal Decree is under amendment.

The main suggestion for an amendment is an inclusion of the Royal Ministry of Foreign Affairs and the Norwegian Coastal Administration in the Crisis Committee.

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 remedial actions to the Crisis Committee.

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 head the Committee.

The Crisis Committee

The Crisis Committee is made up of representatives from the following institutions:

- the Norwegian Radiation Protection Authority;
- the National Police Directorate;
- the Norwegian Defence Staff;
- the Directorate for Civil Protection and Emergency Planning;
- the Directorate for Health and Social Affairs and
- the Norwegian Food Safety Authority.

The Crisis Committee is responsible for implementing remedial 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;
- provide shelter, administer stable iodine, block and secure contaminated areas;
- in the short term restrict production and distribution of foodstuffs;
- advise on dairy products and other dose-reducing actions.

NRPA heads the Crisis Committee. Whenever possible, the Crisis Committee must consult with the ministries before deciding on actions.

Emergency Levels

The Crisis Committee operates with two emergency levels: "information preparedness" and "high preparedness". These apply both to accidents both domestic and abroad. Information preparedness is declared when a situation of significance occurs, which might develop in severity. High preparedness is declared when there is a risk of radiological consequences.

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)

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 and economic consequences of a nuclear accident affecting Norway, or Norwegian interests.

The Secretariat for the Crisis Committee

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

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 continuously liaise with the Crisis Committee.

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,

the NRPA has access to the data. A mobile monitoring unit is also available. The data acquired is directly available to the competent authority, the emergency response organisation, and the public via radnett.nrpa.no.

In addition, Norway has 5 high volume air samplers, where 4 have alarm capabilities with GM-counters on top of the filters.

The Nordic countries have established an agreement that makes all the data from the national automatic gamma monitoring networks directly available to each other. Similar agreements are in place with the rest of the Baltic Sea countries.

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.

B: 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 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.

Exercises

The NRPA 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 level. In 2013, the NRPA participated in a Nordic-Baltic exercise (NB8). The NRPA participates in regular exercises among the Nordic countries: i.e. the REFOX exercise in Sweden in September 2012. The NRPA also participates in most of the IAEA Convex exercises when arranged. These exercises are valuable training opportunities for the NRPA staff and the CCNP.

Norwegian emergency response arrangements are exercised on the national, regional, and local levels. Relevant scenarios include: satellite crash, nuclear submarine accidents, nuclear ice-breaker accidents, transport accidents, dirty bombs, etc. Orphan sources are found every now and then, helping maintaining a high awareness of such incidents. There is no predefined regularity in these exercises.

IFE has adapted emergency plans for each site, and exercises these regularly.

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

NRPA has conducted an evaluation of its own performance during the event in Fukushima and will take due note of the findings. The review includes a survey among main actors in the media, analysing their interaction with the NRPA, and the information they received during the crisis. In addition, a survey among the general public was conducted. The conclusions were largely that the NRPA 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 show that there are no real changes in the threat assessment. Major changes in the emergency organisation are thus not necessary. However, the lessons learned from the crisis will be taken into account in the future work to enhance the effectiveness of the emergency organisation.

C: Severe Accident Management and Recovery (On-Site)

The analysis of the consequences of the most severe accident have also been reviewed; the loss of coolant with simultaneous loss of several emergency systems. Such an event will

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.

However, the review identified that in a complete blackout situation the communication relying on electronic means, e.g. phone, fax, and e-mail, would become unavailable. This includes difficulties in getting reactor status in the case of an emergency. IFE will further assess such a situation, and will consider holding exercises without the use of the normal electronic communication infrastructure. A need to review the type, number and location of equipment for such emergency situations was also identified.

The NRPA has taken note of the information given by IFE, and awaits the final results.

Article 17: SITING

Construction of nuclear power plants or new research reactor is not planned in the foreseeable future. However, in the light of the Fukushima accident, assessments relevant to the sites have been made:

In accordance with IAEA Safety Standards Series No. NS-R-4 "Safety of research Reactors" Appendix 1, a number of postulated initiating external events had been analysed and documented in the Safety Analysis Reports of the IFE facilities. This was a requirement in the licensing process. The safety analysis performed by IFE has been based on very conservative assumptions and the safety margins were rather large. IFE has made a review of these analyses after the Fukushima accident, and has concluded that the analysis and the conclusions drawn are still valid.

NRPA has assessed the findings made by the operator and accepted the conclusion that these are valid.

Article 18: DESIGN AND CONSTRUCTION

All IFE's nuclear facilities were subject of the stress tests, but it was only identified need for measures at HBWR due to extreme events.

IFE found following accident scenarios most challenging for its facilities:

1. Complete station blackout when reactor running with full power
2. Design based accident with complete station blackout
3. Beyond design based accident with complete station blackout

Additionally, stress tests for the spent fuel pits have been conducted. No account for the initiation of a scenario has been considered in the analyses. Starting point of all the analyses is taken as the loss of external power supply, extending it to uninterrupted power supplies / batteries.

In a scenario when operating at full power, experiencing a blackout and loss of all safety systems, the analysis identified the need of forced cooling of some test fuel elements. As a part of the experimental program, these elements are equipped with a system for forced cooling of the fuel, a system that would malfunction in a blackout situation. This could lead to overheating of the fuel. A new system of additional cooling by natural convection in an emergency situation has thus been installed for these fuel elements during spring 2012.

After use in the HBWR reactor, the fuel is stored in fuel pits in the reactor hall. The pipe inlets and outlets are at the top of the pits, and thus a pipe break will not result in leakage of water. If a blackout occurs with a full core loading in the fuel pit, the calculations show that the fuel may be completely uncovered within 7.5 hours. However, the heat generation from the fuel normally stored in the pit is about 30% of a full core loading of spent fuel. The calculations show that the cladding temperature will not be high enough to cause hydrogen production. As an extra precautionary measure, an additional water supply was installed in the first half of 2012.

NRPA has assessed the analysis and proposed actions done by the operator and accepted them. NRPA will follow up planned measures during inspections.

Article 19: OPERATION

The operation of the two research reactors is limited to the time needed for performance of the research activities.

All experience gained from the regular operation and from incidents is fed back into the operation regime and relevant information from this is contained in the Safety Analysis Reports which form the basis for the licensing of the reactors. IFE updates the management system based on operational experience both regularly and as feed-back from incidents. This updating is closely supervised by NRPA.

IFE participates in international forums like European Atomic Energy Society where operating experiences from research reactors are exchanged. Norway also participates in the Incident Reporting System for Research Reactors, IRSRR.

CONCLUSION

Based on the above reporting under the applicable articles for a party having no nuclear installations on their territory, we conclude that Norway is in compliance with its obligations according to the Convention on Nuclear Safety.