STUK

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COMPLIANCE WITH THE OBLIGATIONS OF THE CONVENTION ON NUCLEAR SAFETY

Finnish national report as referred to in Article 5 of the Convention on Nuclear Safety

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RADIATION AND NUCLEAR SAFETY AUTHORITY

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EXECUTIVE SUMMARY

Finland signed on 20 September 1994 the Convention on Nuclear Safety which was adopted on 17 June 1994 in the Vienna Diplomatic Conference. The Convention was ratified on 5 January 1996, and it came into force in Finland on 24 October 1996.

There are two nuclear power plants in Finland: the Loviisa and Olkiluoto plants. The Loviisa plant includes two VVER units, operated by Imatran Voima Oy, and the Olkiluoto plant two BWR units, operated by Teollisuuden Voima Oy. The Loviisa units were connected to the electrical network in 1977 (unit 1) and 1980 (unit 2) and the Olkiluoto units 1 and 2 in 1978 and 1980, respectively. The nominal reactor thermal power of the Loviisa units is 1500 MW and of the Olkiluoto units 2500 MW. At both sites there are interim storages for spent fuel as well as for medium and low level radioactive wastes.

Finland observes the principles of the Convention, when applicable, also in other uses of nuclear energy than nuclear power plants, e.g. research reactors and facilities for nuclear waste. In Finland, such facilities are the TRIGA Mark II research reactor (250 kW) in Espoo and the final disposal facilities for low and medium level radioactive waste at the Olkiluoto and Loviisa plant sites. The TRIGA Mark II reactor was taken into operation in 1962, and the disposal facility at Olkiluoto in 1992 and at Loviisa in 1998.

In this report, the implementation of each of the Articles 4 and 6 to 19 of the Convention is separately evaluated. Based on the evaluation it can be concluded that

- the Finnish nuclear and radiation regulations fulfil the obligations of the Convention
- the Finnish regulatory infrastructure is in compliance with the Convention obligations
- the regulatory and licensee practices comply with the Convention obligations
- there are issues requiring further measures to enhance safety; main issues are discussed in the report.

In conclusion, Finland has implemented the obligations of the Convention and also the objectives of the Convention are complied with.

CONTENTS

Annexes 2–11 are not included in this report STUK-B-YTO 177; they are however provided together with the Finnish national report.

1 INTRODUCTION

Finland signed on 20 September 1994 the Convention on Nuclear Safety which was adopted on 17 June 1994 in the Vienna Diplomatic Conference. The Convention was ratified on 5 January 1996, and it came into force in Finland on 24 October 1996.

The fulfilment of the obligations of the Convention is evaluated in this report. The evaluation is mainly based on the Finnish legislation and other regulations as well as on the safety assessments of Finnish nuclear power plants.

Main regulations in the field of nuclear energy are the Nuclear Energy Act and Decree, the Radiation Act and Decree, and the Decisions of the Council of State as well as the Regulatory Guides (YVL Guides) issued by the Radiation and Nuclear Safety Authority (STUK).

The Finnish nuclear energy legislation is modern and comprehensive. One of the general principles of the Nuclear Energy Act requires that the use of nuclear energy must be safe; it shall not cause injury to people, or damage to the environment or property. The Act also provides that the use of nuclear energy, taking into account its various effects, shall be in line with the overall good of the society. According to the safety regulations, the level of safety must continuously be maintained as high as reasonably achievable. The most essential safety regulations are listed in Annex 1.

Finland is a member state of the European Union. The regulations of the Union are in force in Finland. When necessary, the Finnish regulations are modified to take into account the EU regulations. The EU regulations relate e.g. to radiation protection, but there are no regulations pertaining directly to nuclear safety.

In Finland, there are two nuclear power plants: the Loviisa and Olkiluoto plants. The Loviisa plant includes two VVER units, operated by Imatran Voima Oy, and the Olkiluoto plant two BWR units, operated by Teollisuuden Voima Oy.

The nominal thermal power of both of the Loviisa units is 1500 MW (109% as compared to the original 1375 MW). The increase of the power level was licensed in April 1998. The Operating Licences of the units are valid until the end of 2007.

The nominal thermal power of both of the Olkiluoto units is 2500 MW, which was licensed in August 1998. The new power level is 115,7% as compared to the earlier nominal power 2160 MW licensed in 1983. The original power levels of the units were 2000 MW. The Operating Licences of the units are valid until the end of 2018. According to the conditions of the licenses, the licensee shall carry out an intermediate safety assessment by the end of 2008. This assessment will be reviewed by STUK.

The Loviisa and Olkiluoto nuclear power plant units were connected to the electrical network as follows:

- Loviisa 1 8.2.1977
- Loviisa 2 4.11.1980
- TVO I 2.9.1978
- TVO II 18.2.1980.

In Annexes 2 and 3 technical information on the facilities is given. At both sites there are fresh and spent fuel storage facilities, and facilities for storage and treatment of low and medium level radioactive wastes.

In the Vienna Diplomatic Conference in 1994 Finland informed that it observes the principles of the Convention, when applicable, also in other uses of nuclear energy than nuclear power plants, e.g. research reactors and facilities for nuclear wastes. In Finland, such facilities are the TRIGA Mark II

research reactor (250 kW) in Espoo and the final disposal facilities for low and medium level radioactive waste at the Olkiluoto and Loviisa plant sites. The TRIGA Mark II reactor was taken into operation in 1962, and the disposal facility at Olkiluoto in 1992 and at Loviisa in 1998.

Spent fuel from the Olkiluoto plant has been stored in the intermediate storage facility at the plant site. At the Loviisa plant, spent fuel has been stored in the storages of the plant for some years, after which spent fuel was transported back to Russia. Due to the changes of the Nuclear Energy Act in 1994, spent fuel generated in Finland has to be treated, stored and disposed of in Finland. Accordingly, spent fuel shipments to Russia were terminated at the end of 1996, and additional spent fuel storage capacity is being constructed at the Loviisa site by Imatran Voima Oy. For taking care of the spent fuel final disposal, a joint company Posiva Oy has been established by Imatran Voima Oy and Teollisuuden Voima Oy. As regards the final disposal of spent fuel, the decision of the Ministry of Trade and Industry in 1991 requires that by the end of 2000 such a disposal site has been selected where a disposal facility can be constructed, if needed.

The attached booklet Nuclear Energy in Finland, Annex 4, provides an overview on the use of nuclear energy in Finland. In the use of nuclear energy, international co-operation is of high importance, and the Finnish regulatory authorities, nuclear power utilities and research institutes have actively seeked for connections with foreign organisations. In this respect, especially the functions of the IAEA and OECD/NEA are essential.

In Chapter 2 of this report, the implementation of each of the Articles 4 and 6 to 19 of the Convention is separately evaluated. At the end of Chapter 2, a concluding summary on the fulfilment of the obligations of the Convention is presented. Main issues requiring further measures to enhance safety are discussed in Chapter 3.

2 COMPLIANCE WITH ARTICLES 4 AND 6 TO 19

2.1 Article-by-article review

Article 4. Implementing measures

Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

The legislative, regulatory and other measures to fulfil the obligations of the Convention are discussed in this report.

Article 6. Existing nuclear installations

Each Contracting Party shall take the appropriate steps to ensure that the safety of nuclear installations existing at the time the Convention enters into force for that Contracting Party is reviewed as soon as possible. When necessary in the context of this Convention, the Contracting Party shall ensure that all reasonably practicable improvements are made as a matter of urgency to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shut-down may take into account the whole energy context and possible alternatives as well as the social, environmental and economic impact.

The latest comprehensive safety assessments of the Loviisa and Olkiluoto nuclear power plants were carried out in connection with re-licensing of the operation of the plants. The current Operating Licences of the Loviisa units were issued in April 1998. The licences are valid until the end of 2007. The Operating Licences of the Olkiluoto units were issued in August 1998, and they are valid until the end of 2018. According to the conditions of the Operating Licenses of the Olkiluoto units, the licensee shall carry out an intermediate safety assessment by the end of 2008. This assessment will be reviewed by STUK. The licensed nominal thermal power of the Loviisa units is 1500 MW and of the Olkiluoto units 2500 MW.

The license applications for the new licences included the documents required by Section 34 of the Nuclear Energy Decree. E.g. the following documents were updated:

- Final Safety Analysis Reports
- Probabilistic Safety Analysis Reports, including Level 1 and 2 PSA analyses
- Quality Assurance Programmes for Operation
- Technical Specifications
- Programmes for Periodic Inspections
- Plans for Physical Security and Emergency Preparedness
- Manuals for Accounting and Control of Nuclear Materials
- Administrative Rules for the Facilities
- Programmes for Radiation Monitoring in the Environment of the Facilities
- Licensee assessments of how the regulations have been complied with, including the fulfilment of YVL Guides
- Licensee assessments of how an adequate safety level has been maintained
- Plans for Radioactive Waste Management.

The overall safety review of the Loviisa and Olkiluoto plants was carried out by STUK in 1997–1998. The safety documentation, including safety assessments done by both licensees, was submitted to STUK at the end of 1996. In the safety documentation for the Loviisa units the uprated

nominal thermal power 1500 MW was taken into account. This is 109% as compared to the original power 1375 MW. As regards the Olkiluoto units, the safety documentation was based on the uprated nominal thermal power 2500 MW, which is 115,7% as compared to the earlier power 2160 MW. The original power of the Olkiluoto units was 2000 MW.

In addition to the review of the above mentioned documents, STUK also made independent safety assessments and several topical inspections to the facilities, in addition to the regular inspection programme. The statements of STUK were given to the Ministry of Trade and Industry in March 1998 and in June 1998, respectively. As regards radiation and nuclear safety, the main conclusions in the statements were that the conditions of the Finnish nuclear energy legislation are complied with.

The safety, security and emergency response arrangements of the Loviisa and Olkiluoto plants were assessed by STUK based on the Decisions of the Council of State 395/1991, 396/1991 and 397/1991 (see Article 7). The results of the safety review are discussed in Annexes 5 and 6. As a conclusion, the safety, security and emergency response arrangements of the Loviisa and Olkiluoto plants are in compliance with Decisions 395/1991, 396/1991 and 397/1991. During the review many issues for further enhancing safety were identified. The most essential of them are discussed in Chapter 3 of this report. As regards the Loviisa power plant, it was noted that Sections 11 (Limit for a postulated accident), 12 (Limit for a severe accident), 17 (Ensuring containment building integrity) and 18 (Ensuring safety functions) of 395/1991 are not completely fulfilled (see Annex 5). However, taking into account Section 28 of Decision 395/1991 and the plant modifications for enhancing safety to be implemented in the near future, it can be stated that the Loviisa plant is in compliance with Decision 395/1991.

In addition to the comprehensive safety review related to the licensing of the operation of the Loviisa and Olkiluoto plants, ongoing inspection and safety assessment programmes are carried out by STUK to ensure that the required safety level is maintained and enhanced when necessary. Decision 395/1991 provides that for further safety enhancement, actions shall be taken which can be regarded as justified considering operating experience and the results of safety research as well as the advancement of science and technology.

International OSART (Operational Safety Review Team) missions have visited both of the Finnish nuclear power plants, Olkiluoto in March 1986 and Loviisa in November 1990.

Based on Decision 398/1991 (see Article 7), the safety of the Olkiluoto disposal facility for low and medium level radioactive waste was assessed by STUK in 1991, and the facility was taken in operation in 1992. A similar safety assessment was carried out for the Loviisa disposal facility in 1997–1998. The first stage of the Loviisa disposal facility was taken in operation in 1998. According to the licence conditions, the safety of the Olkiluoto disposal facility has to be reassessed by the licensee by the end of 2006, and the safety of the Loviisa facility by the end of 2013.

TRIGA Mark II is the only research reactor in Finland. Its current operating licence was issued in December 1989, and it is valid until the end of 1999. STUK reviewed the safety of the reactor based on the licence application, and gave its statement to the Ministry of Trade and Industry in October 1989. Under the terms of reference of INFCIRC/18/Rev.1, an IAEA team last visited Finland in November 1987 for evaluating nuclear safety and radiation protection at the TRIGA Mark II reactor.

It is concluded in this report that Finnish regulations and practices are in compliance with the obligations of the Convention, and the safety review required by Article 6 has already been carried out. Safety improvements have been annually implemented at the Loviisa and Olkiluoto plants since their commissioning. There exists no urgent need for additional improvements to upgrade the safety of these plants in the context of the Convention. However, there are many identified issues for enhancing safety. These issues are mentioned under the relevant Articles, and they are discussed in Chapter 3 of this report.

Article 7. Legislative and regulatory framework

1. Each Contracting Party shall establish and maintain a legislative and regulatory frame-

work to govern the safety of nuclear installations.

2. The legislative and regulatory framework shall provide for:

(i) the establishment of applicable national safety requirements and regulations;

(ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence;

(iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;

(iv) the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.

In Finland, the legislation for the use of nuclear energy and for radiation protection was established in 1957. Since that several amendments and new regulations have been issued.

In 1988 a completely revised Nuclear Energy Act was issued, together with a supporting Nuclear Energy Decree. The scope of this legislation covers e.g.

- the construction and operation of nuclear facilities; nuclear facilities refer to facilities for producing nuclear energy, including research reactors, facilities for extensive disposal of nuclear wastes, and facilities used for extensive fabrication, production, use, handling or storage of nuclear materials or nuclear wastes
- the possession, fabrication, production, transfer, handling, use, storage, transport, export and import of nuclear materials and nuclear wastes as well as the export and import of ores and ore concentrates containing uranium or thorium.

The Radiation Act and Decree were revised in 1991, taking into account the ICRP Publication 60 (1990 Recommendations of the International Commission on Radiological Protection). Section 2, General principles, and Chapter 9, Radiation work, of the Act are applied to the use of nuclear energy.

Based on the Nuclear Energy Act, the Council of State issued in 1991 the following decisions:

- Decision of the Council of State on the General Regulations for the Safety of Nuclear Power Plants (395/1991)
- Decision of the Council of State on the General Regulations for Physical Protection of Nuclear Power Plants (396/1991)
- Decision of the Council of State on the General Regulations for Emergency Response Arrangements at Nuclear Power Plants (397/1991)
- Decision of the Council of State on the General Regulations for the Safety of a Disposal Facility for Reactor Waste (398/1991).

The general regulations 395/1991, 396/1991 and 397/1991 are applied to a nuclear power plant which is defined to be a nuclear facility equipped with a nuclear reactor and intended for electricity generation, or if such or other nuclear facilities have been placed on the same site, the entity of facilities formed by them. The general regulations are also applied to other nuclear facilities to the extent applicable.

The regulations mentioned above are attached to this document, Annex 7.

Detailed safety requirements are provided in YVL Guides. YVL Guides also provide administrative procedures for regulation of the use of nuclear energy. YVL Guides are issued by STUK, as stipulated in the Nuclear Energy Act. YVL Guides are rules an individual licensee or any other organisations concerned shall comply with, unless some other acceptable procedure or solution has been presented to STUK by which the safety level laid down in an YVL Guide is achieved. Taking into account Sections 27 and 28 of Decision 395/1991, STUK may decide that some new requirements are not applied to a nuclear power plant unit already in use.

The licensing process is defined in the legislation. The construction and operation of a nuclear facility is not allowed without a licence. The licences are granted by the Council of State. The conditions for granting a license are prescribed in the Nuclear Energy Act. The Operating Licences are granted for a limited period of time. This period has been about ten years. The periodic relicensing has allowed good opportunities for a comprehensive, periodic safety review. The new operating licenses of the Olkiluoto units are valid for a longer period, but an intermediate safety

assessment is required as a condition of the licenses.

Before a Construction Licence for a nuclear power plant, a nuclear waste disposal facility, or other significant nuclear facility can be applied, a Decision in Principle by the Council of State is needed. A condition for granting the Decision in Principle is that the operation of the facility in question is in line with the overall good for society. Further conditions are as follows:

- the municipality of the intended site of the nuclear facility is in favour of constructing the facility
- no factors indicate a lack of sufficient prerequisites for constructing the facility according to Section 6 of the Nuclear Energy Act. Section 6 provides that the use of nuclear energy shall be safe; it shall not cause injury to people, or damage to the environment or property.

The coming into force of the Decision in Principle further requires that it will be confirmed by the simple majority of the Parliament. The Parliament can not make any changes to the Decision, it can only approve it or to reject it as it is. The licensing process is described in Figure 1.

The legislation also provides the regulatory control system for the use of nuclear energy. According to Section 55 of the Nuclear Energy Act, STUK is responsible for the regulatory control of the safety of the use of nuclear energy (see Article 8). The rights and responsibilities of STUK are provided in the Nuclear Energy Act. Safety review and assessment as well as inspection activities are covered by the regulatory control.

Furthermore, the Nuclear Energy Act defines the enforcement system and rules for suspension, modification or revocation of a licence. The enforcement system includes provisions for executive assistance if needed and for sanctions in case the law is violated.

In conclusion, Finnish regulations and practices are in compliance with Article 7.

Article 8. Regulatory body

1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.

2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.

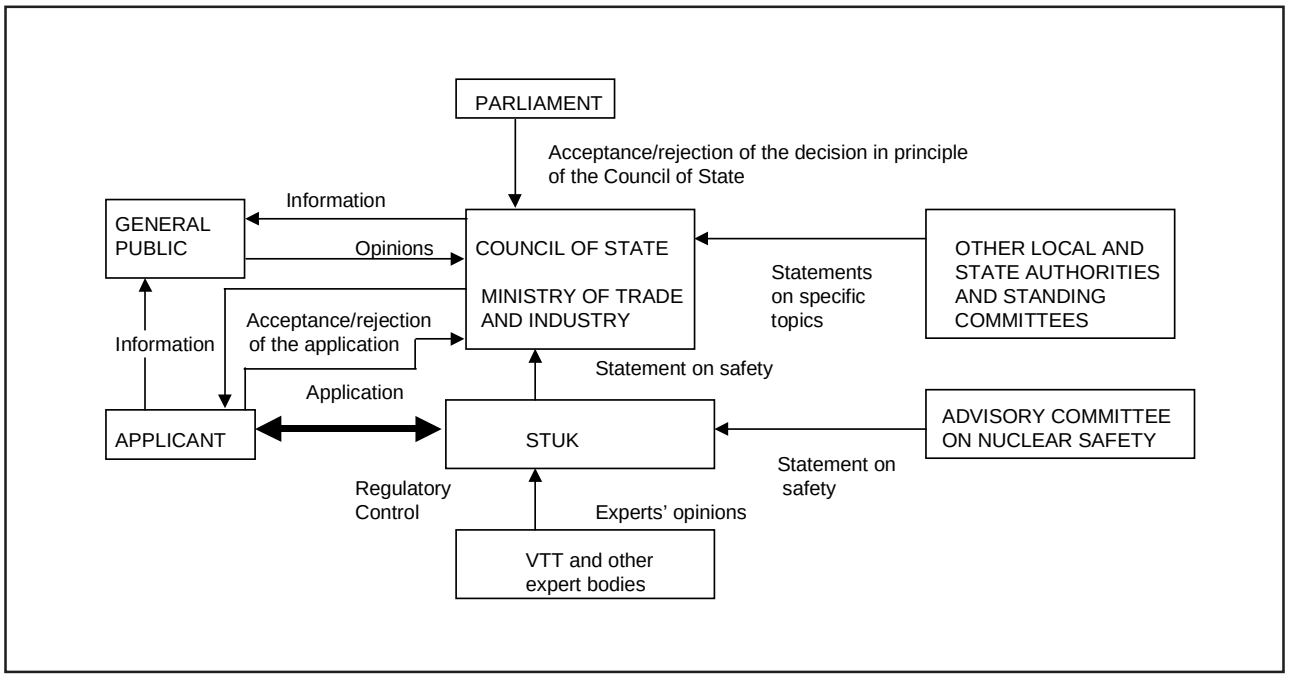

Figure 1. *Licensing of nuclear power plants in Finland.*

According to Section 54 of the Nuclear Energy Act, the overall authority in the field of nuclear energy is the responsibility of the Ministry of Trade and Industry. The Ministry prepares matters concerning nuclear energy to the Council of State for decision-making and, to some extent, grants import and export licences for nuclear equipment and materials. Among other duties, the Ministry of Trade and Industry is responsible for the formulation of a national energy policy.

STUK is an independent governmental organisation for the regulatory control of radiation and nuclear safety. The current Act on STUK was given in 1983. According to the Decree on STUK, STUK has the following duties:

- regulatory control of safety of the use of nuclear energy, emergency preparedness, physical security and nuclear materials
- regulatory control of the use of radiation and other radiation practices
- monitoring of the radiation situation in Finland, and maintaining of preparedness for abnormal radiation situations
- maintaining of national metrological standards in the field
- research and development work for enhancing radiation and nuclear safety
- informing on radiation and nuclear safety issues, and participating in training activities in the field
- producing expert services in the field
- making proposals for developing the legislation in the field, and issuing general guides concerning radiation and nuclear safety
- participating in international co-operation in the field, and taking care of international control, contact or reporting activities as enacted or defined.

STUK is administratively under the Ministry of Social Affairs and Health. Connections to ministries and governmental organisations are described in Figure 2.

It is emphasised that the regulatory control of the safe use of nuclear energy is independently carried out by STUK. STUK has no responsibilities or duties which would be in conflict with regulatory control.

The responsibilities and rights of STUK, as regards the regulation of the use of nuclear energy, are provided in Sections 55 and 63 of the Nuclear Energy Act. They cover the safety review and assessment of licence applications, and the regulatory control of the construction and operation of a nuclear facility. The regulatory control of nuclear power plants is described in detail in Guide YVL 1.1 *The Finnish Centre for Radiation and Nuclear Safety as the Regulatory Authority for the Use of Nuclear Energy.*

STUK does not grant any construction or operating licences for nuclear facilities (see Article 7). However, in practice no such licence would be issued without STUK's statement where the fulfilment of the safety regulations is confirmed.

STUK has the legal authority to carry out regulatory control. STUK has e.g. legal rights to require modifications to nuclear power plants, to limit the power of plants and to require shutdown of plants when necessary for safety reasons.

STUK has adequate resources to fulfil its responsibilities. The staff of STUK is rather large in comparison with regulatory bodies in many other countries. About 70 professionals are working in the field of nuclear energy. The expertise of STUK covers all the essential areas needed in the safety control of the use of nuclear energy.

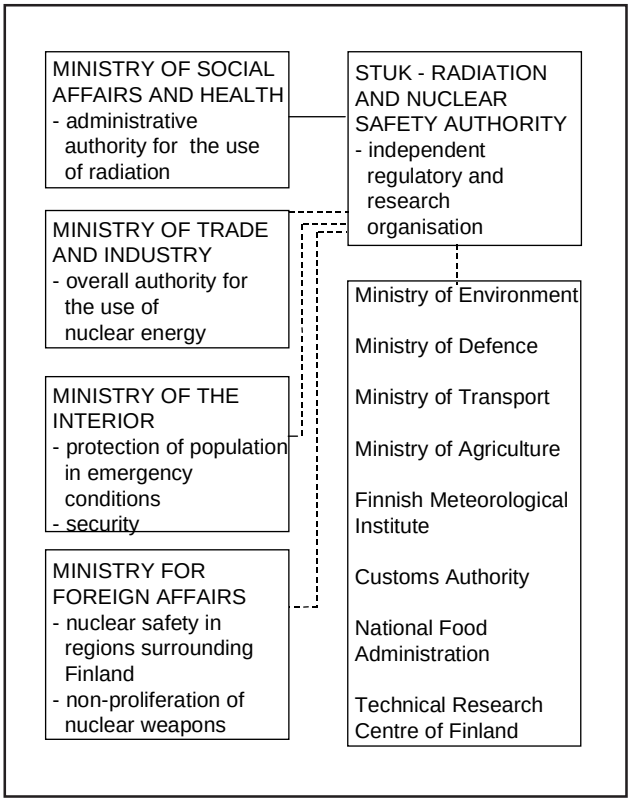

Figure 2. *Co-operation between STUK and Ministries and other governmental organisations.*

All of the professional staff of STUK conducting safety assessments and inspections have a degree of university level. A training programme has been established for the staff of STUK. STUK also has close connections with foreign regulatory bodies for exchanging information on important safety issues. The average experience of the staff is about 14 years in the nuclear field.

The organisational structure and the responsibilities within STUK are provided in the Quality Manuals of STUK. Also procedures for regulatory control and other activities of STUK are presented in the Manuals. The organisation of STUK is described in the Figure 3.

STUK receives the main part of its financial resources through the government budget. The costs of regulatory control are charged in full to the licensees, but they are re-imbursed to the government. This means in practice that STUK is not financially dependent on licensee solvency.

An Advisory Committee on Nuclear Safety has been established by a decree. This Committee gives advice to STUK on important safety issues and regulations. In addition, an Advisory Committee on Radiation Safety has been established for advising the Ministry for Health and Social Affairs. The members of these Committees are nominated by the Council of State.

The main technical support organisation of STUK is the Technical Research Centre of Finland (VTT). In VTT, about 150 experts are working in the field of nuclear energy.

There are also research programmes related to the safety of nuclear power plants and waste management. These programmes are mainly financed by the Ministry of Trade and Industry and STUK. Research programmes are described in Annex 8. In addition to these programmes, STUK finances research projects supporting more directly regulatory control activities.

The annual report on the regulatory control of nuclear safety for 1997 is attached to this document, Annex 9. In the report also the financial resources of STUK are discussed. In 1997, the expenditures of the regulatory control of nuclear safety were about 31,5 MFIM.

In conclusion, Finnish regulations and practices are in compliance with Article 8.

Article 9. Responsibility of the licence holder

Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

According to Section 9 of the Nuclear Energy Act, each licensee is responsible for the safety of his use of nuclear energy. Furthermore, the licensee is responsible for such physical protection and emergency preparedness arrangements and other necessary arrangements for limitation of nuclear da-

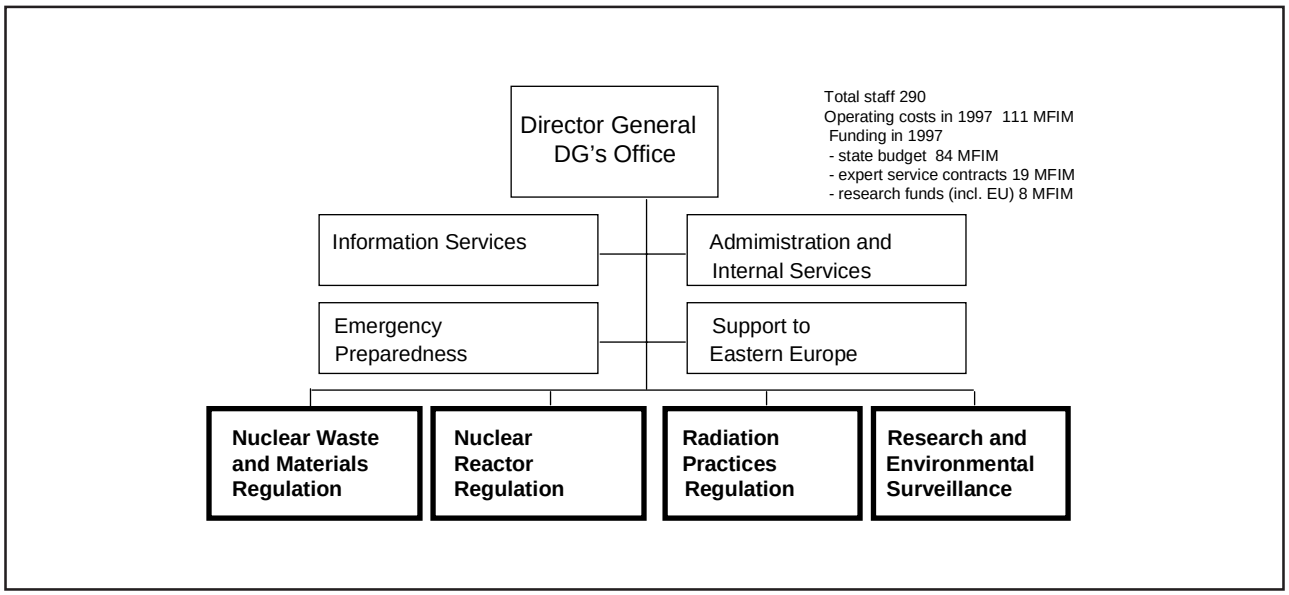

Figure 3. *Organisation of STUK.*

mages, which do not belong to the authorities. The licensee, whose operations generate or has generated nuclear waste, is responsible for all nuclear waste management measures and their appropriate preparation. The licensee is furthermore responsible for depositing in advance for the costs of nuclear waste management in a special nuclear waste fund being operated under the Ministry of Trade and Industry.

It is the responsibility of the regulatory body to verify that the licensees fulfil the regulations. This verification is carried out through safety review and assessment as well as inspection programmes established by STUK.

In conclusion, Finnish regulations and practices are in compliance with Article 9.

Article 10. Priority to safety

Each Contracting Party shall take the appropriate steps to ensure that all organizations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety.

Safety is emphasised in the general principles of the Nuclear Energy Act. According to Section 6 the use of nuclear energy shall be safe; it shall not cause injury to people, or damage to the environment or property.

Section 4 of Decision 395/1991 provides that, an advanced safety culture shall be maintained when designing, constructing and operating a nuclear power plant. It shall be based on the safety emphasising attitude of the management of the organisation in question, and on motivation of the personnel for responsible work. This presupposes well organised working conditions and an open working atmosphere as well as the encouragement of alertness and initiative in order to detect and eliminate factors which endanger safety.

At the Loviisa and Olkiluoto nuclear power plants, actions have been taken to emphasise a high level of safety culture, and to further develop it. Written safety policies have been formally established by the licensees.

According to Section 79 of the Nuclear Energy Act, a responsible director approved by STUK has to be appointed for the construction and operation of a nuclear power plant. The responsible director has a duty to see that the provisions of the Nuclear Energy Act, the rules and regulations issued by virtue of it and the licence conditions concerning the safe use of nuclear energy, the arrangements for physical protection and emergencies and the safeguards control are complied with. The responsible director shall have real possibilities to take effectively care of this duty.

Organisational units for safety exist at the Loviisa and Olkiluoto plants. These units are independent of those units which are directly responsible for the operation of the plants. In addition, independent advisory bodies for safety issues have been established by both licensees.

Safety is also emphasised in the Quality Manuals of STUK as well as in the framework contract between STUK and its technical support organisation VTT.

In conclusion, Finnish regulations and practices are in compliance with Article 10.

Article 11. Financial and human resources

1. ***Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.***
2. ***Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life.***

Sections 19 and 20 of the Nuclear Energy Act define as a condition for granting a Construction or Operating Licence that the applicant has sufficient financial resources. This condition shall be complied with throughout the operation of the facility. For example, the licensee shall have adequate financial resources to enhance the safety of the facility based on operating experience and the results of safety research as well as on the advancement of science and technology. Sections 32 and 34 of the Nuclear Energy Decree provide that the application for the construction and operation of a nuclear facility include information on the financial resources of the applicant.

Sections 35 to 53 of the Nuclear Energy Act provide detailed regulations for the financial arrangements for taking care of nuclear waste management. The Act on Third Party Liability provides regulations on financial arrangements for nuclear accidents, taking into account that Finland is a party to the Paris and Brussels conventions.

The annual reports of Imatran Voima Oy and Teollisuuden Voima Oy for 1997 are attached to this document, Annexes 10 and 11. They provide financial information on the utilities. Both utilities have annually invested typically about 50–100 MFIM for maintaining and improving safety.

According to Section 19 of the Nuclear Energy Act, a necessary condition for granting a Construction Licence of a nuclear facility is the availability of the necessary expertise. According to Section 20 of the Nuclear Energy Act, an Operating Licence of a nuclear facility can be granted if the applicant has available the necessary expertise and, in particular, if the operating organisation and the competence of the operating staff are appropriate.

Section 25 of Decision 395/1991 requires the following:

Nuclear power plant personnel shall be well suited for its duties, competent and well trained. Initial, complementary and refresher training programmes shall be established for the personnel.

For ensuring safety in all situations, competent personnel shall be available in a sufficient number.

The licensee has the prime responsibility for ensuring that his employees are qualified and authorised to their jobs**.** Both Finnish licensees have full-scale plant-specific simulators at the site. Training programmes, including simulator training, are further discussed in Annexes 5 and 6.

According to Sections 55 and 79 of the Nuclear Energy Act, and Sections 113, 119, and 122 to 130 of the Nuclear Energy Decree, STUK is responsible for controlling the necessary qualifications on the persons engaged in activities important to safety. STUK has issued requirements on staff qualification and described the respective regulatory control procedures in the Guide YVL 1.1 *The Finnish Centre for Radiation and Nuclear Safety as the Regulatory Authority for the Use of Nuclear Energy*, Guide YVL 1.6 *Nuclear Power Plant Operator Licensing* and Guide YVL 1.7 *Duties Important to Nuclear Power Plant Safety, Staff Qualification and Training.*

In conclusion, Finnish regulations and practices are in compliance with Article 11.

Article 12. Human factors

Each Contracting party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.

Section 19 of Decision 395/1991 requires the following:

Special attention shall be paid to the avoidance, detection and repair of human errors. The possibility of human errors shall be taken into account both in the design of the nuclear power plant and in the planning of its operation so that the plant withstands well errors and deviations from planned operational actions.

This means that human factors have to be taken into account in the design, construction and operation of the facility. Human factors have also to be taken into account in the failure analyses of plant safety systems and in probabilistic safety analyses (see Article 14). Such analyses have been completed for all Finnish nuclear power plants.

As regards the operation of the facility, the influence of human factors and the respective need for corrective measures are assessed by the licensees and STUK, when evaluating abnormal events and their lessons learnt. Each operating organisation has established a systematic procedure for making event evaluations.

Human resources and quality assurance are discussed under Articles 11 and 13, respectively.

In conclusion, Finnish regulations and practices are in compliance with Article 12.

Article 13. Quality assurance

Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified re-

quirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation.

According to Sections 35 and 36 of the Nuclear Energy Decree, a quality assurance programme for design and construction as well as for operation are required to be submitted to STUK when applying for the construction and operating licence of a nuclear facility, respectively. The general quality assurance requirements apply to the whole life of a nuclear facility.

According to the Decision 395/1991, quality assurance shall refer to all planned and systematic actions necessary to provide adequate confidence that a component, plant, or activity will satisfy given requirements. Section 5 of the Decision requires the following:

Advanced quality assurance programmes shall be employed in all activities which affect safety and relate to the design, construction and operation of a nuclear power plant.

Detailed quality assurance requirements are provided in Guide YVL 1.4 *Quality Assurance of Nuclear Power Plants*. Quality assurance for the operation of a nuclear power plant is especially covered by Guide YVL 1.9 *Quality Assurance during Operation of Nuclear Power Plants,* and for nuclear fuel by Guide YVL 6.7 *Quality Assurance of Nuclear Fuel*. Guide YVL 1.4 and Guide YVL 1.9 are applied also to other nuclear facilities than nuclear power plants.

Quality assurance programmes of the licensees/applicants and of the main suppliers are subject to approval by STUK. Furthermore, quality assurance programmes have to be established by all other organisations participating in activities important to safety of the use of nuclear energy. The implementation of these quality assurance programmes is verified by STUK through audits and inspections. The safety review based on Decision 395/1991 concluded that further development is needed in the existing quality systems of the Loviisa and Olkiluoto plants. Attention is needed in organisational and managerial issues. Quality assurance is further discussed in Annexes 5 and 6.

In conclusion, Finnish regulations and practices are in compliance with Article 13.

Article 14. Assessment and verification of safety

Each Contracting Party shall take the appropriate steps to ensure that:

(i) comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;

(ii) verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.

Safety assessment

Section 6 of Decision 395/1991 requires the following:

If compliance with the safety regulations cannot be directly ascertained, fulfilment shall be demonstrated by the necessary experimental and calculation methods.

Nuclear power plant safety and the design of its safety systems shall be substantiated by accident analyses and probabilistic safety analyses. Analyses shall be maintained and revised if necessary, taking into account operating experience, the results of experimental research and the advancement of calculating methods.

The calculating methods employed for demonstrating the meeting of the safety regulations shall be reliable and well qualified for dealing with the events in question. They shall be applied so that the calculated results are, with a good confidence, less favourable than the results which are considered best estimates. Furthermore, analyses which simulate the likely course of transients and accidents shall be conducted for the purpose of probabilistic safety analyses and for the development of emergency operating procedures.

Detailed requirements concerning transient and accident analyses, including sensitivity analyses, are presented in Guide YVL 2.2 *Transient and Accident Analyses for Justification of Technical Solutions at Nuclear Power Plants* and requirements concerning reliability and risk analyses in Guide YVL 2.8 *Probabilistic Safety Analyses (PSA).*

The design of the facility is described in the Preliminary Safety Analysis Report (PSAR) and in the Final Safety Analysis Report (FSAR). The reports are submitted, respectively, to STUK for approval in connection with the applications for Construction and Operating Licences. According to Section 112 of the Nuclear Energy Decree, FSAR has to be continuously updated.

Deterministic transient and accident analyses are a part of PSAR and FSAR. Separate probabilistic safety analyses are also subject to approval by STUK. Transient and accident analyses as well as PSAs are updated according to Section 6 of Decision 395/1991. The review of these safety assessments by STUK includes independent safety analyses.

The latest update of the accident analyses and PSAs was made in connection with the renewal of the Operating Licences of the Loviisa and Olkiluoto plants. It involved calculations of most transients and accidents with advanced computer codes. The results of the analyses are discussed in detail in Annexes 5 and 6.

Verification

Decision 395/1991 includes several requirements which concern the verification of the physical state of a nuclear power plant. For instance, Section 24 of Decision prescribes as follows:

In all activities affecting the operation of a nuclear power plant and the availability of components, a systematic approach shall be applied for ensuring plant operators' continuous awareness of the state of the plant and its components.

The reliable operation of systems and components shall be ensured by adequate maintenance as well as by regular in-service inspections and periodic tests.

General requirements on verification programmes and procedures are provided in YVL Guides (e.g. Guide YVL 1.8 *Repairs, Modifications and Preventive Maintenance at Nuclear Facilities*, Guide YVL 1.9 *Quality Assurance during Operation of Nuclear Power Plants*, Guide YVL 3.0 *Regulatory Control of Pressure Vessels in Nuclear Facilities. General Guidelines,* Guide YVL 3.8 *Nuclear Power Plant Pressure Vessels. Inservice Inspections*).

Main programmes used for verification of the state of a nuclear power plant are

- periodical testing according to the Technical Specifications
- preventive maintenance programme
- in-service inspection programme
- periodical inspections of pressure vessels and pipings
- surveillance programme of reactor pressure vessel material
- programmes for evaluating the ageing of components and materials.

Activities for verifying the physical state of a power plant are carried out in connection with normal daily routines and with scheduled inspections, testing, preventive maintenance etc. Activities are performed by the licensee personnel, and in the case of certain inspections by contractors approved separately.

Detailed programmes and procedures are established and approved by the licensee, and reviewed and, to some extent, approved by STUK**.** The results of tests and inspections are documented in a systematic way and used through a feedback process to further develop the programmes. The operational limits and conditions are provided in the Technical Specifications, which are subject to the approval of STUK (see Article 19). In general, the role of STUK is to verify that the licensees follow the obligations imposed on them and carry out all activities scheduled in verification programmes.

Comprehensive evaluations related to the state and operation of the Loviisa and Olkiluoto plants were carried out by Imatran Voima Oy and Teollisuuden Voima Oy in 1996–1998. These evaluations also covered the trial tests of the plants at the increased power levels. These activities were controlled by STUK, and the results of the review are described in Annexes 5 and 6.

The qualification of non-destructive testing systems and procedures is recognised as an issue

of high importance. This issue requires high priority at both nuclear power plants.

In conclusion, Finnish regulations and practices are in compliance with Article 14.

Article 15. Radiation protection

Each contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

Section 6 of the Nuclear Energy Act states:

The use of nuclear energy must be safe; it shall not cause injury to people, or damage to the environment or property.

The ALARA principle is included in Section 2 of the Radiation Act. Occupational dose limits and dose limits for the general public are set forth in Sections 3 to 8 of the Radiation Decree. These limits are in conformity with the ICRP 60 Recommendation (1990).

Sections 7 to 12 of Decision 395/1991 include regulations for limiting the radiation exposure of the general public and the releases of radioactive materials into the environment, arising from the operation of a nuclear power plant. These sections also cover design limits for releases in anticipated operational occurrences and accidents.

There are several YVL Guides which deal with radiation protection as regards the design and operation of nuclear power plants.

Guide YVL 1.0 *Safety Criteria for Design of Nuclear Power Plants* provides the general design principles, including radiation protection.

Guide YVL 7.18 *Radiation Protection in the Design of Nuclear Power Plants* gives more detailed radiation protection related guidance e.g. on lay-out, shielding, components and systems. It describes a procedure according to which it shall be demonstrated how the radiation protection requirements are taken into account in the design, construction and commissioning of a nuclear power plant.

Guide YVL 7.1 *Limitation of Public Exposure in the Environment of and Limitation of Radioactive Releases from Nuclear Plants* and Guide YVL 2.2 *Transient and Accident Analyses for Justification of Technical Solutions at Nuclear Power Plants* give criteria and requirements for analysing plant behaviour, potential releases and radiation doses caused by accidents.

Guide YVL 7.10 *Monitoring of Occupational Exposure at Nuclear Power Plants* provides requirements for control of external and internal occupational exposure during operation of a nuclear facility.

STUK carries out regulatory control for ensuring that the radiation protection requirements are complied with during the operation of nuclear facilities. Experience gained from operation of Finnish nuclear facilities shows that the dose limits have not been exceeded, and that the ALARA principle has been followed. The results of environmental surveillance programmes show that the amount of radioactive materials originating from Finnish nuclear facilities has been very low in the environment of nuclear facilities. Radiation protection is discussed in more detail in Annexes 5 and 6.

In conclusion, Finnish regulations and practices are in compliance with Article 15.

Article 16. Emergency preparedness

1 Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency.

For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.

2. Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.

3. Contracting Parties which do not have a nuclear installation on their territory, insofar

as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.

The basic regulations for on-site emergency planning are given in the Nuclear Energy Act and in Decision 397/1991. According to Section 20 of the Nuclear Energy Act, adequate on-site emergency preparedness arrangements are required before starting the operation of a nuclear facility. Detailed requirements are issued by STUK in Guide YVL 7.4 *Nuclear Power Plant Emergency Response Arrangements.* On-site emergency plans are subject to approval by STUK.

The licensee is responsible for the on-site emergency response arrangements. Section 3 of Decision 395/1991 states e.g. as follows:

Emergency planning shall be based on the analysis of nuclear power plant behaviour in emergencies and on the analysis of the consequences of emergencies.

Action in an emergency shall be planned taking into account controllability of events as well as severity of their consequences. Therefore, emergencies shall be grouped into classes.

Emergency response arrangements shall be consistent with management of operation and physical protection of nuclear power plants.

Emergency response arrangements shall also be consistent with the rescue service and emergency plans made by the authorities in provision against nuclear power plant accidents.

Section 7 of Decision 395/1991 requires as follows:

Appropriate training and exercises shall be arranged to maintain operational preparedness. Exercises shall be arranged in co-operation with the authorities concerned.

On-site emergency exercises are conducted before the first fuel loading of a nuclear power plant, and thereafter yearly so that at least the licensee personnel, local off-site emergency management group and STUK participate in them. There are always observers from STUK and several other organisations assessing the performance of exercising teams.

STUK carries out periodical inspections on-site to verify operational emergency preparedness. Among other things, the maintenance and adequacy of appropriate rooms and equipment, communication and alarm systems, computerised support systems as well as personnel training and qualifications are inspected.

STUK made in 1997–1998 a comprehensive re-evaluation of the emergency preparedness of Finnish nuclear power plants. The general findings stated that the emergency response arrangements have been made in accordance with the above mentioned national regulations. However, some issues, such as the classification of emergency situations, arrangements for accident management, protection of personnel during an accident, and advance information to the public, were identified as issues where further development work is needed.

In addition to the on-site emergency plans established by the licensees, off-site emergency plans are prepared by local authorities. The planning for off-site emergency preparedness started and the measures needed were established before the commissioning of the Finnish nuclear power plants. The relevant regulations and guides have been regularly updated and developed further. At the moment, the requirements for off-site plans and activities in a radiation emergency are provided in Decision No 1/97 and in Guide A:57, 1998, issued by the Ministry of Interior. The off-site emergency exercises are conducted at least every third year. In the case of an accident the local authorities are alerted by the operating organisation of the plant.

The on-site and off-site plans include provisions to inform the population in the case of an accident. In addition, written information on radiation emergencies, emergency planning and response arrangements have been provided to the population. Such information can also be found in the telephone directories of Finland. Citizens living near nuclear facilities are regularly provided with more detailed written information on nuclear accidents and emergency measures needed.

STUK has established an Emergency Preparedness Manual for its own activities in the case of a nuclear accident or radiological emergency. STUK has an officer on duty for 24 hours a day, in order to be able to immediately give advice to local

and governmental authorities on needed emergency response actions. These actions can include, i.a., warning the population with a message which can be heard through all radio channels. The message on an exceptional event (alarm) can be received from the operating organisations of the facilities, or automatically from the radiation monitoring network that is dense in the whole country (Figure 4), or from foreign authorities.

Finland is a party to the International Convention on Early Notification of a Nuclear Accident, done in Vienna in 1986. In addition, Finland has respective bilateral agreements with Denmark, Germany, Norway, Russia, Sweden and Ukraine. Accordingly, arrangements have been agreed to directly inform the competent authorities of these countries in the case of an accident. Similar arrangements ensure direct notification to the authorities of Estonia. The bilateral agreements also cover the exchange of relevant information on nuclear facilities.

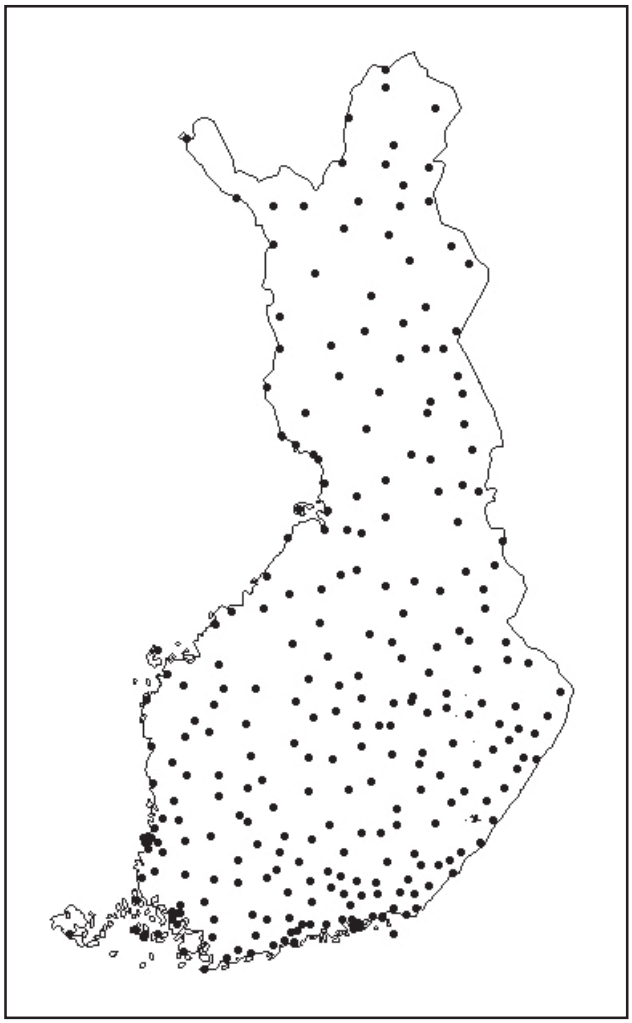

Figure 4. *The automatic radiation monitoring stations of Finland.*

The foreign nuclear power plants close to Finland have been taken into account in the local rescue plans.

In conclusion, Finnish regulations and practices are in compliance with Article 16.

Article 17. Siting

Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:

(i) for evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime;

(ii) for evaluating the likely safety impact of a proposed nuclear installation on individuals, society and the environment;

(iii) for re-evaluating as necessary all relevant factors referred to in sub-paragraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation;

(iv) for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation.

A Decision in Principle by the Council of State is required according to Section 11 of the Nuclear Energy Act for the construction of a nuclear power plant. This decision, which additionally has to be approved also by the Parliament**,** has to be made before the application for a Construction Licence is submitted to the Council of State.

According to Section 24 of the Nuclear Energy Decree, the application for a Decision in Principle has to include e.g.:

- an outline of the ownership and occupation of the site,
- a description of settlement and other activities and town planning arrangements at the site and its vicinity,
- an evaluation of the suitability of the site and the restrictions caused by the nuclear facility on the use of surrounding areas,

- an assessment report in accordance with the Act on the Environmental Impact Assessment Procedure (468/1994) as well as a description on the design criteria the applicant will observe in order to avoid environmental damage and to restrict the burden to the environment.

More detailed requirements on the Environmental Impact Assessment are provided in the Decree (792/1994). The procedures have been applied in practice e.g. when modernising and increasing the power levels of Finnish nuclear power plants.

The site selection has to be confirmed in the application for a Construction Licence. This application includes also up-to-date descriptions similar to the above.

In the design of a nuclear plant, site-related external events have to be taken into account. Section 20 of Decision 395/1991 provides as follows:

The most important nuclear power plant safety functions shall remain operable in spite of any natural phenomena estimated possible on site or other events external to the plant. In addition, the combined effects of accident conditions induced by internal causes and simultaneous natural phenomena shall be taken into account to the extent estimated possible.

Specific provisions against earthquakes are provided in Guide YVL 2.6 *Provision against Earthquakes Affecting Nuclear Facilities.*

The probabilistic safety analysis required as part of the safety review for Construction and Operating Licences provides information on risks caused by external events. As an input to PSA, deterministic analyses are made to assess the impact of various natural phenomena and other external events.

In connection with the construction of the Loviisa and Olkiluoto plants, safety requirements were defined for the siting of nuclear power plants and for the population density and human activities in the surrounding area. Currently, these requirements include also administrative restrictions for industrial facilities and air traffic. In a sparsely populated country like Finland the safety requirements were quite easily and practically achievable. No new sites are being considered for a possible new nuclear power plant.

STUK reviews the licence applications, including all site-specific safety reports. These reports deal e.g. with meteorology, hydrology, population and use of land and sea area as well as other items mentioned above.

During the operation of the nuclear facility, FSAR, including the descriptions of its site-specific parts, has to be periodically reviewed and updated as needed. As regards safety analyses, see Article 14.

The operating licences for nuclear facilities are granted for a limited period of time. For the application of a new licence, a comprehensive reassessment of safety, including the environmental safety of the nuclear facility and the effects of external events on the safety of the facility, have to be done.

Finland is a party to the Convention on Environmental Impact Assessment in a Transboundary Context, done in Espoo in 1991. The Finnish policy is, as provided in Chapter 3 of the Act (468/1994), to provide full participation to all neighbouring countries, which can be affected by the nuclear facilities in question.

In 1976, an agreement was done between Denmark, Finland, Norway and Sweden as regards nuclear power plants to be constructed near the borders. This agreement includes provisions for exchanging information on such plants.

The bilateral agreements mentioned under Article 16 include provisions to exchange information on the design and operation of nuclear facilities.

In conclusion, Finnish regulations and practices are in compliance with Article 17.

Article 18. Design and construction

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defense in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;

(ii) the technologies incorporated in the design and construction of a nuclear installation

are proven by experience or qualified by testing or analysis;

(iii) the design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.

Defence in depth

According to Section 13 of Decision 395/1991 several levels of protection have to be provided in the design of a nuclear power plant. In the design, construction and operation, proven or otherwise carefully examined high quality technology shall be employed to prevent operational transients and accidents. A nuclear power plant shall encompass systems by means of which operational transients and accidents can be quickly and reliably detected and the aggravation of any event prevented. Effective technical and administrative measures shall be taken for the mitigation of the consequences of an accident. Section 13 further requires that the design of a nuclear power plant shall be such that accidents leading to extensive releases of radioactive materials are highly unlikely.

Section 14 of Decision 395/1991 requires that dispersion of radioactive materials from the fuel of the nuclear reactor to the environment shall be prevented by means of successive barriers which are the fuel and its cladding, the cooling circuit of the nuclear reactor and the containment building. Provisions for ensuring the integrity of the fuel, primary circuit and containment are included in Sections 15, 16 and 17.

Section 18 of Decision 395/1991 requires that in ensuring safety functions, inherent safety features attainable by design shall be made use of in the first place. If inherent safety features cannot be made use of, priority shall be given to systems and components which do not require an off-site power supply or which, in consequence of a loss of power supply, will settle in a state preferable from the safety point of view (passive and fail-safe functions).

Section 18 further provides that systems which perform the most important safety functions shall be able to carry out their functions even though an individual component in any system would fail to operate and additionally any component affecting the safety function would be simultaneously out of operation due to repairs or maintenance. In ensuring the most important safety functions, systems based on diverse operation principles shall be used to the extent possible. Furthermore, a nuclear power plant shall have sufficient on-site and off-site electrical power supply systems.

Detailed requirements are given in Guide YVL 1.0 *Safety Criteria for Design of Nuclear Power Plants*, Guide YVL 2.4 *Primary and Secondary Circuit Pressure Control at a Nuclear Power Plant,* Guide YVL 2.7 *Ensuring a Nuclear Power Plant's Safety Functions in Provision for Failures,* Guide YVL 3.0 *Regulatory Control of Pressure Vessels in Nuclear Facilities. General Guidelines,* Guide YVL 4.3 *Fire Protection at Nuclear Facilities,* and Guide YVL 6.2 *Fuel Design Limits and General Design Criteria.*

An assessment of the design of the facility and related technologies is made by STUK for the first time when assessing the application for a Decision in Principle. Later on, the evaluation is continued when the Construction Licence application is reviewed. Finally, the detailed evaluation of systems and equipment is carried out through their design approval process.

The design of Loviisa and Olkiluoto nuclear power plants was reassessed by STUK in 1997–1998, as referred to under Article 6. The results of this review are discussed in Annexes 5 and 6.

Severe accidents were not taken into account in the original design of the Loviisa and Olkiluoto plants. However, since their commissioning, many improvements have been implemented in the plant structures and systems, as well as procedures to enhance safety and to mitigate the consequences of severe accidents. The issue of severe accidents still needs further attention.

Proven technology

The requirement to use proven or otherwise qualified technology is stated in Section 13 of Decision 395/1991 as follows:

In design, construction and operation proven or otherwise carefully examined high quality technology shall be employed to prevent operational transients and accidents (preventive measures).

The respective detailed requirements are provided in many YVL Guides. The implementation

of these requirements at the Loviisa and Olkiluoto plants is discussed in Annexes 5 and 6.

Reliable, stable and easily manageable operation

Section 22 of Decision 395/1991 requires that a nuclear power plant's control room shall contain equipment which provide information about the plant's operational state and any deviations from normal operation as well as systems which monitor the state of the plant's safety systems during operation and their functioning during operational transients and accidents. Furthermore, it requires that a nuclear power plant shall contain automatic systems that maintain the plant in a safe state during transients and accidents long enough to provide the operators a sufficient time to consider and implement the correct actions.

According to Section 19 of Decision 395/1991, special attention shall be paid to the avoidance, detection and repair of human errors. The possibility of human errors shall be taken into account both in the design of the nuclear power plant and in the planning of its operation so that the plant withstands well errors and deviations from planned operational actions.

Plant systems reliability and human factors are systematically considered in the probabilistic safety analyses. The analyses support the efforts to eliminate accidents or to mitigate their consequences. The probabilistic safety analyses are subject to the approval of STUK (see Article 14).

In the Finnish nuclear power plants digital instrumentation and control technology has already been implemented in some modernised systems. The development of detailed safety requirements and procedures to ensure adequate reliability of such systems is still underway.

In conclusion, Finnish regulations and practices are in compliance with Article 18.

Article 19. Operation

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the initial authorization to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;

(iii) operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;

(iv) procedures are established for responding to anticipated operational occurrences and to accidents;

(v) necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;

(vi) incidents significant to safety are reported in a timely manner by the holder of the relevant licence to the regulatory body;

(vii) programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies;

(viii) the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.

Initial authorisation

According to Sections 35 and 36 of the Nuclear Energy Decree, the Preliminary and Final Safety Analysis Reports are required to be submitted to STUK when applying for Construction and Operating licences, respectively. More detailed requirements are given in Guide YVL 1.1 *The Finnish Centre for Radiation and Nuclear Safety as the Regulatory Authority for the Use of Nuclear Energy*. Requirements for safety analyses are given in Guide YVL 2.2 *Transient and Accident Analyses for Justification of Technical Solutions at Nuclear Pow-*

er Plants and Guide YVL 2.8 *Probabilistic Safety Analyses (PSA)* (see Article 14).

Requirements for the commissioning programme are set forth in Guide YVL 2.5 *Pre-operational and Start-up Testing of Nuclear Power Plants*. According to Guide YVL 2.5, the purpose of the commissioning programme is to give evidence that the plant has been constructed and will function according to the design requirements. Through the programme possible deficiencies in design and construction can also be observed.

The commissioning programme is described in the Preliminary and Final Safety Analysis Reports. The participation of the operating staff in the commissioning programme is a requirement of Guide YVL 1.6 *Nuclear Power Plant Operator Licensing*.

The Safety Analysis Reports and the commissioning programme are to be submitted to STUK for approval. The detailed commissioning test programmes for systems in safety classes 1, 2 and 3 are submitted separately to STUK for approval. STUK witnesses commissioning tests and assesses the test results before giving stepwise permits to proceed in the commissioning.

An Operating Licence is needed before fuel loading into the reactor can be started. Furthermore, according to Section 110 of the Nuclear Energy Decree, the various steps of the commissioning, i.e. criticality, low power operation and power ascension, are subject to the approval of STUK.

Operational limits and conditions

According to Section 36 of the Nuclear Energy Decree, the applicant for an Operating Licence must provide STUK with the Technical Specifications. Section 36 requires that the Technical Specifications

shall at least define limits for the process quantities that affect the safety of the facility in various operating states, provide regulations on operating restrictions that result from component failures, and set forth requirements for the testing of components important to safety.

In Section 23 of Decision 395/1991, it is further stated as follows:

Technical and administrative requirements and restrictions for ensuring the safe operation of a nuclear power plant shall be set forth in the plant's Technical Specifications.

More detailed requirements concerning the Technical Specifications are given in Guide YVL 1.1 *The Finnish Centre for Radiation and Nuclear Safety as the Regulatory Authority for the Use of Nuclear Energy*. According to Guide YVL 1.1, the minimum staff availability in all operational states and the limits for the releases of radioactive substances have also to be defined in the document.

The Technical Specifications have been established for each nuclear power plant unit. The Technical Specifications are updated based on operational experiences, tests, analyses and plant modifications.

The Technical Specifications are subject to the approval of STUK prior to the commissioning of a facility. Strict observance of the Technical Specifications is verified by STUK through a regular inspection programme.

General requirements related to needs to revise the Final Safety Analysis Report, Technical Specifications, operating procedures and other plant documentation after plant modifications are given as follows in Section 112 of the Nuclear Energy Decree:

If the licence-holder intends to carry out modifications in the nuclear facility systems or structures, in nuclear fuel or in the way the facility is operated, and these modifications would have an effect on safety and would involve changes in the plans or documents approved by the Radiation and Nuclear Safety Authority (STUK), the licence-holder shall obtain an approval from STUK for these modifications before they are carried out. The licence-holder must see to it that the documents mentioned in sections 35 and 36 are revised accordingly.

Guide YVL 1.1, Guide YVL 1.8 *Repairs, Modifications and Preventive Maintenance at Nuclear Facilities*, and Guide YVL 1.9 *Quality Assurance during Operation of Nuclear Power Plants* include detailed requirements concerning updating of plant documents.

Guide YVL 1.1 describes the regulatory policy regarding to the approval and submittal of updated documents. Guide YVL 1.8 gives detailed requirements for repairs, modifications and preventive maintenance at nuclear facilities. Guide YVL

1.9 requires that documents and operating procedures needed by the control room operators have to be defined, and that these documents and procedures shall be continuously updated. The responsibilities and administrative procedures indicating how to take care of these actions are described in the Quality Assurance Programme.

Approved procedures

Requirements related to the procedure approvals are provided in Section 23 of Decision 395/1991:

Appropriate procedures shall exist for the operation, maintenance, in-service inspections and periodic tests as well as transient and accident conditions of a nuclear power plant.

The procedures for operation, maintenance, inspection and testing have been established at both Finnish nuclear power plants. The procedures shall be approved by the licensee itself, and most of them are required to be submitted to STUK for information. Detailed requirements are presented in appropriate YVL Guides. STUK verifies by means of inspections and audits that approved procedures are followed in the operation of the facility.

Anticipated operational occurrences and accidents

Section 13 of Decision 395/1991 defines the levels of protection needed for ensuring nuclear safety. Together with the requirements to prevent transients and accidents by the plant system design, the section states as follows:

Effective technical and administrative measures shall be taken for the mitigation of the consequences of an accident. Counter-measures for bringing an accident under control and for preventing radiation hazards shall be planned in advance.

Section 23 of Decision 395/1991 requires the following:

Appropriate procedures shall exist for the operation, maintenance, in-service inspections and periodic tests as well as transient and accident conditions of a nuclear power plant.

At both Finnish nuclear power plants, procedures for anticipated operational occurrences and accidents are in use. To the extent found necessary, the procedures have been verified during operator training at the plant simulators. At both nuclear power plants there are also advanced safety panels for monitoring critical safety functions. STUK has independently evaluated the appropriateness and comprehensiveness of the procedures for anticipated operational occurrences and accidents.

As regards emergency preparedness for accidents, see Article 16.

Engineering and technical support

The staffing, training and qualifications of the personnel are discussed in general under Article 11. The licensee has the prime responsibility for ensuring that his employees are qualified and authorised to their jobs.

The requirements in Guide YVL 1.7 *Functions Important to Nuclear Power Plant Safety, and Training and Qualification of Personnel* also cover technical support.

Competence of the engineering and technical support is supervised by the licensee. In addition, STUK carries out inspections and audits by which also the competence of the support staff is evaluated.

According to Section 113 of the Nuclear Energy Decree, only organisations and their employees approved by STUK are allowed to carry out non-destructive testing of a nuclear power plant's structures and components. The approval procedures are described in Guide YVL 1.3 *Mechanical Components and Structures of Nuclear Power Facilities. Inspection Licenses.*

Incident reports

Guide YVL 1.5 *Reporting Nuclear Power Plant Operation to the Finnish Centre for Radiation and Nuclear Safety* provides in detail the reporting requirements on incidents. The Guide provides a number of examples of operational disturbances and events, which have to be reported to STUK. It also defines requirements for the contents of the reports and the administrative procedures for reporting, including time limits for submitting of various reports.

Incident evaluation

Section 27 of Decision 395/1991 requires the following:

Operating experience from nuclear power plants as well as results of safety research shall be systematically followed and assessed.

For further safety enhancement, actions shall be taken which can be regarded as justified considering operating experience and the results of safety research as well as the advancement of science and technology.

Guide YVL 1.11 *Nuclear Power Plant Operating Experience Feedback* provides detailed requirements and administrative procedures for the systematic evaluation of operating experiences, and for the planning and implementation of corrective actions. Foreign operational occurrences have to be assessed as well, from the point of view of their safety significance to own plant.

The licensees have developed the required procedures for analysing operating experiences. The procedures for root cause analyses are in use. Further attention is, however, still needed to avoid recurrence of incidents. Incident evaluation procedures are further discussed in Annexes 5 and 6.

Experiences gained from plant operations are directly shared with utilities operating similar types of plant (same NSSS vendor), and appropriate reports are also distributed through WANO.

The evaluation of incidents by STUK is described in Guide YVL 1.1 *The Finnish Centre for Radiation and Nuclear Safety as the Regulatory Authority for the Use of Nuclear Energy*. STUK verifies by means of inspections and audits that the activities of the licensees as regards incident evaluation are effective. When necessary, a special investigation team is appointed by STUK to evaluate a certain incident. The evaluation of foreign operational occurrences and incidents is based on the reports of the IRS Reporting System (IAEA/NEA) and on the reports of other national regulatory bodies. IRS-reports are also evaluated by the licensees. Reports for the IRS System on safety-significant occurrences at Finnish nuclear power plants are written by STUK.

Radioactive wastes

The requirement for limitation of fuel damages, provided by Section 15 of Decision 395/1991, partly aims at limiting quantities of low and medium level reactor wastes.

YVL 1.0 *Safety Criteria for Design of Nuclear Power Plants* provides the following:

Provision for a nuclear power plant's decommissioning shall be made already during the plant's design phase. One criterion when deciding the plant's materials and structural solutions shall be that volumes of decommissioned waste are to be limited.

The detailed requirement for radioactive waste minimisation is included in Guide YVL 8.3 *Treatment and Storage of Radioactive Waste at the Nuclear Power Plants*. It calls for a limitation of waste volumes in particular from repair and maintenance works, and segregation of wastes on the basis of activity. Clearance of wastes from regulatory control, prescribed in Section 10 of the Nuclear Energy Decree and in Guide YVL 8.2 *Exemption from Regulatory Control of Nuclear Wastes*, aims at limiting the volumes of waste to be stored and disposed of.

Guide YVL 8.3 requires that besides the short-term radiation protection objectives, also the long-term properties of waste packages with respect to final disposal shall be taken into account in the conditioning and storage of waste. The Guide includes also more specific requirements for the conditioning and interim storage of wastes.

Liquid wastes will be solidified before their disposal. At the Olkiluoto site the necessary facilities are already in place and at the Loviisa site the solidification facility will be commissioned around the year 2000. There are on-site disposal facilities in operation at the Loviisa and Olkiluoto site for low and medium level radioactive wastes. As these facilities are operated by the nuclear power plant utilities, there is direct economic motivation to minimise the generation of radioactive waste.

Guide YVL 8.1 *Disposal of Reactor Waste* calls for a waste type description, to be approved by STUK, for each category of reactor waste to be disposed of. In the description of waste type, the most important characteristics of waste with respect to the safety of disposal are defined.

Interim spent fuel storage facilities are available at the Loviisa and Olkiluoto sites. At the Loviisa plant, additional spent fuel storage capacity is being constructed for taking care of all spent fuel to be produced during the remaining lifetime of the plant. There is later on a need for additional storage capacity at Olkiluoto, too. The Loviisa and Olkiluoto storages are wet-type storages. No treatment facilities are yet available for spent fuel final disposal in Finland.

In conclusion, Finnish regulations and practices are in compliance with Article 19.

2.2 Concluding summary on the fulfilment of the obligations

In the above the implementation of the obligations of the Convention, Articles 4 and 6 to 19, is evaluated. Based on the evaluation it can be concluded that Finnish regulations and practices are in compliance with the obligations of the Convention.

Safety improvements have been annually implemented at the Loviisa and Olkiluoto plants since their commissioning. There exists no urgent need for additional improvements to upgrade the safety of these plants in the context of the Convention. However, there are issues requiring further measures to enhance safety. Main issues are discussed in the following Chapter 3.

3 PLANNED ACTIVITIES TO IMPROVE SAFETY

3.1 Plant specific issues

The Finnish regulatory control system includes both periodic safety review as well as continuous safety review processes. Actions for safety enhancements shall be taken whenever they can be regarded justified, considering operating experience and the results of safety research, as well as the advancement of science and technology.

Loviisa plant

As regards the Loviisa plant, the safety review based on Decision 395/1991 (Annex 5) concluded that i.a. the following issues require further attention:

- Quality Assurance
  Responsibilities for design and safety need to be so organised that adequate expertise is available. Especially this is important in issues related to the implementation of the safety principles. In addition to quality assurance, this pertains to plant safety culture, licensee on-site personnel and plant organisation.
- Severe accidents
  Further reduction of the consequences of accident sequences involving containment bypass is needed.
- Non-destructive testing
  Qualification of non-destructive testing systems and procedures is recognised as a high priority issue. The Finnish utilities are required to develop general procedures for qualification of test equipment and personnel as well as to manufacture test blocks and produce technical justifications for their applicability.
- Operational experience
  More attention is needed for better use of operational experiences in order to avoid recurrence of incidents.

In addition to the aforementioned issues, there are ongoing efforts to improve safety by backfitting the plant. Most important and of widest scope among these backfitting projects is the implementation of the overall strategy of severe accident management. This involves the following:

- Provision of means for passive external cooling of the reactor vessel to ensure retention of molten core inside the vessel
- Installation of catalytic recombiners inside the reactor containment to ensure successful hydrogen management (assuming 100% core zircaloy oxidation)
- Installation of independent control systems to perform severe accident management functions, including monitoring of the containment integrity.

As regards severe accidents, the following improvements have already been completed:

- Replacement of pressurizer safety valves to ensure primary circuit depressurisation under conditions of steam, water or non-condensible gas in the pressurizer
- An additional emergency coolant tank to provide safe cooling to a cold shutdown in the case of a major coolant leak from primary to secondary circuit
- Installation of an independent external cooling system of the containment in order to ensure decay heat removal without compromising the containment integrity, i.e. without venting
- Installation of an independent additional emergency feedwater system to ensure safety of the plant e.g. in the case of a major fire in the turbine hall.

In addition, a backfitting project related to intermediate cooling circuit is being completed. Higher heat loads than analysed earlier may be caused by

hot sump water to the intermediate cooling circuit that is an essential part of the decay heat removal chain. The plant changes made include the upgrading of pumps and motors for higher operating temperatures and process and procedural revisions to distribute the heat loads more evenly.

Olkiluoto plant

As regards the Olkiluoto plant, the safety review based on Decision 395/1991 (Annex 6) concluded that i.a. the following issues require further attention:

- Quality Assurance
  Quality Assurance is needed to be further developed. This relates to both organisational and managerial matters. Project planning and management procedures need special attention.
- Non-destructive testing
  Qualification of non-destructive testing systems and procedures is recognised as a high priority issue. The Finnish utilities are required to develop general procedures for qualification of test equipment and personnel as well as to manufacture test blocks and produce technical justifications for their applicability.
- Severe accidents
  Severe accident management still has two major weaknesses. Firstly, the containment integrity may be endangered by a violent interaction between core melt and water in the case the accident proceeds into a pressure vessel rupture. Possibilities to strengthen the containment personnel hatch, which is the part of the containment most vulnerable to strong pressure shocks, are being analysed. Secondly, containment venting may result in unacceptable releases if it is done while organic iodides are formed, or the filter of the venting system is contaminated by chlorine released from the containment cables. Therefore, possibilities to enhance iodine retention in the containment and in the venting system are studied.

The following improvements to prevent severe accidents and to mitigate the consequences of a severe accident have already been completed:

- Automatic depressurisation of the reactor in the case of low water level
- Diversification of the safety relief valves of the reactor circuit
- Overpressure protection of the containment
- Shielding of penetrations to the lower dry-well of the containment
- Containment flooding
- Filtered depressuration system of the containment
- New measurement systems in the containment.

As regards both the Loviisa and Olkiluoto plants further attention is to be given to programmable instrumentation and control systems. This technology has been implemented in some modernised systems of the Olkiluoto plant, but this issue still requires the development of detailed safety requirements and procedures to ensure adequate reliability and safety.

3.2 Challenges for future work

In general, the work for maintaining the safety level achieved and improving it requires continuous alertness as well as systematic monitoring of operating experience—domestic and abroad—and of the results of safety research. The Finnish approach, as provided in Decision 395/1991, Section 27, is that for further safety enhancement, actions shall be taken which can be regarded as justified considering the operating experience and the results of safety research as well as the advancement of science and technology.

In addition, issues considered to be of high importance in Finland are as follows:

- maintaining and strengthening the safety culture among all organisations involved in the use of nuclear energy

- maintaining and further improving the level of technical expertise in the nuclear field and ensuring the availability of new employees for the licensees as well as for the regulatory organisations
- ensuring the continuation of long term domestic safety research programmes and participation in international research activities
- being open to new ideas like risk-informed, performance-based regulations, and being prepared to respond to changes in the industrial infrastructure.
- maintaining and developing contacts with industrial enterprises as well as foreign regulatory organisations in order to share experiences and carry out benchmarking, especially in the field of quality assurance.

Special attention will be paid to these issues in the near future.

ANNEX 1

LIST OF MAIN REGULATIONS

Legislation

1 Nuclear Energy Act (990/1987)

2 Nuclear Energy Decree (161/1988)

3 Act on Third Party Liability (484/1972)

4 Decree on Third Party Liability (486/1972)

5 Radiation Act (592/1991)

6 Radiation Decree (1512/1991)

7 Decision of the Council of State on the General Regulations for the Safety of Nuclear Power Plants (395/1991)

8 Decision of the Council of State on the General Regulations for Physical Protection of Nuclear Power Plants (396/1991)

9 Decision of the Council of State on the General Regulations for Emergency Response Arrangements at Nuclear Power Plants (397/1991)

10 Decision of the Council of State on the General Regulations for the Safety of a Disposal Facility for Reactor Waste (398/1991)

11 Act and Decree on the Finnish Centre for Radiation and Nuclear Safety (1069/1983 and 1515/1991)

12 Decree on Advisory Committee on Nuclear Safety (164/1988)

13 Decree on Advisory Committee on Nuclear Energy (163/1988)

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YVL 1.0 Safety criteria for design of nuclear power plants, 12 Jan. 1996

YVL 1.1 The Finnish Centre for Radiation and Nuclear Safety as the regulatory authority in control for the use of nuclear energy, 27 Jan. 1992

YVL 1.2 Documents pertaining to safety control of nuclear facilities, 11 Sept. 1995

YVL 1.3 Mechanical components and structures of nuclear power facilities. Inspection licenses, 22 Oct. 1996 (in Finnish)

YVL 1.4 Quality assurance of nuclear power plants, 20 Sep. 1991

YVL 1.5 Reporting nuclear power plant operation to the Finnish Centre for Radiation and Nuclear Safety, 1 Jan. 1995

YVL 1.6 Nuclear power plant operator licensing, 9 Oct. 1995

YVL 1.7 Functions important to nuclear power plant safety, and training and qualification of personnel, 28 Dec. 1992

YVL 1.8 Repairs, modifications and preventive maintenance at nuclear facilities, 2 Oct. 1986

YVL 1.9 Quality assurance during operation of nuclear power plants, 13 Nov. 1991

YVL 1.11 Nuclear power plant operating experience feedback, 22 Dec. 1994

YVL 1.13 Nuclear power plant outages, 9 Jan. 1995

YVL 1.15 Mechanical components and structures in nuclear installations, Construction inspection, 19 Dec. 1995 (in Finnish)

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YVL 2.3 Preinspection of nuclear power plant systems, 14 Aug. 1975

YVL 2.4 Primary and secondary circuit pressure control at a nuclear power plant, 18 Jan. 1996

YVL 2.5 Pre-operational and start-up testing of nuclear power plants, 8 Jan. 1991

YVL 2.6 Provision against earthquakes affecting nuclear facilities, 19 Dec. 1988

LIST OF MAIN REGULATIONS

ANNEX 1

YVL 2.7 Ensuring a nuclear power plant's safety functions in provision for failures, 20 May 1996

YVL 2.8 Probabilistic safety analyses (PSA), 20 Dec. 1996

Pressure vessels

YVL 3.0 Regulatory control of pressure vessels in nuclear facilities. General guidelines, 11 Sep. 1996

YVL 3.1 Construction plan for nuclear facility pressure vessels, 27 May 1997 (in Finnish)

YVL 3.3 Pressure vessels of nuclear facilities. Piping, 4 December 1996 (in Finnish)

YVL 3.4 Nuclear power plant pressure vessels. Manufacturer's competence, 16 December 1996 (in Finnish)

YVL 3.7 Pressure vessels of nuclear facilities. Commissioning inspection, 12 Dec. 1991

YVL 3.8 Nuclear power plant pressure vessels. In-service inspections, 13 Dec. 1993

YVL 3.9 Nuclear power plant pressure vessels. Construction and welding filler materials, 6 April 1995 (in Finnish)

Buildings and structures

YVL 4.1 Concrete structures for nuclear facilities, 22 May 1992

YVL 4.2 Steel structures for nuclear facilities, 19 Jan. 1987

YVL 4.3 Fire protection at nuclear facilities, 2 Feb. 1987

Other structures and components

YVL 5.1 Nuclear power plant diesel generators and their auxiliary systems, 23 Jan. 1997 (in Finnish)

YVL 5.2 Nuclear power plant electrical systems and equipment, 23 Jan. 1997 (in Finnish)

YVL 5.3 Regulatory control of nuclear facility valves and their actuators, 7 Feb. 1991

YVL 5.4 Supervision of safety relief valves in nuclear facilities, 6 April 1995 (in Finnish)

YVL 5.5 Supervision of electric and instrumentation systems and components at nuclear facilities, 7 June 1985

YVL 5.6 Ventilation systems and components of nuclear power plants, 23 Nov. 1993

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YVL 5.8 Hoisting appliances and fuel handling equipment at nuclear facilities, 5 Jan. 1987

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YVL 6.2 Fuel design limits and general design criteria, 15 Feb. 1983

YVL 6.3 Supervision of fuel design and manufacture, 15 Sept. 1993

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YVL 6.5 Supervision of nuclear fuel transport, 12 October 1995 (in Finnish)

YVL 6.6 Surveillance of nuclear fuel performance, 5 Nov. 1990

YVL 6.7 Quality assurance of nuclear fuel, 23 Nov. 1993

YVL 6.8 Handling and storage of nuclear fuel, 13 Nov. 1991

YVL 6.9 The national system of accounting for and control of nuclear material, 23 Nov. 1993 (in Finnish)

YVL 6.10 Reports to be submitted on nuclear materials, 23 Nov. 1993 (in Finnish)

YVL 6.11 Physical protection of nuclear power plants, 13 July 1992 (in Finnish)

ANNEX 1

LIST OF MAIN REGULATIONS

YVL 6.21 Physical protection of nuclear fuel transports, 15 Feb. 1988 (in Finnish)

Radiation protection

YVL 7.1 Limitation of public exposure in the environment of and limitation of radioactive releases from nuclear power plants, 14. Dec. 1992

YVL 7.2 Evaluation of population doses in the vicinity of a nuclear power plant, 23 Jan. 1997 (in Finnish)

YVL 7.3 Evaluation of models for calculating the dispersion of radioactive substances from nuclear power plants, 23 Jan. 1997 (in Finnish)

YVL 7.4 Nuclear power plant emergency response arrangements, 23 Jan. 1997 (in Finnish)

YVL 7.5 Meteorological measurements of nuclear power plants, 28 Dec. 1990

YVL 7.6 Monitoring of discharges of radioactive substances from nuclear power plants, 13 July, 1992

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YVL 7.8 Environmental radiation safety reports of nuclear power plants, 11 Dec. 1995 (in Finnish)

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YVL 8.1 Disposal of reactor waste, 20 Sept. 1991

YVL 8.2 Exemption from regulatory control of nuclear wastes, 19 March 1992

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