

Nuclear power plant emergency preparedness

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Authorisation

By virtue of section 55, second paragraph, point 3 of the Nuclear Energy Act (990/87) and section 29 of the Council of State Decision (395/91) on General Regulations for the Safety of Nuclear Power Plants, the Finnish Radiation and Nuclear Safety Authority (STUK) issues detailed regulations concerning the safety of nuclear power plants.

YVL Guides are rules an individual licensee or any other organisation concerned shall comply with, unless STUK has been presented with some other acceptable procedure or solution by which the safety level set forth in the YVL Guides is achieved. This Guide does not alter STUK's decisions which were made before the entry into force of this Guide, unless otherwise stated by STUK.

1 General

The use of nuclear energy is stipulated in the Nuclear Energy Act (990/87) and the Nuclear Energy Decree (161/88) issued by virtue of the Act. According to section 3, point 7 of the Nuclear Energy Act, emergency preparedness means *the measures needed to reduce nuclear damage at the nuclear facility, in its precincts, in other places or vehicles where nuclear energy is used.*

In accordance with paragraphs 1 and 2 of section 9 of the Nuclear Energy Act *it shall be the licence-holder's obligation to assure the safe use of nuclear energy. It shall be the licence-holder's obligation to assure such physical protection and emergency planning and other arrangements, necessary to ensure reduction of nuclear damage, which do not rest with the authorities.* In practice, the licensee is obliged to assure the safety of the nuclear power plant under all circumstances.

Section 7 of the Nuclear Energy Act decrees about physical protection and emergency preparedness as follows:

Sufficient physical protection and emergency preparedness as well as other arrangements for reducing nuclear damage and for protecting nuclear energy against illegal activities shall be a prerequisite for the use of nuclear energy.

The Council of State Decision (397/91) sets forth general regulations for nuclear power plant emergency preparedness.

The licensee's emergency plan includes a description of emergency preparedness planning, implementation and maintenance. The emergency plan sets out the measures to be taken during an emergency situation. An emergency situation means an unusual situation, which requires the emergency organisation to be alerted.

In an emergency, the on-site emergency manager of the nuclear power plant is in charge of onsite rescue operations until the rescue au-

thority announces that it assumes command responsibility for the operations.

As prescribed in Guide YVL 1.1, STUK maintains preparedness to act in case of nuclear power plant emergency situations. In the event of emergencies, STUK is an expert authority providing support to authorities in charge of emergency services.

This guide sets forth detailed requirements for the planning, implementation and maintenance by the licensee of nuclear power plant emergency preparedness. This guide also applies to nuclear material and nuclear waste transport, as referred to in Guide YVL 6.5. Nuclear power plant physical protection is set forth in Guide YVL 6.11 and the physical protection requirements for nuclear fuel transport in Guide 6.21.

Illicit action can take place during an emergency situation. According to section 10, first paragraph, of the Council of State Decision (396/91) on general regulations for the physical protection of nuclear power plants, *during a threat, immediate action in compliance with the security plan shall be taken. Even other measures to gain control of the threat shall be taken, where necessary.* According to paragraph 3, *during a threat, the person designated for the task in the security plan takes over command of onsite activities. Command of activities is handed over to the police when the police officer concerned announces he assumes command of physical protection.* [— —].

Rescue operations and physical protection shall be co-ordinated to facilitate evaluation of the safety of the nuclear power plant, its workers, the population and the environment as a whole.

2 Emergency response requirements

2.1 Emergency plan

The emergency plan shall cover the following matters:

- classification of emergency situations and description of events and accidents on which classification is based (see subsection 2.2)
- description of the emergency organisation (see subsection 2.3)
- description of arrangements for alerting and communication (see subsection 2.4)
- management of an emergency situation and assessments of the situation (see subsection 2.5)
- worker safety and radiation protection (see subsection 2.6)
- on- and offsite radiation measurements during an emergency situation (see subsection 2.7)
- provision of information (see subsection 2.8)
- rooms, equipment and facilities (see subsection 2.9)
- post-emergency measures (see subsection 2.10)
- a description of the maintenance of preparedness (see chapter 3).

In addition, the emergency plan shall include the licensee's actions relating to rescue operations (see chapter 4). Instructions pertaining to emergency response shall also be appended to the plan.

The emergency plan is a public document, with the exception of contact data and some technical instructions to be specified separately.

2.2 Emergency response planning

According to section 3 of the Council of State Decision (397/91), *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 manageability of events as well as severity of their consequences. Therefore, emergencies shall be grouped into classes.

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

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

The progress and consequences of typical accident scenarios shall be analysed to facilitate emergency response and the classification of emergency situations. Highly unlikely accidents, which may have severe consequences, shall also be analysed. In the accident scenarios, various plant states and event durations and the quantities, qualities and release pathways of radioactive releases plus weather conditions shall be used. The radiation situation around the power plant shall be analysed at various distances and for various periods of time, considering both internal and external radiation dose. The impact of protective measures shall be separately analysed.

Radiation conditions that may hamper actions at the plant and plant site shall be analysed in advance to plan what action and radiation protection measures should be taken during accidents.

Guide YVL 7.3 sets requirements for the criteria for calculating the dispersion of radioactive substances. Guide YVL 7.2 deals with the calculation of radiation doses to the population in the vicinity of a nuclear power plant.

Emergencies shall be rated by severity and manageability as follows:

- A **site emergency** is a situation during which the nuclear power plant's safety deteriorates or is in the danger of deteriorating significantly. In the event of a plant emergency, STUK shall be alerted and the rescue authorities informed without delay.
- A **general emergency** is a situation during which the hazard of a radioactive materials leak exists, which may require protective measures in the vicinity of the nuclear power plant. In the event of a general emergency, STUK and the rescue authorities shall be alerted without delay.

Preparedness situations also include a **emergency standby**, which involves alerting the nuclear power plant emergency organisation in the extent necessary to ensure the plant safety level. The **emergency standby** and its justification shall be promptly communicated to STUK and, if necessary, to the local rescue authority.

The emergency plan shall show the emergency classification levels. In addition to this, examples of various emergency situations shall be given. Information about the state of the plant and its components or systems shall be given to establish the situation. The plant's emergency operating procedures can also be used for event identification.

2.3 Emergency organisation

According to section 4 of the Council of State Decision (397/91), *the duties and responsibilities of personnel who plan and implement emergency response arrangements (emergency organisation) shall be defined.*

Duties

The emergency organisation is headed by an on-site emergency manager who shall be in charge of on-site emergency response and liaison with the authorities. He is the person referred to in section 8, third paragraph of the Council of State Decision (397/91) who uses authority of command according to section 30, third paragraph, of the Act (559/75) on fire and rescue services until the rescue authority assumes command.

The on-site emergency manager is responsible for:

- identifying and announcing the emergency classification level
- managing the safety of those onsite
- managing plant safety
- alerting the authorities
- securing the transport and care of those injured
- keeping an event log
- informing the emergency organisation, power plant personnel and authorities
- providing information to the media (see subsection 2.8)

- ordering plant site evacuation
- issuing recommendations for evacuation in the plant environment and for the carrying out of other counter-measures in the plant surroundings, if necessary, until STUK announces it assumes responsibility for the issuing of recommendations
- having radiation measurements made and environmental samples taken on- and offsite
- restricting and managing damage
- deciding about the scope and termination of the emergency organisation's operation.

In the emergency plan, a sufficient number of individuals shall be assigned to perform the aforementioned tasks.

If the emergency manager is not at the plant site in the event of an accident, the shift supervisor shall act in his stead until he arrives and assumes command responsibility.

The emergency organisation

The individuals or organisation units responsible for preparing and maintaining the emergency plan shall be named. When defining the duties involved, attention shall, in addition to overall planning, be paid to the planning of the various sectors of emergency response.

The emergency plan shall describe the actions to be taken in emergency situations and how duties are assigned and carried out. For this purpose, the plan shall include the emergency organisation's structure and tasks and the assignment of duties within it. Furthermore, the plan shall give a general picture of other organisations active in emergencies and of their most important duties.

The functions of a nuclear power plant's emergency organisation shall be presented in such a way that the nuclear power plant's obligations in the management of an emergency are defined in the emergency plan. The plan shall also describe how the plant's operation is coordinated with rescue operations carried out by authorities and with STUK's activities.

Preparedness to act

The nuclear power plant shall have a sufficient 24-hour preparedness for immediate emergency response, should it be required. The emergency plan shall describe the nuclear power plant's constantly available emergency organisation and also its organisation when fully manned.

The licensee shall be prepared to continue the operation of the emergency organisation for several days in succession and to supplement the organisation, if necessary. The plan shall give a target period after which, at the latest, the emergency organisation is capable of operating efficiently. The organisation's availability shall be regularly tested.

2.4 Alerting and communication

According to section 5, third and fourth paragraphs, of the Council of State Decision (397/91) *there shall be appropriate rooms and equipment as well as sufficient communication and alarm systems for emergency response arrangements.*

It shall be ensured that there are always enough personnel promptly available in an emergency.

There shall be preplanned procedures for alerting and communicating with those at the plant site, the plant emergency organisation and the authorities' emergency response and rescue organisations. In addition, the contents of alarm messages shall be planned in advance. Alarm and communication procedures during situations defined in the emergency plan shall be agreed upon with offsite organisations. The licensee's emergency instructions shall include a procedure for assuring the recording of spoken alarms and the most important spoken messages.

2.5 Management of an emergency situation

According to section 5, first paragraph, of the Council of State Decision (397/91) *provision shall be made at a nuclear power plant to carry out in*

an emergency the measures necessary to keep an accident under control. Provision shall be made to analyse the emergency and its consequences as well as to assess their postulated development.

Section 8, first paragraph, of the Council of State Decision (397/91) stipulates about emergency actions as follows: *In an emergency, immediate action in compliance with the emergency plan shall be taken. Also in other respects, effective action shall be taken to prevent or limit radiation exposure.*

The emergency organisation shall prevent or restrict the progress of an accident and its duty is to bring the plant into a safe state. Radiation effects at the plant, on the plant site and in the plant's environment, which are caused by an uncontrolled release of radioactive materials, shall be prevented or restricted as well as possible.

According to Guide YVL 1.9, the licensee shall make provision against abnormal situations by preparing emergency operating procedures to guide work during operating shifts, and, in the event of disturbances and emergencies, it shall also assign an individual to the main control room to give support to the shift manager. This individual's other duty will be to independently assess nuclear safety.

During an emergency situation, the emergency organisation shall make assessments of the situation, its development and possible causes. When an assessment of the situation is made, the plant's technical condition and the radiation situation inside the plant, on the plant site and in its environment are assessed. On the basis of the assessment, measures to manage the situation and to prevent and restrict radiation exposure shall be planned and implemented. These assessments are also needed for the planning of measures to protect workers and the population as well as for the provision of information.

Requirements for environmental radiation situation assessment procedures are prescribed in Guide YVL 7.2 and YVL 7.3.

There shall be pre-planned procedures for the planning, approval and implementation of operations and repairs during emergencies.

The licensee shall assure that the various units of the emergency response and rescue organisations and STUK have sufficient and uniform data about a situation. The liaison and data transfer needed for situation assessment shall be arranged in such a way that there is as little as possible interference with the activities of the emergency organisation's various units, the control room in particular. There shall be liaison officers and automated data transfer equipment for handling liaison and data transfer. In addition to this, in an emergency, the licence-holder shall send a liaison officer to the rescue services command centre of the co-operation area and to the local area information centre.

2.6 Worker safety and radiation protection

According to section 8 of the Radiation Decree (1512/91) *measures needed to restrict the radiation hazard and bring the radiation source under control in an accident situation shall be taken in such a way that the radiation exposure due to the situation is kept as low as possible.*

As far as possible, the measures referred to above in the first paragraph shall be taken in such a way that the effective dose of a person participating in them does not exceed 0.5 Sv and the dose at any point on the skin does not exceed 5 Sv.

A pregnant woman shall not be ordered to take part in measures causing exposure to radiation referred to in this section.

Only volunteers should be assigned to perform accident restriction measures involving the possibility of radiation exposure in excess of 50 mSv. These persons shall be appropriately trained and aware of the potential health risks of radiation exposure.

All actions should be planned in advance. Radiation exposure should be kept below 100 mSv. Exceptions to this are life saving operations and prompt action to bring a radiation source under control.

To monitor radiation exposure, those participating in accident restriction must carry a dosimeter, which reliably records the dose incurred, and also an alarming real-time dosimeter with alarm limits set in accordance with the above-mentioned dose limits. Workers must have appropriate protective equipment and a radiation work permit. Requirements for these are set in Guide YVL 7.9.

There shall be procedures for the preparation and granting of a radiation work permit in an accident situation. It shall be planned in particular what the procedures should be if doses exceeding the annual limit for normal operations might be incurred. When issuing the permit, attention shall be attached to the establishment and monitoring of the radiation situation in the work area, to instructions pertaining to habitability times and whether the reduction of radiation exposure is possible. Procedures for the decontamination of workers and equipment shall also be planned in advance.

There shall also be preplanned access monitoring to areas where a radiation work permit is required plus procedures for keeping in contact with those working in the restricted area.

Dose monitoring shall be arranged in such a way that dosimeters are read and the accumulation of dose is regularly followed according to the situation. If necessary, individual doses shall be recorded after each task has been performed. Internal exposure shall also be monitored. Radiation exposures in excess of 50 mSv shall be reported to STUK's Dose Register separately and without delay.

Data on radiation exposure incurred in an emergency situation shall be recorded and reported to STUK's Dose Register separately from doses incurred during normal operation.

Doses incurred by all those onsite in an emergency situation shall be monitored as required by the radiation situation. Radiation doses in excess of 5 mSv incurred by the rescue personnel and other corresponding external workers shall be reported without delay to STUK's Dose

Register after the accomplishment of work onsite.

The emergency organisation must have a sufficient number of personal protective equipment available for emergency situations. This equipment shall be stored or placed appropriately for quick availability. There shall be rooms available for the decontamination of workers and equipment during emergencies.

The licensee shall make provision for assisting the rescue authorities in rescuing, giving first aid to and transporting injured workers to hospital. The instructions must take into account the possible contamination of patients.

2.7 Radiation measurements

According to section 5, second paragraph, of the Council of State Decision (397/91) *on site of a nuclear power plant provision shall be made to carry out radiological and meteorological measurements in an emergency to assess the dispersion of radioactive substances.*

According to section 9, first paragraph, of the Council of State Decision (397/91) *in an emergency, the licensee shall arrange for off-site radiation monitoring in order to promptly obtain information on the dispersion of radioactive substances in the environment.*

The licensee shall be prepared to evaluate the volume and nuclide composition of radioactive releases in all emergency situations and to make prognoses pertaining to them. For this purpose, onsite and offsite measurement programs shall be designed for identifying exceptional releases. In addition to the continuous measurement of radioactive releases, the nuclear power plant shall also have facilities for measuring unusual radioactive releases at all dose rates that may occur. In addition to this, the licensee shall be prepared to carry out in the plant's vicinity measurements that help the authorities to establish what radioactive releases into the environment have occurred and what measures are needed to protect the population.

Radiation and release measurements are dealt with more closely in the Guides YVL 7.6, YVL 7.7 and YVL 7.11. The requirements for meteorological measurements are set forth in Guide YVL 7.5.

Plans for making measurements at the nuclear power plant and in its vicinity shall be prepared as part of response planning. Local conditions shall be taken into account in these plans and they shall also indicate the degree of preparedness of the personnel, the schedule of activities, the number and types of measurement equipment ready for use, the filing of measurement results, as well as personal protective equipment. There shall also be plans for the taking of samples.

During an emergency, there shall be preparedness to apply and complement measurement and sampling plans according to the prevailing situation. The radiation conditions allowing, environmental patrols shall be employed to complement data transmitted by fixed measurement stations about the location and composition of the radioactive plume and fallout. In order to rapidly obtain a general picture of the radiation situation, if possible, the highest dose rate and airborne concentrations of the most important nuclides corresponding to the dose rate shall be measured at several distances from the point of release.

The nuclear power plant shall have a sufficient number of measuring equipment continuously ready for use for onsite and offsite measurements. The equipment shall be appropriately placed. Each measurement patrol shall be capable of measuring external dose rate at all possible radiation intensities concerned. At least one environmental measurement patrol must be capable of taking samples and measuring them for significant concentrations of airborne radioactive substances. A sufficient number of dosimeters shall be available for placement in the plant environment.

The environmental measurement patrols shall have in their use vehicles suited for the making

of measurements and channels for communicating with the onsite emergency organisation. A reliable pre-planned method shall be used for identification of the measurement locations. Data transfer for use by the power plant emergency organisation, rescue organisations as well as STUK shall be planned in such a way that the data are available quickly and reliably.

2.8 Information to the public

According to section 5, fifth paragraph, of the Council of State Decision (397/91) *informing the media and the public in an emergency shall be preplanned*. Section 9, second paragraph, stipulates that *the licensee shall, in co-operation with the authorities responsible for rescue services, supply the local population with advance instructions for emergencies*. [— —].

Provision of information in advance

In co-operation with the authorities in charge of the rescue services, the licensee shall see to it that information material is distributed to all permanently occupied and free-time residences as well as workplaces in the emergency planning zone (with a radius of about 20 km from the plant). The material should include the following information:

- basic information about radioactivity and its effects on man and the environment
- examples of various radiation hazard situations and their effect on the population and the environment
- planned measures to alarm, protect and help the population in a radiation hazard
- instructions for actions in a radiation hazard.

The information material shall be regularly updated and disseminated and continuously available to the population in the emergency planning zone.

Provision of information during an event

The off-site emergency manager is responsible for providing information about accidents and rescue operations. Only the off-site emergency manager may issue instructions and orders to

the population. STUK follows and assesses situations involving a radiation danger or the threat of it and provides information to other authorities and the population.

The licensee, too, shall be prepared to provide information about the emergency in question, its origin, extent and likely progress via the media to the population at risk at regular intervals and every time the situation essentially changes. When disseminating information, the licensee shall take into account the information provided by the authorities.

For the purpose of public information there shall be preparedness during emergency response operations to classify a situation according to the International Nuclear Event Scale (INES). There shall also be preparedness to change preliminary classification if the situation changes or when more detailed information is obtained. The preliminary classification with its justification shall be delivered to STUK who decides the final emergency classification level.

2.9 Rooms, equipment and facilities

According to section 5, third paragraph, of the Council of State Decision (397/91) *there shall be appropriate rooms and equipment as well as sufficient communication and alarm systems for emergency response arrangements*.

Rooms and equipment

For the purpose of rescue operations, the nuclear power plant shall have rooms, equipment, facilities and instruments for accident management, overall assessment of the situation, alerting, communication, data transfer and recording, provision of information, planning and repair, fire protection, transport, assembly and decontamination of personnel, first aid, personnel monitoring as well as the making of radiation and laboratory measurements.

The rooms reserved for emergency response shall be designed in such a way that working there is safe during an event. Access routes between the rooms shall be sufficiently quick

and safe. Access control shall be planned in such a way that the whereabouts of those on the site are known and that the operation of the emergency organisation is not disturbed.

The rooms reserved for accident management, assessment of the situation, emergency response planning and laboratory measurements shall be provided with equipment, systems and computer programs for making an assessment of the situation, for updating the assessment, for presenting and recording the situation and for communication. The situation shall be assessed as promptly as possible and it shall be explicitly presented. These rooms and equipment shall be available also in case large quantities of radioactive materials have been released onsite and also in case power supply has been interrupted both onsite and offsite.

STUK sends its representative to the nuclear power plant, if necessary. STUK's representatives shall be reserved working space near the rooms reserved for emergency response.

There shall also be offsite facilities available for media briefings.

A record shall be kept of the location, availability and operability of the rooms, equipment and accessories.

Communication

The control room and emergency response command posts shall be equipped with redundant alarm and communication systems to warn those in danger, to launch emergency response and rescue operations and to keep contact with the command and operations units of the emergency organisation, the rescue services command centre of the co-operation area and STUK.

Spoken connections between the control room and emergency command posts shall as a rule be independent of single failures. The number of connections shall be adequate. The personnel who carry out onsite and offsite measurements and repairs shall have the necessary devices for

keeping in contact with the operations command post.

STUK's representative shall be reserved an own telephone connection for offsite communication at the emergency response command post.

The control room and emergency response command posts shall be equipped with communication equipment, which produce records of their use.

For making an assessment of the situation, the licensee shall arrange a system for automatic data transfer and display from the power plant's computer system to STUK and to the onsite emergency response command posts. A redundant configuration shall also be designed in provision against system failures or malfunctions.

The contents of transferred data shall be so planned that all data having relevance to the situation and to the assessment of its development are transferred. Data on the status of plant systems and measured parameters shall be transmitted. The data transmission system must be capable of relaying both the current situation and the previous one for a sufficiently long period of time to facilitate event progress monitoring. When data transmission is planned attention shall also be paid to the lucid presentation of data.

The transmitted data shall include at least

- reactor main parameters
- primary circuit main parameters
- secondary circuit main parameters (PWR)
- make-up and emergency cooling systems
- decay heat removal systems
- containment main parameters
- the most important reactor and plant protection signals
- the most important electrical systems
- radiation situation at the plant unit
- radiation situation onsite
- radiation situation in the plant vicinity
- meteorological data.

Furthermore, the transfer of measurement results yielded by environmental patrols as well as of calculated environmental radiation situations and prognoses between the emergency command posts and to STUK shall be arranged.

2.10 Post-emergency measures

The principles governing post-emergency measures shall be defined. A precondition for declaring an end to an emergency situation is that the nuclear power plant has been brought into a safe state, that releases do not exceed the thresholds set for normal operation and that post-emergency measures are initiated.

Post-emergency measures include at least the following:

- identification of any changes in the nuclear power plant's structures, components or systems with a bearing on keeping the plant in a safe state and managing radioactive materials
- measures which may be required to keep the plant in a safe state and to prevent and reduce releases
- evaluation of radiation doses caused by the accident
- investigation of event causes and preparation of an event report.

Decontamination measures and waste management shall also be undertaken, if necessary. If rescue operations are continued after the post-emergency debriefing, there shall be preparedness for co-operation in a way corresponding to that during an emergency.

2.11 Emergency response records

The licensee shall have procedures for recording data on the course of events and decisions of essential importance.

3 Maintenance of preparedness

According to section 9, third paragraph, of the Council of State Decision (397/91) *the licensee*

shall maintain continuous preparedness to perform measures related to rescue services in an emergency. These measures shall be practised in co-operation with the authorities concerned. [— —].

According to section 7 of the Decision *appropriate training and exercises shall be arranged to maintain operational preparedness. Exercises shall also be arranged in co-operation with the authorities concerned.*

The rooms and equipment reserved for emergency response arrangements shall be maintained operational at all times.

Documents pertaining to emergency response arrangements shall be continuously updated.

Operability of rooms and equipment

The rooms shall be provided with the necessary equipment that are available for prompt action. The operability of all rooms, accessories and equipment shall be regularly ascertained at least once a year. The alarm devices as well as the communication and data transfer connections shall be regularly tested according to a separate programme at least once a month. A repair time shall be determined for faults, disturbances and defects detected by tests or in some other way. The significance of detected faults and defects shall be assessed to identify potential needs for improvement.

The emergency plan and other documents pertaining to emergency response shall be reviewed and regularly updated at least once a year. All changes in contact information and computer programs shall be promptly made. When the emergency plan is revised, any defects detected during emergency exercises or otherwise shall be taken into account, as well as technical developments in the field, plus changes in operational conditions and legislation.

Training

Guide YVL 1.7 deals with the qualification and training of nuclear power plant personnel.

Those in the emergency organisation shall be given basic training according to their tasks prior to their assignment to a task. They shall be arranged refresher and further training every year. Special attention shall be paid to defects and development targets observed during emergency exercises.

All nuclear power plant staff, both permanent and temporary, shall be given training in how to act during emergency situations. The training shall deal with alarm and accident situation instructions. Furthermore, an general idea of the operation of the emergency organisation during emergency situations shall be given.

The licensee shall make available training in nuclear power plant emergency preparedness to organisations contributing to the operation of the rescue service.

An emergency training and exercise plan shall be drawn up every year.

Emergency exercises

Before the commissioning of a nuclear power plant unit, an exercise in the practical implementation of the emergency plan shall be arranged in co-operation with the emergency and rescue organisations of relevant authorities.

During the operation of a nuclear power plant, extensive joint exercises testing the emergency response and rescue operations of public authorities and the nuclear power plant shall be arranged approximately every three years. The licensee shall participate in the planning, arrangement and implementation of the exercises.

When the nuclear power plant is in operation there shall be at least one emergency exercise every year. The objective of the exercises is to ascertain the appropriateness of rooms, equipment and instruments reserved for emergency response; the suitability, compatibility and scope of instructions and computer programs; and the capability of the organisation to identify potential needs for modifications or improvements.

Public rescue and emergency organisations shall be reserved the opportunity to participate in these exercises in a way that is suitable regarding the exercise situation.

The annual emergency exercise shall cover a significant part of the activities contained in the emergency plan. Event exercises involving one or several sectors shall be arranged, too, to practice the performance of tasks, to improve co-operation and to develop operation.

An exercise plan shall be prepared before an emergency exercise is held. The date and participants of the exercise can be announced in advance but the exercise situation shall be kept unannounced in the first place. Exercises involving only some sectors of response planning can also be arranged for training purposes, in which case the exercise situation may be known in advance.

The annual emergency exercises shall be evaluated. For this purpose, evaluators shall witness the exercises. The experiences of and suggested improvements by the participants to the exercise shall be collected for example in a post-exercise debriefing, by interviews or by means of written feedback.

An exercise report shall be prepared, stating any observed defects or objects of development and actions decided on their basis.

An exercise and training record shall be kept to evaluate the scope and quality of the activities. A record shall be kept of all who have taken part in the training and exercises to ensure the regular participation of those with assigned emergency response duties.

4 Protection of the public

4.1 Rescue services

According to section 9, third paragraph, of the Council of State Decision (397/91) *the licensee*

shall maintain continuous preparedness to perform measures related to rescue services in an emergency. The plans for measures pertaining to rescue services are set forth in the emergency plan.

According to section 8, third paragraph, of the Council of State Decision (397/91) *on site of a nuclear power plant, the authority of command referred to in Section 30, third paragraph of the Act (559/75) which addresses rescue services is exercised by the individual designated for the task in the emergency plan until the rescue service officer concerned announces he assumes command responsibility for rescue activities. Enough assisting personnel with expert knowledge of nuclear technology and radiological protection shall then be placed at the disposal of the authority.*

The individual in charge of the licensee's activities is obliged to comply with the instructions pertaining to rescue operations issued by the public authority who has assumed command responsibility for the rescue operations. In practice, however, the licensee is always responsible for matters of nuclear safety and radiation protection at the plant and on the site.

Rescue operations management is based on the Fire and rescue services act (559/75) and decree (1089/75). The rescue administration management system is based on the allocation of responsibilities at local level in the whole of Finland. The Ministry of the Interior in co-operation with the rest of the central government authorities is responsible for measures at national level. Corresponding responsibility at provincial level rests with provincial governments, which act in co-operation with other local administration authorities. Municipal chief fire officers and rescue authorities manage action taken in their fields of responsibility. By virtue of section 29 of the Fire and rescue services act (559/75), the Ministry of the Interior can order an official in its employment to take command of rescue operations.

Rescue command by the Ministry of the Interior and provincial governments entails in the first place procurement and channelling of the necessary resources to appropriate targets, maintenance of a general picture of the situation, and, on that basis, issuing of orders and instructions to lower levels of management as well as provision of information. Municipal chief fire officers and authorities are responsible for arranging and managing actual rescue operations and other actions required in a situation.

In plans prepared in provision for a nuclear power plant accident, it is assumed that when rescue operations are initiated the municipal chief fire officer of the area of location of the power plant assumes rescue management and initiates the necessary notification, alerting and rescue operations. In the event of a severe accident, which, in addition to the neighbouring municipalities, requires extensive action elsewhere, too, the aforementioned national command system is taken into use in the extent required.

According to section 8, second paragraph, of the Council of State Decision (397/91) [— —]. *The rescue services command centre and STUK shall be provided with the information necessary in the event of an emergency.*

It is STUK's duty in a radiation situation caused by a radiation and nuclear accident to assess the situation and to issue to the authority responsible for rescue operations recommendations for counter-measures, if any, to reduce the radiation exposure of the population.

In the early stages of an accident situation, the nuclear power plant's emergency organisation shall ensure that recommendations for counter-measures to protect the population are issued to the authority in command of the rescue operations. This obligation stands until STUK has sufficient information about the event and announces to assume responsibility for the issuing of recommendations. Even after that the power plant emergency organisation shall assess the

course of the accident and its consequential effects and deliver the information to STUK.

According to section 9, second paragraph, of the Council of State Decision (397/91) [— —]. *In emergencies the licensee is obliged to take part in warning and alerting those in jeopardy.*

The warning and alerting of those onsite and of the population in imminent danger in the vicinity of the nuclear power plant shall be planned in co-operation with the responsible authorities. The plan covering the site of the nuclear power plant shall include alerting, provision of information about the situation, issuing of instructions for action, and instructions on how to assemble and exit the plant site. It shall be ensured that everybody on-site is alerted. To ensure efficient action, the vehicles and routes for exiting the plant site shall be assessed in advance as well as the time it takes to exit the site. The nuclear power plant must be equipped with an efficient alarm system for alerting the population. The system shall be capable of operation although any single component would be inoperable.

Stable iodine tablets for use in permanent and free-time dwellings as well as workplaces shall be distributed to the population in advance at least at five kilometres' distance from the nuclear power plant. The tablets are subject to regular re-issuing when their use by date passes.

4.2 Guidelines for intervention levels to protect the population

The following shall be taken into account when issuing recommendations for counter-measures.

The objective of radiation protection in an emergency (an intervention situation) is to prevent all serious direct (deterministic) health effects of radiation and to keep any stochastic effects of radiation as low as practically possible in all population groups. The starting-point for the consideration of counter-measures is that the measures shall be justifiable under the circumstances in question.

The off-site emergency manager decides about counter-measures on the basis of recommendations. When counter-measures are planned, the prevailing situation and the benefits and disadvantages ensuing from them are considered. For example, the objective of evacuation is that a release would not in a period of less than a week cause radiation doses in excess of 50 mSv.

During an accident, radioactive materials released from nuclear fuel can be quickly transported to the environment. It is thus necessary to initiate measures to protect the population already before the reactor is damaged, if practicable. First action in the plant's vicinity is to warn the population and to request preparation for sheltering. If the estimates are that the plant transient leads to severe reactor damage, it is recommendable to carry out evacuation in the plant vicinity in an area with a ca. 5 km radius. In the same way, it is necessary to prepare for the intake of stable iodine by intensifying or supplementing emergency preparedness, if necessary.

Gradual evacuation is recommendable at the latest when an accident has reached a phase where a reactor core melt is assumed to have occurred. It is advisable to carry out evacuation according to need in an area extending to a ca. 20 kilometres' distance from the facility. The area subject to evacuation can also extend further in case the weather conditions are particularly unfavourable from the viewpoint of the dispersion of the release, or it is assumed on the basis of measurements made during the accident that the amount of radioactive iodine in the release may be in excess of one per cent of the amount of radioactive iodine in the reactor.

If dose rates within the impact zone of the accident can be reliably assessed on the basis of on-site or off-site environmental measurements, the intervention level guidelines in Table I are employed when counter-measures are considered to protect the population. If doses are predominantly caused by noble gases, the guidelines for intervention levels are multiplied by five.

Table I. Guidelines for intervention levels when issuing recommendations to the off-site emergency manager for protection of the population during a radiation situation that involves a release of unknown consistency. If most doses are likely to be incurred from noble gases, the numerical values in the Table are multiplied by five.

Counter measure	Guidelines for intervention levels as external dose rate ¹
Protecting cattle and its fodder	10 µSv/h
Sheltering	100 µSv/h
Ingestion of stable iodine	100 µSv/h
Access controls	100 µSv/h
Evacuation	500 µSv/h

¹ External dose rate in the plant environment or anticipated on the basis of plant measurements

5 Regulatory control

According to section 35 of the Nuclear Energy Act *when applying for a construction licence, the applicant must submit to the Finnish Centre for Radiation and Nuclear Safety: [— —] 4) plans for physical protection and emergencies.* According to Section 36, first paragraph, *when applying for an operating licence, the applicant must submit to the Finnish Centre for Radiation and Nuclear Safety: [— —] 6) a description of the arrangements for physical protection and emergencies.*

According to section 6 of the Council of State Decision (397/91) *approval for the plan referred to in Section 35, point 4 (preliminary emergency plan) and the report referred to in Section 36, first paragraph, point 6 of the Nuclear Energy Decree (161/88) and amendments therein shall be applied for with the Finnish Centre for Radiation and Nuclear Safety.*

The licensee shall provide the Ministry of the Interior, the country government and the rescue service authority concerned with approved emergency plans and amendments therein.

STUK regulates the operation of nuclear power plants as described in Guide YVL 1.1. This Guide sets forth i.a. general procedures for the updating of documents approved by STUK. Any contact information updates to an emergency

plan and other corresponding minor changes or further definitions to instructions, which do not affect operation, are to be delivered to STUK for information.

STUK shall be sent for information the annual plan for emergency exercises and training and a summary of their implementation as well as a more detailed emergency exercise plan with descriptions of situations. A report on the exercise shall be delivered to STUK for information within three months from the exercise. The training given to nuclear power plant personnel is subject to STUK's control as described in Guide YVL 1.7.

During emergencies STUK monitors and assesses the situation and its development as well as the appropriateness of measures taken at the nuclear power plant to manage the situation. STUK's nuclear safety team maintains contacts with the nuclear power plant's emergency organisation, sends an emergency team to the site of the accident and monitors data on the condition of the plant and its environment obtained from the nuclear power plant by automatic data transmission.

STUK's approval need not be obtained for measures required in an emergency. If necessary, STUK gives recommendations to the licensee for emergency response measures and accident management.

STUK prepares an overall assessment of the situation on the basis of the plant's condition and its postulated development and the situation in the plant's environment. On the basis of the overall assessment STUK issues recommendations for rescue operations, if necessary. These are presented to the off-site emergency manager who makes the necessary decisions.

6 References

- 1 International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources, IAEA Safety Series No. 115, Vienna 1996.
- 2 Preparedness of the Operating Organisation (Licensee) for Emergencies at Nuclear Power Plants, IAEA Safety Guide No. 50-SG-O6, Vienna 1982.
- 3 Preparedness of Public Authorities for Emergencies at Nuclear Power Plants, IAEA Safety Guide No. 50-SG-G6, Vienna 1982.
- 4 On-site Habitability in the Event of an Accident at a Nuclear Facility, IAEA Safety Series No. 98, Vienna 1989.
- 5 Emergency Preparedness Exercises for Nuclear Facilities: Preparation, Conduct and Evaluation, IAEA Safety Series No. 73, Vienna 1985.
- 6 Intervention Criteria in a Nuclear or Radiation Emergency, IAEA Safety Series No. 109, Vienna 1994.
- 7 Principles for Intervention for Protection of the Public in a Radiological Emergency, ICRP Publication No. 63, Annals of the ICRP 22 4, Pergamon Press, Oxford 1993.
- 8 Emergency Response Planning and Preparedness for Transport Accidents Involving Radioactive Materials, IAEA Safety Series No. 87, Vienna 1988.
- 9 Protective measures in a radiation situation and information to the Public. Order of the Ministry of the Interior 1/97.
- 10 EU Council Directive 89/618/Euratom of 27 November 1989 on informing the general public about health protection measures to be applied and steps to be taken in the event of a radiological emergency.
- 11 EU Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation. OJ No L 159, 29. 6. 1996, p. 1.