STUK

GUIDE **YVL 7.4** / 9 JANUARY 2002

NUCLEAR POWER PLANT EMERGENCY PREPAREDNESS

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Authorisation

By virtue of the below acts and regulations, the Radiation and Nuclear Safety Authority (STUK) issues detailed regulations that apply to the safe use of nuclear energy and to physical protection, emergency preparedness and safeguards:

- Section 55, paragraph 2, point 3 of the Nuclear Energy Act (990/1987)
- Section 29 of the Government Resolution (395/1991) on the Safety of Nuclear Power Plants
- Section 13 of the Government Resolution (396/1991) on the Physical Protection of Nuclear Power Plants
- Section 11 of the Government Resolution (397/1991) on the Emergency Preparedness of Nuclear Power Plants
- Section 8 of the Government Resolution (398/1991) on the Safety of a Disposal Facility for Reactor Waste
- Section 30 of the Government Resolution (478/1999) on the Safety of Disposal of Spent Nuclear Fuel.

Rules for application

The publication of a YVL guide does not, as such, alter any previous decisions made by STUK. After having heard those concerned, STUK makes a separate decision on how a new or revised YVL guide applies to operating nuclear power plants, or to those under construction, and to licensees' operational activities. The guides apply as such to new nuclear facilities.

When considering how new safety requirements presented in YVL guides apply to operating nuclear power plants, or to those under construction, STUK takes into account section 27 of the Government Resolution (395/1991), which prescribes that *for further safety enhancement, action 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.*

If deviations are made from the requirements of the YVL guides, STUK shall be presented with some other acceptable procedure or solution by which the safety level set forth in the YVL guides is achieved.

Translation. Original text in Finnish.

1 General

The use of nuclear energy is enacted in the Nuclear Energy Act (990/1987) and the Nuclear Energy Decree (161/1988) 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 in vehicles where nuclear energy is used.*

In accordance with paragraphs 1 and 2 of Section 9 of the Nuclear Energy Act *it is the licence holder's obligation to assure the safe use of nuclear energy. It is the licence holder's obligation to assure such physical protection and emergency planning and other arrangements, necessary to ensure limitation of nuclear damage, which do not rest with the authorities.*

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

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

The Government Resolution (397/1991) provides the general regulations concerning the nuclear power plant emergency preparedness.

The licensee's emergency plan includes a description of emergency preparedness planning, implementation and maintenance. The emergency plan describes the measures to be taken in an emergency situation. An abnormal situation, which requires the alerting of the emergency organisation, is considered to be an emergency situation.

In an emergency, the on-site emergency manager of the nuclear power plant is in charge of on-site rescue operations until the rescue authority announces that it assumes command responsibility for the rescue operations.

According to Guide YVL 1.1, STUK maintains preparedness to act in case of a nuclear power plant emergency situation. In a possible emergency situation, STUK acts as an expert authority providing support to authorities in charge of rescue services.

This guide sets forth detailed requirements on how the licensee of a nuclear power plant shall plan, implement and maintain emergency response arrangements. This guide is also applied to nuclear material and nuclear waste transport in situations referred to in Guide YVL 6.5. Requirements on physical protection are presented in a separate guide of STUK.

Requirements on methods used to conduct assessments on the radiation situation of the environment are given in Guides YVL 7.2 and YVL 7.3. Radiation and release measurements are dealt with in more detail in Guides YVL 7.6, YVL 7.7 and YVL 7.11. Requirements concerning meteorological measurements are presented in Guide YVL 7.5.

Illicit action may also take place during an emergency situation. According to Section 10, first paragraph, of the Government Resolution (396/1991) 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 on-site 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 arrangements shall be fit together in such a way that the safety of the nuclear power plant, its workers, the population and the environment is assessed as a whole.

Emergency plan referred to in Section 6 of the Government Resolution (397/1991) is a part of a rescue plan mentioned in Section 10 of the Decree on Rescue Services (857/1999).

2 Emergency response requirements

2.1 Emergency plan

The emergency plan shall cover the following:

- classification of emergency situations and description of events and accidents on which classification is based on (Chapter 2.2)
- description of the emergency organisation (Chapter 2.3)

- description of alert and communication arrangements (Chapter 2.4)
- management of an emergency situation and conducting situation assessments (Chapter 2.5)
- safety of workers and radiation protection (Chapter 2.6)
- on-site and off-site radiation measurements during an emergency situation (Chapter 2.7)
- provision of information to the public (Chapter 2.8)
- premises and equipment (Chapter 2.9)
- termination of an emergency situation and post-emergency measures (Chapter 2.10)
- report on the maintenance of preparedness (Chapter 3).

In addition, the emergency plan shall describe the licensee's actions related to rescue operations (Chapter 4). Instructions on the emergency response activities shall also be attached to the plan.

2.2 Emergency response planning

According to Section 3 of the Government Resolution (397/1991), *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 [rescue] and emergency plans made by the authorities in provision against nuclear power plant accidents.

In order to plan emergency response activities and the classification of emergency situations, events related to different accident scenarios shall be analysed. Also severe reactor accidents shall be considered, and the variations concerning the state of the plant, duration of events, radioactive releases, radioactive release routes and weather conditions shall be taken into account. The radiation situation in the environment of the power plant shall be analysed at various distances and for various periods of time, considering both internal and external radiation doses. The impact of protective measures shall be separately analysed.

Radiation conditions that may hamper actions at the plant and on the plant site shall be analysed in advance to plan the actions and radiation protection measures taken during an emergency.

Guide YVL 7.3 sets requirements on the criteria for calculating the dispersion of radioactive releases. Guide YVL 7.2 deals with the calculation of radiation doses to the population in the surroundings 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 notified immediately.
- A **general emergency** is a situation during which the hazard of such a radioactive material 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 immediately.

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

The emergency plan shall include the classification of emergency situations. In addition, examples of various emergency situations shall be given. The plan shall especially include such information on conditions of the plant, components or systems which define the situation. The plant's operating procedures for disturbance and accident situations may also be used for the identification of the situation.

2.3 Emergency organisation

According to Section 4 of the Government Resolution (397/1991), *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 responsible for the emergency response on the site of a nuclear power plant and liaison with the authorities. The on-site emergency manager is in charge of the on-site emergency response activities until the rescue authority notifies that it assumes command over the rescue operations.

The on-site emergency manager is responsible for the following:

- classification of the emergency situation
- managing the safety of on-site personnel
- managing plant safety
- organising the alerting of the authorities
- securing the transport and care of those injured
- organising event log keeping
- informing the emergency organisation, power plant personnel and authorities
- INES rating of the event
- organising communication to the media (Chapter 2.8)
- ordering plant site evacuation
- issuing recommendations, if necessary, for evacuation in the plant environment and for the carrying out other protective measures in the emergency planning zone until STUK announces it assumes responsibility for the issuing of recommendations
- having radiation measurements made and environmental samples taken both on-site and off-site
- restriction and management of damage
- deciding about the scope and termination of the emergency organisation's activities.

The emergency plan shall describe how these duties are allocated and how they are implemented. Accordingly, the plan shall include the structure, duties and responsibility areas of the emergency organisation.

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

If the emergency manager is not at the plant when an accident occurs, the shift supervisor shall act in his stead until he/she arrives and assumes command responsibility.

In an emergency situation, the shift supervisor and control room on-duty personnel are responsible for the operating activities of the plant in the control room.

Drawing of the emergency plan

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

The emergency plan shall describe the actions taken in emergency situations. In addition, the plan shall give an overall picture of other organisations acting in emergency situations and their main duties. The functions of the nuclear power plant's emergency organisation shall be presented in such a way that the plan defines the responsibility of the nuclear power plant for managing an emergency situation; the plan shall also define how the plant's activities are co-ordinated with the rescue operations of authorities and STUK's activities.

Preparedness to act

The nuclear power plant shall have sufficient 24-hour preparedness for immediate emergency response, should the situation require it. 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 without interruption for several days and to supplement the organisation, if the situation requires it. The plan shall give a target time period during which, at the latest, the emergency organisation is capable of operating efficiently. The availability of the emergency organisation staff shall be regularly tested.

2.4 Alerting and communication

According to Section 5, third and fourth paragraphs, of the Government Resolution (397/1991) *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 pre-planned procedures for alerting and communicating with those on 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 for situations defined in the emergency plan shall be agreed upon with off-site organisations. The licensee's emergency instructions shall include a procedure for assuring the recording of spoken alarms and the most important spoken messages.

Management of an emergency situation

According to Section 5, first paragraph, of the Government Resolution (397/1991) *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 Government Resolution (397/1991) stipulates about emergency response 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 duty of the emergency organisation is to prevent or restrict the progress of an accident and to bring the plant into a safe state. An uncontrolled release of radioactive materials and resulting radiation effects at the plant, on the plant site and in the environment shall be prevented or restricted as well as possible.

According to Guide YVL 1.9, the licensee shall make provision for abnormal situations by preparing procedures for disturbance and accident situations to guide actions of the shift. In the event of disturbances and accidents, the licensee shall also assign an individual to the main control room to give support to the shift manager. In addition to the shift, this individual will independently assess nuclear safety.

During an emergency situation, the emergency organisation shall prepare assessments on the situation, its development and possible causes. In a situation assessment, the plant's technical condition and the radiation situation inside the plant, on the plant site and in its environment are assessed. Based on 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 communicating.

There shall be pre-planned procedures for the planning, approval and implementation of operation and repair actions during emergencies.

STUK's approval for actions needed in emergency situations is not required, but these should be reported as effectively as possible. If needed, STUK will present recommendations to the licensee on emergency response activities and management of the plant situation.

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

Safety of workers and radiation protection

Section 8 of the Radiation Decree (1512/1991, *amendment 1143/1998)* provides that *when applying the maximum values for radiation exposure, no allowance shall be made for exposure arising from immediate measures necessary to limit the radiation hazard resulting from an accident and to bring a radiation source under control. These measures shall be arranged so that the radiation exposure resulting from the situation is limited to the least possible.*

If the radiation exposure resulting from measures referred to in paragraph 1 may exceed any of the dose limits prescribed in Section 3, then the

measures shall be performed on a voluntary basis. The persons performing the measures shall be advised of the hazard pertaining to the said measures. The radiation exposure of persons involved in all immediate measures shall be assessed and their medical surveillance shall be arranged in a manner corresponding to the medical surveillance prescribed for radiation workers in category A.

Except where the matter concerns the saving of human lives, the effective dose of a person involved in the measures referred to in this Section shall not exceed 0.5 Sv and the equivalent dose at any point on the skin shall not exceed 5 Sv.

Furthermore, according to Section 8a of the Radiation Decree (1512/1991, amendment 1143/1998) *no duties shall be assigned to a pregnant woman, either during or after an accident situation, which will cause exposure to radiation.*

According to Section 3 of the Radiation Decree (1512/1991, amendment 1143/1998) *the effective dose caused to a worker by radiation work shall not exceed an average of 20 millisieverts (mSv) per year reckoned over a period of five years, nor 50 mSv in any one year. The annual equivalent dose in the lens of the eye shall not exceed 150 mSv, nor shall the annual equivalent dose at any point on the hands, feet or skin exceed 500 mSv.*

All actions should be planned in advance. A goal shall be to limit the radiation exposure below 50 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 a real-time dosimeter. Workers shall have appropriate protective equipment.

There shall be procedures for the preparation and granting of a radiation work permit in an emergency situation. It shall be planned in particular how to proceed if there is a possibility to receive doses exceeding the annual limit. When issuing the permit, attention shall be paid to the clarification and monitoring of the radiation situation in the workplace, instructions on exposure times and possibilities to reduce the radiation exposure. Procedures for the decontamination of workers and equipment shall also be planned in advance.

There shall also be pre-planned access control to areas where a radiation work permit is required and procedures for keeping in contact with those working in radiation hazardous areas.

Dose monitoring shall be arranged so that the dosimeters are read and the accumulation of doses is followed regularly as required by the situation. If needed, individual doses shall be recorded after each separate task has been performed. Also the exposure caused by internal radiation shall be monitored. Radiation exposure exceeding 50 mSv shall be separately reported to STUK without delay.

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

Radiation doses of all on-site persons in an emergency situation shall be monitored as required by the radiation situation. Radiation doses exceeding 5 mSv incurred by the rescue personnel and other corresponding external workers shall be reported without delay to STUK's Dose Register after their work on-site is finished.

The licensee shall be prepared to assist the rescue authorities in rescuing of, giving first aid to and transporting injured workers to hospital. The procedures shall also take into account the possible contamination of patients.

Section 8 a of the Radiation Decree (1143/1998) provides that *when the immediate measures necessary for limiting a radiation hazard and bringing a source of radiation under control have been performed, the dose limits stipulated in Section 3 shall apply to protection work and other measures seeking to ameliorate the consequences of the accident. The protection of workers, monitoring of radiation exposure and medical surveillance shall be governed by the provisions prescribed for radiation work.*

2.7 Radiation measurements

According to Section 5, second paragraph, of the Government Resolution (397/1991) *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 Government Resolution (397/1991) *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 concerning them. For this purpose measurement programmes implemented at the plant and in its vicinity shall be planned, in order to identify exceptional releases. The nuclear power plant shall have preparedness for the continuous measurement of radioactive releases and, in addition, preparedness for the evaluation of exceptional radioactive releases at all relevant dose rates. In addition, the licensee shall be prepared to carry out such measurements in the plant's vicinity that help the authorities to establish what radioactive releases into the environment have occurred and what measures are needed to protect the population.

Plans for measurements at the nuclear power plant and in its vicinity shall be prepared as part of emergency 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 and reporting 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. If the radiation conditions allow, the data from fixed measurement stations on the location and composition of the radioactive plume and fallout should be complemented with the help of measurement patrols to the surroundings. In order to rapidly obtain an overall picture of the radiation situation, the highest external radiation dose rate shall be measured and related airborne concentrations of the most important nuclides determined as far as possible at some distances from the point of release. Each measurement patrol shall be capable of measuring external dose rate at all radiation intensities concerned. At least one measurement patrol must be capable of taking airborne samples and measuring them for determining the concentrations of the most significant radioactive substances. A sufficient number of dosimeters shall be available to be placed in the surroundings.

The measurement patrols in the surroundings shall have vehicles in their use, suited for measurement activities, and channels for communicating with the on-site emergency organisation. A reliable pre-planned method shall be used for identification of the measurement locations. Transferring the data to the on-site emergency organisation, rescue organisations and STUK shall be planned in such a way that the data is available quickly and reliably.

2.8 Providing information to the public

According to Section 5, fifth paragraph, of the Government Resolution (397/1991) *informing the media and the public in an emergency shall be preplanned.* In addition, Section 9, second paragraph, of the Resolution stipulates that *the licensee shall, in co-operation with the authorities responsible for rescue services, supply the local population with advance instructions for emergencies.* [– –].

Prior information

According to Section 4 of the Decree (774/2001) of the Ministry of the Interior *the rescue authorities referred to in Section 9, second paragraph, of the Act on Rescue Services and the licensee of a nuclear facility shall prepare together a bulletin which shall be distributed in advance to the population likely to be affected in a radiological emergency. The bulletin shall include the following information:*

- *basic information about radioactivity and its effects on human beings and the environment*
- *various types of radiological emergency and their consequences for the population and the environment*
- *emergency measures planned to alert, protect and assist the population in the event of a radiological emergency, and information on authorities responsible for these measures*
- *instructions to the population on action in radiological emergencies.*

[– –] the information mentioned in paragraph 1 is continuously updated and distributed at least at three year intervals to the population likely to be

affected in a radiological emergency and whenever significant changes in the arrangements take place. This information shall be permanently available to the public.

In co-operation with the authorities in charge of the rescue operations, the licensee shall see to it that the bulletin is distributed to all permanently occupied and free-time residences as well as workplaces in the emergency planning zone (within a radius of about 20 km from the plant).

Providing information during an event

The commander of rescue operations is responsible for providing information about an accident and rescue operations. Only the commander may issue instructions and orders to the population. STUK follows and assesses situations involving a radiation danger or a threat of it and provides information on them to other authorities and the population.

Also the licensee shall be prepared to provide information through the media to the population at risk about the event, its significance to the safety of the population and its likely progress. The licensee shall provide information at regular intervals and every time the situation essentially changes. When providing information the licensee shall take into account the communication activities of authorities.

For the public information, the licensee shall evaluate the INES level of the event during the emergency situation according to Guide YVL 1.12. There shall also be preparedness to change the preliminary rating if the situation changes or more detailed information is obtained. The INES rating with its justification shall be delivered to STUK without delay.

2.9 Premises and equipment

According to Section 5, third paragraph, of the Government Resolution (397/1991) *there shall be appropriate rooms and equipment as well as sufficient communication and alarm systems for emergency response arrangements.*

Premises and devices

In order to prepare for emergencies, the nuclear power plant shall have premises, equipment, and devices for the management, situation assessment, alerting, communications, data transfer and recording, planning and repair, fire protection, transportation, assembly and decontamination of personnel, first aid, dose monitoring as well as radiation measurements and laboratory activities.

The emergency response premises shall be planned so that it is safe to work there during an emergency. Access routes between different premises have to 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 premises reserved for management, situation assessment, planning of emergency response actions during the emergency and laboratory activities shall be equipped with such devices, systems and computer programmes that are needed in making a situation assessment and in updating, presenting and recording it and in communication. Situation assessment shall be made as promptly as possible and it shall be presented clearly. The premises and devices shall be available also in a situation when large quantities of radioactive materials have been released to the plant site and when both the on-site and off-site power supply has been cut off.

STUK sends its representative to the nuclear power plant, if necessary. Workplaces for STUK's representatives shall be reserved in the close vicinity of the emergency response premises.

There shall also be off-site premises available for media briefings.

The emergency organisation shall have an adequate amount of personal protective equipment available for emergency situations. Protective equipment shall be stored or placed appropriately and in such a way that they are quickly available for different teams. Premises for the decontamination of personnel and devices shall be available in emergency situations.

An adequate amount of measurement equipment shall be on continuous standby at the nuclear power plant so that measurements can be conducted on-site and in the surroundings of the plant. Measurement equipment shall be appropriately placed.

A record shall be kept on quantity, location and operability of the premises and equipment.

Communication means

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

Oral connection between the control room and emergency command posts shall be secured by communication systems that are not dependant on one another. The number of connections shall be adequate. The personnel carrying out on-site and off-site measurements and repairs shall have the necessary devices in order to keep in contact with the command post.

A dedicated telephone connection for off-site communication shall be reserved for STUK's representative at the emergency response command post.

The control room and emergency response command posts shall be equipped with recording communication devices.

For the situation assessment, the licensee shall arrange a system for automatic data transfer and display from the power plant's computer system to STUK and to the on-site emergency response command posts. In provision for a failure or malfunction in the system, a compensatory procedure shall also be planned.

The contents of the transferred data shall be planned so that all data significant to the assessment of the situation and its progress is transferred. Data on the states of the plant systems and measured parameters shall be transmitted. The data transmission system must be capable of supplying information on both the current situation and the previous situation from a sufficiently long time period so that the situation progress can be monitored. When planning the data transfer, also clear displaying of the information shall be taken into account.

The transmitted data shall at least include

- reactor main parameters
- primary circuit main parameters
- secondary circuit main parameters (pressurised water reactors)
- 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
- on-site radiation situation
- radiation situation in the plant vicinity
- meteorological data.

Furthermore, the transfer of measurement results of the on-site and off-site measurement patrols as well as calculated environmental radiation situations and their prognoses to STUK and between the emergency command posts shall be arranged.

2.10 Termination of emergency situations and post-emergency measures

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

Post-emergency measures include at least the following:

- identification of such changes in the nuclear power plant's structures, components or systems which affect on keeping the plant in a safe state and managing radioactive materials
- measures which may be needed to keep the plant in a safe state and to prevent and reduce radioactive releases
- evaluation of radiation doses caused by the accident
- investigation of event causes and preparation of an event report
- necessary decontamination measures and planning of efficient waste management.

If rescue operations are continued after the termination of the emergency situation at the nuclear power plant, there shall be preparedness for co-operation in a way corresponding to that during an emergency.

2.11 Emergency response records

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

3 Maintenance of preparedness

According to Section 9, third paragraph, of the Government Resolution (397/1991) *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 Resolution *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 premises and equipment

The premises shall have the necessary equipment available so that prompt action can take place without delay. The operability of premises, equipment and devices shall be regularly proven at least once a year. Alarms and communication and data transfer shall be tested regularly at least once a month according to a separate programme. Defects, disturbances and deficiencies detected in tests or otherwise shall be fixed without delay. Significance of the detected defects and weaknesses shall be assessed for the recognition of potential improvement needs. Devices intended for emergency situations shall also be tested in exercises.

The emergency plan and other documents concerning the emergency response shall be reviewed and regularly updated at least once a year. Changes in contact information and computer programmes shall be done without delay. Weaknesses detected in exercises or otherwise, technological development of the field and changes in the operating conditions and legislation have to be taken into account when developing the emergency plan.

Training

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

An approval from STUK shall be obtained for the person nominated responsible for the on-site emergency preparedness.

Task related basic training shall be organised for the persons of the emergency organisation prior to their assignment to a task. Persons belonging to the emergency organisation shall be provided with annual refresher training and advanced training. Weaknesses and development areas, detected in emergency exercises, shall be taken into account in training.

All nuclear power plant staff, both permanent and temporary, shall be given training on activities during emergency situations. The training shall deal with alarm and emergency situation procedures. Furthermore, an overall picture of the operation of the emergency organisation during emergency situations shall be given.

The licensee shall arrange training possibilities for organisations participating in the rescue operations on the nuclear power plant emergency response arrangements.

An emergency training and exercise plan shall be prepared 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, joint exercises between the authorities and the nuclear power plant shall be organised with the lead of the State Provincial Office at least once every three years according to Section 7 of the Decree (774/2001) of the Ministry of the Interior. The licensee shall participate in the planning, organising and implementation of these exercises.

When the nuclear power plant is in operation there shall be at least one on-site emergency exercise every year. The objective of these exercises is to ascertain the appropriateness of premises, devices and equipment reserved for emer-

gency response; the suitability, compatibility and scope of operating 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 provided with the opportunity to participate in these exercises in a way suitable for the exercise situation.

The annual emergency exercise shall cover a significant part of the emergency plan activities. In addition, special exercises involving one or several sectors of emergency response shall be arranged to enhance the performance of tasks, to improve co-operation and to develop activities.

An exercise plan shall be prepared for an emergency exercise. The date and participants of the annual exercise may be announced in advance but the exercise situation shall mainly be concealed. Special exercises may be training type activities by nature, where the exercise situation can be known beforehand.

The annual emergency exercise shall be evaluated. For this purpose, evaluators are needed to follow the exercise. The exercise experiences and suggested improvements by the participants shall be collected for example in an evaluation meeting held after the exercise, by post-exercise interviews or by means of written feedback.

An exercise report shall be prepared, stating any observed defects or development areas and actions decided based on them.

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

4 Rescue operations and protective measures of the public

According to Section 9, third paragraph, of the Government Resolution (397/1991) *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.*

The on-site emergency manager is in charge of the emergency response activities within the site area, until the rescue authority assumes command over the rescue operations. According to Section 8, third paragraph, of the Government Resolution (397/1991) e*nough assisting personnel with expert knowledge of nuclear technology and radiological protection shall then be placed at the disposal of the authority.*

The licensee's person in charge is obligated to comply with the orders concerning the rescue operations, issued by the authority that has assumed command responsibility for the rescue operations. In practice, however, the licensee is always responsible for nuclear safety and radiation protection at the plant and on the plant site.

Rescue operations management is based on the Act on Rescue Services (561/1999) and Decree (875/1999). The rescue administration management system is based on a regional responsibility allocation that covers the whole country. The Ministry of the Interior in co-operation with other government authorities is responsible for measures needed at a national level. State Provincial Offices have the corresponding responsibility for measures on the provincial level in co-operation with other local administrative authorities. Local chief fire officers and rescue authorities manage action taken in their own responsibility areas. By virtue of Section 46 of the Act on Rescue Services (561/1999) State Provincial Offices or the Ministry of the Interior can issue orders concerning rescue operations and appoint the commander of rescue operations.

Management activities by the Ministry of the Interior and State Provincial Offices include mainly acquiring the needed resources and allocating them for right areas, upholding an overall picture of the situation and based on that issuing orders and instructions to lower levels of management. In addition, they are also responsible for the provision of information to the public. Local chief fire officers and authorities are responsible for real rescue operations and organising and managing other measures needed in the situation.

In plans prepared for a nuclear power plant

accident, the assumption is that when rescue operations are initiated the local chief fire officer of the nuclear power plant region will act as commander of rescue operations and will initiate the needed notification, alarm and rescue operations. If a severe accident is in question and measures are needed in a wider area, in addition to neighbouring municipalities, the national management system will be established to the extent needed.

According to Section 8, second paragraph, of the Government Resolution (397/1991) [– –]. *The rescue services command centre and STUK shall be provided with the information necessary in the event of an emergency.*

In the early stages of an accident situation, the emergency organisation of the nuclear power plant is responsible for issuing recommendations on protective measures for the population to the authority commanding the rescue operations. This responsibility is continued until STUK has adequate information on the situation and it announces to assume the responsibility for issuing recommendations. Even after this, the plant emergency organisation has to conduct situation assessments on the progress of the accident and its consequences and report them to STUK.

During an emergency situation, STUK monitors and assesses the situation and its progress as well as the appropriateness of management measures of the situation at the nuclear power plant. STUK's accident assessment group keeps in touch with the plant emergency organisation, deploys a plant group to the accident site and monitors data on the plant and surroundings situation, received via the automatic data transfer from the nuclear power plant.

STUK conducts an overall situation assessment based on the plant state, its predicted progress and the surroundings situation. It assesses the safety significance of the accident from the viewpoint of the population, surroundings and society, issues instructions and recommendations on needed protective measures and reports on the situation to the public and domestic and foreign co-operation organisations. STUK issues recommendations on protective measures to the commander of rescue operations and other co-operation organisations which decide on actions in their own administrative areas.

According to Section 9, second paragraph, of the Government Resolution (397/1991) [– –]. *In emergencies the licensee is obliged to take part in warning and alerting those in jeopardy.*

Beforehand planning shall be conducted in co-operation with responsible authorities on how to warn the people on the plant site and in the vicinity, who may be in immediate danger in an accident situation. The plan concerning the plant site shall address the warning of the population, providing information on the event, issuing operative instructions, activities in places of assembly and exit from the plant site. Warning of all personnel on the plant site shall be ensured. For ensuring fluent action, the exit vehicles and routes from the site shall be planned and the needed exit time shall be estimated. The nuclear power plant shall have an effective alarm system to warn the population. The alarm system shall be operable even though any single component of the system would be inoperable.

Iodine tablets shall be distributed in advance for the population to permanent and free-time accommodations as well as work places at least within a five kilometre radius from the nuclear power plant. The distributation shall be repeated regularly in accordance with the expiration of the iodine tablets.

The goal for radiation protection in an emergency situation is to prevent all severe acute (deterministic) health effects of radiation and to keep late effects (stochastic effects) of radiation in all population groups as low as reasonably achievable. When considering the protective measures, the basis is that the measures shall be justified in the prevailing circumstances.

The commander of rescue operations decides on all taken protective measures based on received recommendations. When considering protective measures, the prevailing situation and benefits and drawbacks caused by these measures shall be taken into account.

STUK's Guide VAL 1.1, Protective actions in nuclear or radiological emergency, sets forth the bases for emergency preparedness planning for nuclear and radiological emergencies, intervention levels for initiating essential protective measures and also radiation protection bases for the personnel participating in rescue operations.

5 Regulatory control

According to Section 35 of the Nuclear Energy Decree (161/1998) *when applying for a construction license, the applicant must submit to the Radiation and Nuclear Safety Authority:* [– –] *4) plans for physical protection and emergencies.* According to Section 36, first paragraph, *when applying for an operating license, the applicant must submit to the Radiation and Nuclear Safety Authority:* [– –] *6) a description of the arrangements for physical protection and emergencies.*

According to Section 6 of the Government Resolution (397/1991) *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 Radiation and Nuclear Safety Authority.*

The licensee shall provide the Ministry of the Interior, the State Provincial Office and the rescue 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 out e.g. general procedures which are followed when updating documents approved by STUK. Emergency plan contact information updates and other comparable minor changes or definitions of instructions that do not change the content of activities, are submitted to STUK 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 situation descriptions shall be submitted to STUK for information. A report on an exercise shall be delivered to STUK for information within three months from the exercise.

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. Decree (774/2001) of the Ministry of the Interior on rescue services plans prepared for nuclear and radiological emergencies and communication on the emergencies.
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. OJ No L 357, 7.12.1989, p. 31.
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.
12. Protective Actions in Nuclear or Radiological Emergency. Guide VAL 1.1, 15 June 2001, issued by STUK.