Reporting nuclear power plant operation to the Finnish Centre for Radiation and Nuclear Safety

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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 Centre for Radiation and Nuclear Safety (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.

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1 General

The Finnish Centre for Radiation and Nuclear Safety (STUK) is the authority responsible for controlling the safety of the use of nuclear energy. This control includes, among other things, inspection of documents, reports and other clarifications submitted to the Finnish Centre for Radiation and Nuclear Safety, and also independent safety analyses and inspections at the plant site.

In order to effectively utilise nuclear power plant operating experience, the licensee shall analyse events related to operations. The Finnish Centre for Radiation and Nuclear Safety evaluates the safety significance of operational events and the need for changes concerning operation of the plant and provision of information outside the Centre. With the help of reports and other records, the operation of the plant, operational events and plant modifications can be assessed and analysed even afterwards.

This Guide presents what reports and notifications of the operation of nuclear facilities are required and how they shall be submitted to the Finnish Centre for Radiation and Nuclear Safety. The Guide does not cover reports to be submitted on nuclear material safeguards addressed in Guide YVL 6.10. Guide YVL 6.11 presents reporting related to the physical protection of nuclear power plants. Monitoring and reporting of occupational exposure at nuclear power plants is presented in Guide YVL 7.10 and reporting on radiological control in the environment of nuclear power plants in Guide YVL 7.8. Nuclear power plant pressure vessel inservice inspections are dealt with in Guide YVL 3.8. In addition to safety assessment, the Finnish Centre for Radiation and Nuclear Safety utilises the received reports for information services and in preparing the publication “Operation of Finnish Nuclear Power Plants”.

The Finnish Centre for Radiation and Nuclear Safety reports, in the extent considered necessary, safety significant issues to the International Atomic Energy Agency (IAEA) and to the Nuclear Energy Agency (NEA) of the OECD countries according to the IRS System (Incident Reporting System) and severity classifications to the IAEA. The severity classification of incidents is given in Guide YVL 1.12.

Nuclear power plant emergency response arrangements are dealt with in the Council of State Decision (397/91) and in Guide YVL 7.4. According to chapter 8 of the Decision, the local emergency centre and the Finnish Centre for Radiation and Nuclear Safety shall be informed of an emergency without delay.

2 Reporting requirements

In this Guide reports concerning the operation of nuclear power plants are divided into those submitted on a regular basis and those submitted on event basis.

In regular reports information is presented in a standard form, so that an overall view can be formed of the operation of the plant and of the activities of the licensee to ensure safety. The requirements for the contents and submission of the regular reports are presented in chapter 3 of this Guide.

Event reports apply to events and issues of which it is necessary to report in detail after the event in question has occurred. The Finnish Centre for Radiation and Nuclear Safety shall be informed of these events without delay according to sub-section 4.4 of this Guide.

An event report shall be compiled if the requirements of chapter 4 related to reporting are met. The event may also be such that, according to the Guide, several event reports are necessary (e.g. incident requiring a special report, in the connection of which a reactor scram or pressure vessel damage have taken place). In this case one combined report can be submitted. The report shall be submitted according to the tightest schedule requirement.

The licensee shall have written instructions defining responsibilities and obligations concerning the compilation, checking and approval of each report.

The Finnish Centre for Radiation and Nuclear Safety sets no specific requirements for the form of the reports. The reports can also be more extensive than required in this Guide. Attention shall be paid to clarity of style including e.g. the appropriate use of graphic displays.

If a report submitted to the Finnish Centre for Radiation and Nuclear Safety is later found erroneous or incomplete, the necessary corrections and additions shall be submitted without delay. When compiling and submitting reports, the requirements of Guide YVL 1.2 shall be taken into account.

3 Regular reporting

3.1 Daily report

The daily report shall be submitted for information to the Finnish Centre for Radiation and Nuclear Safety every day so that the report is available at the Centre by 10.00 hours on the working day following the reporting period. The report can be delivered to the Centre e.g. by telefax.

The report shall present the following, as applicable:

a) Concerning the actual operating information, the average power level of the plant unit during 24 hours (the reactor power in percentages of the nominal power, gross electric power), operational state and changes therein as well as changes in power bigger than 5% and their causes or other significant events affecting operation and repair outages. Also planned power reductions and outages shall be presented.

b) Inoperability of structures, systems and components due to a failure, pre-maintenance or other reason, to which the Technical Specifications (TTKE) set requirements concerning availability. Also deviations from the administrative rules and from the regulations of the TTKE and set limits shall be reported.

The daily report must give at least the immediate reason why a system, component or structure has been found to be inoperable. A defect detected in periodic testings (e.g. a jammed valve) shall be reported also when in the first test a defect was detected but in an immediate retest the component operated as planned.

Also the following shall be presented:
— time and means of detecting the potential defect
— sub-systems controlling the same safety function or other systems declared as inoperable as a result of the defect
— number of the failure report/work permit
— corrective measures taken
— time of the beginning of the operational unavailability
— time of the ending of the operational unavailability.

If a component has not been repaired by the end of the reporting day, the information concerning the repair shall be presented in the next daily report.

c) The breaking of the pressure vessel or its components during operation, if the pressure vessel is broken or has otherwise been detected as deviating from the construction plan. Such cases may include e.g. leakage through material or welding seams, breaking of supports, defects requiring corrective welding or incidents weakening the safe operation of the structure.

If erroneous operation of the pressure vessel is detected (e.g. operational limits have been exceeded) or the safety valve of the pressure vessel has failed to operate as planned, it shall be mentioned also in the daily report.

The notification shall present
— object of the damage and the means of detection
— description of the damage

— preliminary plans for measures to be taken (the means of correcting the defect, extra inspections, schedule of the measures etc.).

d) Releases of radioactive substances exceeding the reporting threshold. The reporting threshold is 5 × the standard release rate (average over a week at most)

e) Exceptional events, observations and matters requiring one of the reports mentioned in chapter 4.

During refueling outages and other wide outages the daily report shall include also the following:
— status of the overall schedule of the outage
— status of the reactor loading
— changes taking place in the operational state of parallel subsystems performing safety functions
— observations of significant defects that cause extra work and essential changes in the overall schedule
— events with significance to radiation protection
— severe injuries and other occupational safety related incidents that have or could have had significance concerning nuclear and radiation safety
— disturbances in safety related systems during an outage.

Information related to events and observations shall be presented in so far as known during preparation of the report. When necessary, the information shall be corrected or completed in later daily reports.

3.2 Quarterly report

The quarterly report shall be submitted to the Finnish Centre for Radiation and Nuclear Safety by the 15th day of the month following the reporting period in question. Corresponding information can also be submitted monthly.

The report shall include the following information:

a) Short descriptions of the most significant events and matters of the organisational units responsible for operation, maintenance, technical support and quality assurance measures.

b) Plant operational information
— production diagram of the electric power (gross or net power)
— the following information of the reported months, the quarter in question, the current year and since commencement of operation:
— produced gross electric power
— produced net electric power
— load factor
— availability factor.

c) Summary of power reductions and outages bigger than 5% in size
— changes in the power of the reactor and generator and date and time of changes
— cause(s) of the event
— most significant activities and operational measures during the event.

d) Reactor operation and the use of fuel
— burnup data of the fuel e.g. the average burnup of the core, increase of burnup during the operation period and the highest burnup per fuel assembly
— greatest monthly local linear heat ratings (PWR)
— greatest monthly local linear heat ratings and smallest local dry-out margins (BWR)
— estimate of potential leakages of the cladding tube of the fuel
— causes of possible exceeding and surpassing of the TTKE limits or other exceptional events.

e) A short description of failures that have caused inoperablity of the systems and components subject to the TTKE during the reporting period and a cumulative summary of the unavailability of components subject to the TTKE during the last 12 months.

f) A list of modifications of the structures, systems and components subject to Technical

Specifications, or in safety class 1 or 2, made during the operational period. The list shall present the date of completing the modification, its cause and the measures taken as well as the identification number of the modification (e.g. work order number).

g) The highest weakly specific activities of the most significant radionuclides measured from the primary and the secondary circuits and from the fuel pools. If, during the period in question
   — fuel failures
   — events influencing the release of corrosion products or
   — changes in primary to secondary leakages

   have occurred at the plant, the activity changes of the relevant nuclides shall be presented concerning the events in question. In the case of a significant fuel leakage, also the measured concentrations of uranium and transuranium elements in the primary circuit shall be presented.

h) The most important chemical parameters and the amounts of impurities measured weekly from the reactor coolant, feed water, fuel pool water and secondary circuit water.

   Every six months, a summary of the decided modifications shall be added to the report.

3.3 Annual report

The annual report concerning the operation of the previous calendar year shall be submitted to the Finnish Centre for Radiation and Nuclear Safety for information by March 1 of the following year.

The annual report shall include a summary of the operational year describing the licensee's activities in general in utilising the operational experience and safety studies. The summary shall include a description of the measures taken or started to ensure and develop safety and a description of quality assurance activities during the reporting year.

In addition, the following shall be presented:

a) Operating data of the plant
   — thermal power production diagram of the reactor
   — electric power production diagram (gross or net power)
   — following information for the reporting period and since startup:
      — produced thermal energy
      — produced gross electric power
      — produced net electric power
      — load factor
      — availability factor.
   — diagrams presenting on annual basis the operation of the plant since startup
      — load factors
      — length of annual maintenance outages
      — number of reactor scrams.

b) Events with safety significance
   — summary of exceptional situations of the year (compare with chapter 4)

c) Pressure and temperature transients in different parts of the primary circuit and other fatigue loaded pressure vessels
   — number of the various types of pressure and temperature transients used as the design basis for parts of the primary circuit or other fatigue loaded pressure vessels and changes in temperature or pressure larger or faster than those used for design.

d) Reactor operation and the use of fuel
   — trend during the year of the parameters representing thermal margins, power distribution and control of the reactivity registered during supervision of the reactor operation (diagrams)
   — observed or suspected fuel failures during the year
   — number of fuel bundles loaded in the reactor specified as follows: manufacturer, type, average enrichment
   — average and greatest burnup of the fuel bundles removed from the reactor and the number of bundles classified as follows: manufacturer, type, operation time in reactor.

e) Water chemistry
   — in diagram form the most important chemical parameters and amounts of impurities and radionuclides measured from the reactor coolant, feed water (pressure and boiling water reactors) and fuel pools.

f) Storage of liquid waste
   — the amount and total activity of stored radio-active waste as well as the most significant radionuclides in the waste.

g) Storage and transport of solid waste
   — the amount and total activity of stored radioactive waste and the most significant radionuclides in the waste
   — the amount and gross activity of waste removed from the plant as well as the most significant radionuclides, the storage site and method.

h) Releases
   — a summary of radioactive releases and the calculated environmental radiation doses caused by them
   — a diagram of the calculated environmental radiation doses caused by the releases since startup.

i) Personnel dosimetry
   — diagram of the annual collective radiation doses of the personnel since startup
   — distribution of different size doses of employees' individual doses
   — collective radiation dose of different groups of employees, number of people exposed and the highest individual radiation dose; in addition, distribution of the dose between staff of the plant and guest workers
   — jobs resulting in exposure over 0.02 manSv; divided into periodic jobs or repeated jobs (e.g. reloading, steam generator maintenance) and into single unusual jobs; name or object of the job, collective radiation dose, highest individual dose, number of employees and duration of work as well as
   — recording of possible internal doses (see Guide YVL 7.10 for details).

j) Plant modifications having considerable safety significance.

k) Changes in the organisations of the licensee and the plant and changes in the staff

l) Changes made in the general part of the Final Safety Analysis Report concerning the site (e.g. local population, traffic arrangements, environmentally hazardous industry, changes concerning the use of coolant water).

3.4 Outage report

The scope of the report depends on the outage. The report shall be submitted to the Finnish Centre for Radiation and Nuclear Safety for information within a month, as applicable, of unexpected maintenance outages and within three months of refuelling outages as well as of large outages comparable to them. The report shall present
— an overview of the outage and schedules carried out
— modifications made during the outage with major safety or other significance
— technical and administrative realisation of the outage in comparison with plans
— significant deficiencies and defects detected during periodic tests and inspections
— realisation of plans and dose estimates concerning radiation protection
— events and observations significant for the development of the quality system as well as measures taken thereupon.

Outage control is presented in Guide YVL 1.13.

3.5 Environmental radiation safety reports

The report concerning the results of the previous calendar year shall be submitted to the Finnish Centre for Radiation and Nuclear Safety for information by April 15 of the following year. The report shall include, among other things, a summary of the operation of the plant unit from the point of view of environmental radiation safety: release information, dispersion information, results of dose calculations as well as results of environmental radiation monitoring based on measurements and information on waste exempted from control.

In addition to this, information on releases, dispersion conditions and monitoring of the external dose of the environment shall be submitted to the Finnish Centre for Radiation and Nuclear Safety for information within a month of the end of each annual quarter and results of radiation monitoring based on the measurement of environmental samples within two and half months of the end of each annual quarter.

Reporting of the radiation safety of the environment is dealt with in Guide YVL 7.8.

3.6 Reports on individual doses

The licensee shall report monthly the external individual doses of the staff to the Finnish Centre for Radiation and Nuclear Safety for inclusion in the central Dose Register of the Centre. Internal radiation doses are reported in the radiation dose report following the observation.

Reporting of the individual radiation doses is dealt with in detail in YVL 7.10.

3.7 Report on the utilisation of operational experience

Every six months the licensee shall submit a summary report to the Finnish Centre for Radiation and Nuclear Safety for information on the activities it has taken to utilise the operating experience gained at own and other nuclear facilities. The report shall include:

— descriptions of significant operational events and their handling during the reporting period
— recommendations based on root cause analyses or other clarifications and decisions about the implementation of the recommendations
— clarification of corrective measures decided or taken.

A list of events under clarification and brief description of their handling status shall be attached to the report.

Utilisation of operational events is presented in Guide YVL 1.11.

4 Event reporting

4.1 Special report

4.1.1 Special situations

Special situations are incidents, defects, observations, deficiencies and problems (later in text referred to as incidents) if they have importance to the nuclear safety of the plant, to the safety of the plant personnel or to radiation safety in plant's environment. The following list includes examples of incidents the Finnish Centre for Radiation and Nuclear Safety considers special situations. A special report shall be made of the events presented on the list.

The Finnish Centre for Radiation and Nuclear Safety gives more detailed instructions on whether an incident fulfills requirements set for a special report.

Emergencies

a) A plant emergency or a general emergency has been declared at the nuclear facility.

Special situations related to the Technical Specifications (TTKE)

b) The plant has been operated in a way violating the Technical Specifications.

c) It has been necessary to interrupt power production due to a requirement in the Technical Specifications.

c) A limit set in the TTKE has been exceeded which is intended to ensure the integrity of fuel cladding tubes or of a pressurized component of the primary circuit.

Incidents launching safety functions

e) The emergency core cooling systems or isolation of the containment building has been actuated. The normal isolation of some process systems occurring normally after a reactor scram is not considered

isolation of the containment building as meant here.

f) An automatic protective function has not been triggered or a protective function has not been completed as planned although a parameter has exceeded the safety limit set in the TTKE.

Defects and degradation of systems and components

g) An increase has been detected in the radioactivity of the reactor coolant indicating degradation of several fuel rods, an exceptional leakage or degradation of the primary circuit or degradation of the containment building so that it no longer fulfills requirements set for strength and isolation.

h) A component defect, operational defect/ deficiency, erroneous process, automation or electric connection, erroneous guide or other reason which might prevent the performance of a safety function assumed in accident analysis or in some other document used as a basis for the TTKE has been detected.

i) Errors have been repeatedly observed in some important instrument type related to a safety function and a decision has been made to take corrective measures to increase safety.

j) Failure or deficient operation of a safety or pressure suppression valve in the primary or secondary circuit has been observed.

k) Liquid or gas leakage at the plant has caused circumstances which jeopardise or may jeopardise the performance of a safety function.

Deficiencies in safety assessment

l) Deviation of more than 1 percent from the estimated value of the reactor multiplication factor in a stationary state or detection of the possibility of an unplanned criticality inside or outside the reactor.

m) Observation of an error in an accident analysis or in an analysis method or other erroneous criteria for TTKE and there is reason to suspect that the safety of the operation of the plant in some situations is not as good as earlier assessed.

Incidents related to radiation safety

n) Uncontrolled radioactive leakage inside the plant so that air and surface contamination or radiation dose rate in the rooms has essentially risen.

o) Some individual’s radiation dose may have exceeded the dose limit (see Guide YVL 7.10).

p) Radioactive releases to the environment have exceeded the limit requiring corrective measures (see Guide YVL 7.1).

External incidents

q) An exceptional natural phenomenon or some other external threat to the plant has caused a situation where limitation of power or some other protective measure has been considered necessary.

r) A fire or an explosion has occurred at the plant site.

s) Off-site power has been lost and it has been necessary to supply the plant’s alternating current by on-site electrical power supply units.

Other incidents

t) A fuel bundle has or may have sustained damage during handling or may have been at risk as a result of another incident.

u) A safety threat or an attempt to cause damage to the plant or a significant

defect in the physical protection arrangements has been detected (see Guide YVL 6.11).

v) Unexplained defects have been detected in the nuclear material accounting or there is other reason to suspect a nuclear material diversion.

4.1.2 Requirements for a special report

A special report shall be submitted to the Finnish Centre for Radiation and Nuclear Safety for approval within two weeks of an incident. If the incident requires more extensive clarifications it is possible to first submit only a description of the event, a preliminary safety assessment, and a proposed schedule for submitting the missing clarifications of the special report. The missing clarifications shall be submitted to the Finnish Centre for Radiation and Nuclear Safety as soon as they have been completed.

The special report shall include, in addition to a short summary concentrating on the event's safety importance, the following detailed data as applicable:

a) Event description

— operational condition of the plant at the beginning of the incident
  — operational state and power level of the plant
  — status and functioning of systems and components related to the incident
  — on-going operational and maintenance work related to the event
  — alarms or other deviations from normal operation preceding the incident.
— detection of the incident
— chronological progress of the event
  — initiating fault or malfunction
  — automatic control and protective functions
  — activities of the operators and other staff to ensure safety
  — faults and malfunctions influencing the process of events.
— consequences of the incident (e.g. changes in the operational state of the plant, personal injuries, radiation doses, releases of radioactive substances to environment)
— diagrams describing the behavior of the process (e.g. pressure, temperature, flow)
  — starting situation
  — changes in parameters
  — flow charts, electrical drawings, logic charts etc. of systems included in the incident.

b) Safety assessment

— overview of the safety importance of the incident
— level of the event on the international INES scale
— influence of the incident on ensuring the main safety functions
  — reactor shutdown
  — reactor cooling
  — removal of decay heat from the reactor and from the spent fuel
  — isolation of radioactive substances from the environment.
— potential consequences of the incident in some other operational conditions
— references to similar incidents which have occurred earlier at the same nuclear facility.

c) Causes of the incident

— direct causes
— root causes.

d) Measures to avoid recurrence

— summary of clarifications and studies made
— incident handling in the safety organisation and in the quality assurance organisation
— structural improvements in the plant (both immediate and later improvements)
— improvements e.g. in the TTKE, procedures, guides and training.

A root cause analysis shall, as a rule, be drawn up of special situations. The carrying

out of a root cause analysis is dealt with in Guide YVL 1.11. The report on the root cause analysis shall be submitted to the Finnish Centre for Radiation and Nuclear Safety for information within four months of the incident.

4.2 Report on reactor scram

A scram report shall be prepared of reactor scrams, not including planned scram experiments on low power. The report shall be submitted to the Finnish Centre for Radiation and Nuclear Safety for information within a month of the scram. The report shall include, as applicable, the information required for a special report in sub-section 4.1.2.

4.3 Report on operational transient

An operational disturbance report shall be prepared of significant disturbances which have lead to a forced power decrease of the reactor or the generator as well as of other major disturbances in the operation of the plant or its systems. The report shall be submitted to the Finnish Centre for Radiation and Nuclear Safety for information within a month of the incident. The report shall include, as applicable, the information required for special report in sub-section 4.1.2.

4.4 Informing on reportable events

In case of emergency the licensee shall alarm the Finnish Centre for Radiation and Nuclear Safety according to the emergency plan of the nuclear facility. An emergency is a situation in which the safety of the plant and/or its environment is, or may be, considerably jeopardised. Emergencies shall be defined in more detail in plant specific emergency plans. Guide YVL 7.4 deals with emergency plans.The Finnish Centre for Radiation and Nuclear Safety gives the licensee a separate decision on the practical alarm procedures and the contact data.

During office hours the Finnish Centre for Radiation and Nuclear Safety shall be informed immediately by telephone, and also in the next daily report, of all special situations, scrams, operational transients as well as of pressure vessel failures if they cause personal injuries or damage to property or the environment.

Events at nuclear facilities are classified on the International Nuclear Event Scale (INES). During office hours the Finnish Centre for Radiation and Nuclear Safety shall be informed immediately by telephone of incidents classified level 1 or higher. The proposed INES level classification with justifications shall be submitted to the Finnish Centre for Radiation and Nuclear Safety for example by telefax or in some other suitable written form. On the basis of the information received the Finnish Centre for Radiation and Nuclear Safety classifies the event and uses the classification when providing information for the general public and possibly when notifying the IAEA of the event.

If an event is classified level 0, but it may be of interest in or outside Finland, notification of the event shall be issued correspondingly.

Classification of nuclear power plant operational events on the INES scale is dealt with Guide YVL 1.12.

The Finnish Centre for Radiation and Nuclear Safety gives the licensees instructions for the reporting of incidents outside office hours in separate decisions.